AMPP™ CHAPTER INDIA

UNITING THE WORLD IN MITIGATING & COMBATING CORROSION

ASIA'S LARGEST CORROSION CONFERENCE IN INDIA

CORCON 2024

20th - 23rd November
Chennai, India

www.corcon.org

SOUVENIR

Hosted by

NACE® INTERNATIONAL INDIA SECTION

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WHY CHOOSE US

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Inspeks Coating is a recognized coating inspection leader across india and around the world. All of our inspectors are NACE Certified and committed to our Safety First approach.

All our inspectors are carefully selected and trained to see all sides of every project across a wide range of industrial applications. They bring expert knowledge attained through NACE, ISO 9001:2015, SSPC and MPI training and certification.

Office at Chennai & Coimbatore

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AMPP CHAPTER INDIA

CORCON 2024
20th - 23rd November
Chennai, India
www.corcon.org

NACE INTERNATIONAL INDIA SECTION

We are privilege to present this souvenir for CORCON 2024 – International Conference & Expo organized by AMPP India Chapter Formerly known as NACE International India Section [NIIS] being held during 20 – 23 November 2024 at Chennai Trade Centre, Chennai, Tamil Nadu, India.

CORCON-2024 is a technical feast for the delegates numbers over 815 industry leaders for across the globe, with 6 Plenary talks, 12 Keynote lectures, 150 + selected technical talks distributed across 23 Session and 18 poster presentations. 5 technical interactive forums (TIF) on "Cathodic Protection Systems, Water Treatment, Corrosion in Petrochemical Plants and Refineries, Pipeline Integrity Management, Corrosion Monitoring, Inspection and Testing, along with a round table conference on the "Protective Coatings and Lining Industry" and "Jung Se Jung" and Workshops: "Marine Corrosion in Defence Industry" and "How to Prevent Human Corrosion" with Industry Professionals.

CORCON-2024 also boasted of a large exhibition area where more than 65 stalls from not only India but across the globe used the opportunity to introduce their products, technology and services to the industry.

The conference gives us the opportunity to display and catch up on the various developments that have happened over the last two years not to forget the in person meeting and networking rapport building that all are longing for. It is a strong technical programme which is the main attraction for the participants. It also provides a great opportunity and is an ideal platform to carryout networking and find a possible solution to the issues back at workplace.

The Souvenir is a one stop document for both academia and industry. It provides a coherent synergy of technical information by way of the abstracts of technical papers and details of exhibitors. Also, there are relevant details of the various industries participating and their profile for the benefit of the fraternity and for those who have contributed to the success of this conference.

We on behalf of the Chapter Governing Board, Executive Committee and Staff of AMPP India Chapter and CORCON Organizing Committee would like to thank the Supporters, Exhibitors, Advertisers and Delegates for their unstinted support.

We also wish to thank the Organizing Committee, AMPP India Chapter staff, Associates and all others who are associated with this conference, for their valuable help and co-operation in releasing this Souvenir.

Have a Great time in CORCON - 2024

MESSAGE

DR. N. RAJENDRAN

Rapid developments in the field of corrosion science and engineering necessitate a yearly update of the available techniques and updating our knowledge. Owing to this fact, I am extremely happy to welcome each and everyone to CORCON 2024 – Asia's largest corrosion conference, held from November 20, 2024 to November 23, 2024. I am highly privileged to introduce the 31st edition of our prestigious conference, 'CORCON – 2024: SOUVENIER'.

CORCON, Asia's largest corrosion conference, an esteemed international platform dedicated to the exploration and advancement of corrosion science and engineering. Over the past three decades, the conference has substantially benefited the society, owing to the commitment of individuals who have effectively participated on Chapter Governing Boards, Executive Committees and as volunteers. This annual corrosion conference foster under uniting the world in mitigating and combating corrosion and brings together the brightest minds in corrosion science and engineering.

AMPP India Chapter has constantly promoting educational initiatives, workshops and community engagement, striving to enhance industry standards and encourage sustainable practices that amplify the benefits to the society. I am proud to acknowledge their collective efforts in advancing the field of materials protection and corrosion control.
CORCON - 2024 provides a pivotal platform for professionals, researchers and industry leaders around the globe to converge and exchange insights, innovations, knowledge and collaborative opportunities on the latest advancements in corrosion science and engineering.

This global event stands as an ideal opportunity for the exhibitors to display their equipments, technologies and service. It ventures talks by eminent speakers, distinguished scientists and top professionals around the world. It also facilitates source and purchase the latest product, technology and service (approximately 90+ exhibitors), increase the productivity to see new ideas and innovations (225 technical sessions), networking opportunities (over 900 delegates).

This year, an inspiring lineup of plenary speakers, keynote speakers, interactive sessions and networking opportunities anticipate enhancing the collective understanding and strategies for combating corrosion. Throughout the conference, participants are expected to engage in stimulating discussions, attend insightful presentations that highlight the latest advancements in corrosion prevention, detection and management.

I extend my heartfelt gratitude to all our esteemed speakers, sponsors, organizations, supporters, delegates, authors and attendees whose contributions make CORCON 2024 a remarkable platform for knowledge exchange and professional growth.

Together, we are fostering a community committed to excellence and sustainability in corrosion management. Your participation and enthusiasm are essential to our mission and I look forward to continuing this journey with each of you.

Let us address the challenges and pave way for innovative solutions that will mold the prospects of the industries and work on shaping a more resilient and sustainable future.

Best Regards,

Dr. N. Rajendran
(CHAIRMAN CORCON 2024)

MESSAGE

DR. ANAND KUMAR TEWARI

It is indeed a matter of immense pleasure that Asia largest Corrosion Conference CORCON 2024, has been successfully concluded at Chennai Trade Centre, Chennai from 20-23rd Nov 2024. My compliments to Conference Chair Dr N Rajendran, Prof & Head Deptt of Chemistry Anna University, Dr Toleti Subba Rao Chairman Technical Committee (Director, Center for research, innovation, collaboration & policy) Dignitaries from AMPP International Dr Kimberly Joy Harris, Mr. Alan, CEO, AMPP International, Dr Amir Elizer, Mr. Juan , Ms. Helena Seelinger , learned Speakers for plenary talk, TIFs, Technical sessions, Jung se Jung , other symposia, Sponsors, Exhibition stall owners, delegates , participants, AMPP India Board Members, Past chairs , AMPP India staff, faculties and students, of SAI University and Anna University, for grand success of CORCON 2024. With more than 700 participants and much higher footfalls in Expo, are testimony of its success and grandeur.

CORCON is an Asia largest Corrosion Conference and developed its brand image progressively, through focus on its professionalism for facilitating highly relevant and quality papers selection, meaningful technical discussion and structured knowledge sharing sessions besides display of latest product, technology and emerging trends in expo. It is a unique conference with larger focus on core subject of corrosion management, across the spectrum of industries like infrastructure, energy sector, marine and off shore, chemicals & petrochemicals, fertilizers, defense sector etc.

CORCON 2024 theme was “UNITING WORLD IN MITIGATING & COMBATING CORROSION” as corrosion is not limited by geographical boundaries. As per theme, the session are well crafted, by a highly experienced team, which selected technical papers ranging from field of cathodic protection, coatings, paints, corrosion in water industry, chemical, fertilizers, defence, Building & RCC structure, nuclear plant, marine and offshore etc besides emergence on horizon for corrosion monitoring, testing, corrosion inhibitors development etc. Additionally, Expo show casing latest product and services remained the major highlights and attraction of CORCON 2024.

The presence of Chief Guest on Opening day Mr H Shankar CMD CPCL, Chief Guest of Award Ceremony Mr N S Kumar Director Pipelines and Business Development, Indian Oil, Dr K Ramesha Director CECRI, on concluding day was major highlights. Their presence and valued messages as Industry and Research veteran, was highly motivating, stimulating and inspiring to one and all.

The mesmerising Bharat Natyam performance under the guidance of Mrs Latha by her students, kept the audience spell bound on evening of 22nd Nov 2024.

In the Expo, apart from leading companies from world over, Indian companies pioneered cost-effective, latest technology like AI and robotics based, sustainable corrosion solutions, especially with the rising focus on Make in India and Atmanirbhar Bharat.

I have great satisfaction for successful conclusion of CORCON 2024, as three days were of great learning, full of interaction, making new connects, and fully engaging. Once again, my sincere thanks to all my team members. My best wishes for FUTURE CORCONs

Jai Hind Jai Bharat

Best Regards,

(Dr. Anand Kumar Tewari)
Chairman AMPP INDIA Chapter 2023-24
Former Executive Director (Operations) Indian Oil, Pipelines

MESSAGE

DIPEN JHAVERI

Dear CORCON 2024 Attendees, Supporters and Exhibitors,

A Hearty Welcome to all the Corrosion professionals, scholars, and technical experts to this signature event of the year – CORCON 2024 30th International Conference and Expo on Corrosion at Chennai.

This conference aims to spread knowledge about corrosion with a focus on modern techniques for corrosion awareness and training, mitigation, and control.

We look forward to learning the latest theories on corrosion from top industrial, government and academic scientists on these topics and everything else that is presented. New products and technologies exhibited by companies will go a long way in curbing the costs of corrosion. We are indeed in a time of great innovation in corrosion science, so enjoy the multiple papers, technical interactive forums and the exhibition of the latest technologies in corrosion prevention and mitigation.

Let us continue to work together to advance the understanding and application of corrosion science, ensuring the safety, reliability, and sustainability of industries worldwide. We hope this conference provides you with new knowledge, insights, and opportunities for collaboration.

We are looking forward to an invigorating experience with great minds from different facets of the industry and academia.

We wish you a fruitful and enriching experience at the conference.

With Best Regards शुभकामनाए

Dipen Jhaveri दीपेन झवेरी

MESSAGE

TOLETI SUBBA RAO

I am privileged to be the Technical Chair of CORCON – 2024, The 30th International Conference & Expo on Corrosion Science & Technology, which is being held during 20 – 23 November 2024, at Chennai Trade Centre, India. This international conference on Corrosion & Expo is the biggest conference on corrosion aspects in India, and one of the most sought after among Association for Materials Protection & Performance (AMPP) programs.

AMPP India Chapter has been organizing CORCON annually for three decades. A special feature of this conference is the exhibition that attracts a majority of companies and professionals active in the field of corrosion and its control both in India and the world over. This event brings together corrosion fraternity for synergistic interactions, education, inspiration and networking. With the experience gained over the years, we are expecting the total delegates for CORCON – 2024 to be over 800 from all over the world. This year there was an overwhelming response to the abstract submission and I am pleased to inform you all that the CORCON – 2024 received 238 abstracts for the 11 symposia topics. I feel it is a great honour to be associated with the CORCON - Technical Committee and put together the program schedule which was not possible with the constant efforts put in by the various Symposia Chairs. Each abstract, full text paper and the technical presentation have been carefully reviewed by the respective technical chairs. Some of the papers have been revised to incorporate the correct technical view and general suggestions were made during the review process.

Mr. Rishikesh Mishra, from the office of the AMPP India Chapter, Mumbai was helpful from the back end to help authors and also provide the deadlines of the technical committee. This year there are 14 symposia, 2 Workshops, 5 Technical Interactive Forums, one Round Table Conference on Protective Coatings & Linings and a Jung Se Jung session. Coming to CORCON 2024 Plenary and keynote talks, we have planned 6 plenary talks, 12 keynote lectures and more than 151 oral papers and 18 posters. We hope that each delegate of CORCON will have a rich feast of technical sessions in the conference.

I am also glad to inform you that the full text manuscript received for CORCON – 2024 will be thoroughly reviewed and that we are planning to publish them in a suitable journal, the selected manuscript authors will be intimated later for further necessary action.

I wish the delegates and eminent speakers of CORCON 2024 a technically stimulating and fruitful conference.

T.S Rao

Toleti Subba Rao

Chairman Technical Committee ~ CORCON – 2024

MESSAGE

TUSHAR JHAVERI

Dear Participants,

Welcome to CORCON - 2024 being held from 20 – 23 November at Chennai Trade Center, Chennai.

It is my privilege and honour to convey my best wishes for the success of this prestigious Conference and EXPO.

Corrosion is a very critical issue for our Society and industry. Corrosion is always leading to continuous damage and losses. This cost is huge and as per some estimates can be as high as 3.5% of GDP. Hence, our efforts to reduce this loss at CORROSION-2024 are of great importance. Protecting people, assets and environment from the effects of corrosion is essential in our growing economy and education related to corrosion is imperative to support this effort.

AMPP courses are well accepted and help promote corrosion awareness CORCON-2024 will facilitate technical information exchange and interaction which together with exhibition have become a premier corrosion event in our part of the world. Please make most of this excellent opportunity to meet fellow professionals, AMPP officers and members.

I wish everyone a successful conference and my congratulations to all the award winners.

Tushar Jhaveri

Tushar Jhaveri
President 2013-14
NACE International

AMPP: The Association for Materials Protection & Performance

"A Safer, Protected, and Sustainable World"

AMPP represents the largest global community of corrosion and protective coatings professionals. Our members are dedicated to advancing technical and practical expertise in corrosion prevention and control. AMPP provides members with the knowledge and resources to ensure high performance materials are used to build and maintain sustainable infrastructure.

AMPP provides members with the knowledge and resources to ensure high performance material are used to build and maintain sustainable infrastructure.

AMPP protects infrastructure and assets worldwide through member and workforce education and credentialing, company accreditation, technological innovation, and global standardization.

For more information visit www.ampp.org

AMPP INDIA CHAPTER

AMPP India Chapter (previously NACE International India Section (NIIS)) was established in 1992. AMPP India Chapter is one of the largest and most active sections of AMPP through its significant efforts for the promotion of corrosion awareness, protection and control of corrosion in India. With over 1000 members, AMPP India Chapter has organized over 215 certification courses on CIP Level 1, Level 2, Peer Review, CIP 2 Emphasis, Nuclear Power Plant course, O-CAT, PCS 2, Basic Corrosion, Direct Assessment, Internal Corrosion for Pipeline, Refinery Corrosion and Cathodic Protection 1, 2 & 3 of AMPP. It has also organized more than 225 educational corrosion awareness programs and hosted 29 annual corrosion conferences. To commemorate Corrosion Awareness Day, AMPP India Chapter awards individuals and institutions for their contributions to corrosion awareness and developments in the field of corrosion science and technology. The AMPP India Chapter sponsors three student chapters, one each in Mumbai, Chennai and Vadodara. AMPP student chapters had organized "CORSYM" international corrosion conference for students. AMPP is committed to enhance the quality and range of its services and activities in the field of corrosion awareness and dissemination of knowledge on corrosion, its protection and control in India and worldwide.

For more information visit www.amppindia.org

CORCON: (Corrosion Conference & Expo)

The world is rapidly moving towards developing sustainable infrastructure with the focus on corrosion free materials for effective optimizing corrosion controls and reduction in lifecycle costs. Corrosion- control and mitigation at the initial design and construction stage of assets is more rewarding in the long run-in terms of increased safety, performance, asset life, environment protection and operational cost-effectiveness. Overall, the global cost of corrosion is estimated to be in trillions. In India corrosion is believed to impact approx. 4 per cent of the country's GDP and the ever-growing environmental threat calls for urgent and appropriate measures.

CORCON, the annual conference and expo on corrosion science and engineering held in India, is the largest event of its kind in Asia, attracting participation from academic and research institutions, public and private sector organizations including defense establishments and professionals. This event offers an excellent platform for exchange of information on matters concerning corrosion, learning about existing and upcoming products and technologies and networking. As the world faces more and more challenges with ageing infrastructure, it is imperative for advocates of corrosion mitigation to unite and address the problem. Each year over 1000 industry leaders from around the world come together at CORCON, in an effort to tackle corrosion issues, and inform participants of the latest solutions and methods.

For more information visit www.corcon.org

ANAND K. TEWARI
Chairman

Dr. Anand Kumar Tewari, Retired Executive Director (Operations), Indian Oil Corporation Limited, Pipelines Division NOIDA (Retired in June 2020).

A Mechanical Engineer having over 40 years of experience in the field of Oil and Gas Pipelines Design, Technical Services, Project Execution, Operation, HSE, Contracting and Budgeting, HR and General Management Operation & Maintenance and inspection of cross country crude Oil, Petroleum Products, LPG and Natural Gas Pipelines Corrosion Monitoring and Integrity Management of Pipelines, Risk Management, RBL and RCM Implementation Auditing Experience of CGD Networks, NG Pipelines, Consultant / SME LPG Pipelines, Flow and Group Gathering Pipelines Consultancy and Business Development in the field of specialised inspection, LPG Terminal, CNG Terminal etc., Disaster Management, Environment Management, Implementation of Sustainable Development Goals, Safety Management Systems Implementation and Periodic review / monitoring.

DIPEN JHAVERI
Vice Chairman

Mr. Dipen Jhaveri is Chemical Engineer and holds a M.B.A. degree from Virginia Polytechnic Institute and State University, USA. He has experience of over 21 years in Water Treatment Chemicals.

Mr. Jhaveri is a member of NACE International, U.S.A. He is also a member BMA, NCQM, WQA etc.

He has been awarded by AOTS (a Govt. of Japan Organization) to participate in an Innovative Operations Management program and also se;ected to be one of seven of an International Consulting Group to the University of Maribor, Slovenia. Presently, he is serving as Jt. Chief Executive of Vasu Chemicals Since 1999.

N MANOHAR RAO
Member Delegate

Mr. N. Manohar Rao is a Civil Engineer from the Mysore University. He has over 35 years in the Oil & Gas Industry in all business units. He has retired as Executive Director [HSSE & Biofuels] from Bharat Petroleum Corporation Limited in June 2018.

He has been a member of NACE International and AMPP since 2002 and has worked in almost all the positions on the board. He is presently the Member Delegate of the Chapter.

He has presented many technical papers in CORCONs. He is a recipient of 12th Corrosion Awareness Award for Excellence in Corrosion, from NACE Internation India Section; The NACE Distinguished Service Award in 2020 from NACE International and The Lifetime Achievement Award in 2022 from NACE International India Section. He also held the position of Vice Chair of the of the NACE EAPA Area.

He is also a member of various technical bodies like the Institution of Engineers. He is a regular faculty in the training programmes of NACE Internation India Section / AMPP India Chapter.

DENZIL D'COSTA
Treasurer

Mr. Denzil D'Costa is a Mechanical Engineer with a Management Diploma in Quality control & ISO certified, A NACE Certified Coating Inspector, Presently working as National Sales Manager for Graco Hong Kong Ltd., over 22 years experience in Paints and Coating Applications equipments in India and Abroad.

He has presented papers at various conferences and is a regular faculty member of educational institute & organization. Mr. Denzil is co-ordinator of NIGIS Educational Corrosion Awareness program on coating Applicator.

URVESH VALA
Member At Large

Pursuing PhD im Metallurgy Engg., Gujarat Technical University, Ghandhinagar Master of Metallurgy Engg., Faculty of Engg & Tech, M. S. University of Baroda, Vadodara, Dec.'99 (Corrosion Engineering as a Specialization) Bachelor of Metallurgy Engg., Faculty of Engg. & Tech M. S. University of Baroda, Vadodara, May 97 Lean & Six Sigma Green Belt from ASCB (E) Ltd., U.K. Certified Lead Auditor for QMS Lead Auditor based on ISO 9001:2018. NDT Level II in LPT, RT, UT, MPI & Helium Leak Test from ASNT, USA NDT Level II in NDE Level II Radiagraphy Testing (RTFI) from EN ISO 9712.

Area of specialisation in Material Selection & Corrosion, Cathodic Protection, Coating, Insulation, Fire Proofing, Welding, NDE, Failure Analysis, Asset Integrity - RBI, RCM & Base Line Survey, Cryogenic and Aerospace application.

26+ years of experience in various industries like Steel Marketing, Manufacturing, PMC, EPC, LSTK, Pipeline for Oil & Gas Refineries, Petrochemical Complex.

HARSH ZALA
Secretary

I am a passionate and driven individual with a unique blend of expertise in Metallurgy and Data Science. My journey began with a Bachelor's degree in Metallurgy and Material Science Engineering from M. S. University of Baroda. Currently, I am pursuing a Bachelor of Science in Data Science from the prestigious Indian Institute of Technology Madras, further expanding my knowledge at the intersection of traditional metallurgy and cutting - edge data technologies.

Professionally, I am associated with L & T Technology Services, Vadodara. My skills encompass a wide range of metallurgical aspects, including corrosion analysis, steelmaking processes, material selection, quality control and welding.

EXECUTIVE COMMITTEE MEMBERS - 2023-24	
Mr. Tushar Jhaveri	Vasu Chemicals LLP , Mumbai
Mr. K B Singh	KBS Assoiciates, Delhi
Dr. Anil Bhardwaj	Ex.ONGC, Mumbai
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Prof. N. Rajendran	Anna University, Chennai
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AMPP India Chapter (AIC) Corrosion Awareness Awards are presented to honour and respect individuals / institutions for their contribution to corrosion awareness and developments in the field of corrosion science and technology in India. The awards are presented during the AIC Annual Corrosion Conference since 1995. AIC has so far honoured 152 scientists / teachers / engineers / professionals 57 students and 28 public / private sector laboratories. Detail information about awards is given at www.amppindia.org.

AIC Corrosion Awareness Award Committee 2024

Members	Dr. Nithyanand Prabhu, Professor, Indian Institute of Technology, Bombay
	Prof. M A Shenoy EX - University Institute of Chemical Technology, Mumbai
	K V Seshadri,
	EX - BPCL, Navi Mumbai

AIC Corrosion Awareness Award Winners 2024

1	Excellence in Corrosion Science & Technology in Research & Education	Prof. Smrutiranjan Parida IIT Bombay
2	Distinction in Corrosion Science & Technology in Research & Education	Prof. Ambrish Singh Nagaland University
3	Distinction in Corrosion Science & Technology in Industrial Organisation	Mr. T Siva Central Institute of Petrochemical Engineering & Technology (CIPET), Chennai
4	Excellence in Innovation award	Krishna Conchem Products Pvt Ltd. Navi Mumbai
5	Excellent Laboratory	Gail (India) Ltd. Rajamundry
6	Student Award for PhD Degree	Ankur Kumar IIT Roorkee
7	Meritorious Contribution in Research & Education	Dr. M G Sethuraman The Gandhigram Rural Institute, Gandhigram
8.	Meritorious Contribution in Industrial Organisation	Pankajkumar Dhabjibhai Panchal Corrosion Protection Specialist Pvt. Ltd.

ASIA'S LARGEST CONFERENCE ON CORROSION

CORCON 2024

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30th International Conference & Expo on Corrosion
20 – 23 November 2024, Chennai Trade Centre, India

Conference Program

Inaugural Function (20 November 2024, Wednesday: Main Hall)

Time	Activity
15:00 - 18:30	Delegate Registration
19:00 - 20:00	Conference & Expo Inauguration
20:00 - 21:30	Dinner

Technical Program (21- 23 November 2024: Thursday - Saturday)

Time	Activity	Venue	21/11/2024 (Thursday)	22/11/2024 (Friday)	23/11/2024 (Saturday)
09:00 - 11:00	Symposia	Hall - A	Cathodic & Anodic Protection - 1	Cathodic & Anodic Protection - 2	Workshop - Marine Corrosion in Defence Industry
		Hall - B	Corrosion in Oil and Gas Sector - 1	Corrosion in Oil and Gas Sector - 3	Materials and Composites - 1
		Hall - C	Corrosion in Petrochemical, Refineries and Fertilizer Industry - 1	Coatings Linings and Thermal Insulation	Corrosion in Concrete and Infrastructure
		Hall - D	Corrosion in Nuclear Industry & MIC - 1	Marine Corrosion	Microbial Corrosion & Inhibitors - 2
11:00 - 11:30	Tea / Coffee (Expo Visit & Networking)				
11:30 - 13:00	Plenary Talk	Main Hall	A new zinc alloy for galvanizing of steel Prof. Ralf Feser, University of Applied Sciences South Westphalia, Germany	Stress Corrosion Cracking within the Pipeline Industry Jim Marr, P.Ag, President, Marr Associates Pipeline Integrity, Canada	Nano-Biotechnology and Development of Advanced Medical Devices Amir Eliezer, Shamoon College of Engineering, Israel, Immediate Past Chair 2024, AMPP
			Importance of Formal Training and Certification to prevent Corrosion - A Perspective K B Singh	Importance of suppressing corrosion in Li/ Na ion Batteries Prof. Vijayamohanan K Pillai, Chair, Chemistry and Dean (R&D), IISER, Tirupati	Ushering into a self-dependent India in Energy Storage materials: Bridging the Gap between Lab to Pilot Scale Manufacturing @ARCI Dr. R. Vijay, Director, ARCI, Hyderabad
13:00 - 14:00	Lunch (Expo Visit & Networking)				
14:00 - 16:00	Symposia	Hall - A	TIF - Cathodic Protection Systems	TIF - Corrosion Monitoring, Inspection and Testing	Corrosion in Defence Sector - 2
		Hall - B	Corrosion in Oil and Gas Sector - 2	Cathodic & Anodic Protection - 3	Materials and Composites - 2
		Hall - C	Corrosion in Petrochemical, Refineries and Fertilizer Industry - 2	Corrosion in Defence Sector - 1	Corrosion Issues in Biomaterials
		Hall - D	TIF - Water Treatment	Round Table Conference - Protective Coatings and Lining Industry	Corrosion Monitoring and Testing - 2
16:00 - 16:30	Tea / Coffee (Expo Visit & Networking)				
16:30 - 18:00	Symposia	Hall - A	TIF - Corrosion in Petrochemical Plants and Refineries	Jung Se Jung	Valedictory Function
		Hall - B	Corrosion and its Mitigation in Renewable Energy Sector	Corrosion Monitoring and Testing - 1	
		Hall - C	TIF - Pipeline Integrity Management System	Corrosion in Petrochemical, Refineries and Fertilizer Industry - 3	AMPP CHAPTER INDIA
		Hall - D	Corrosion Control in Water Treatment Utilities	Workshop - How to Prevent Human Corrosion, Dr. Piyush Saxena	
18:00 - 19:00	Product Presentation / Expo/ Cultural/ Award Ceremony	Main Hall	* Product Presentation - Hall A , Visit to Expo & Poster Presentation - Exhibition		NACE INTERNATIONAL INDIA SECTION
19:00 - 20:30			Corrosion Awareness Award - 2024 Ceremony	Cultural Program	
20:30 - 21:30			Dinner		

THANK YOU FOR YOUR SUPPORT

CORCON 2024
20th - 23rd November
Chennai, India
www.corcon.org

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TRENTON ANTICORROSION MATERIALS

VR Coatings Pvt. Ltd.

THANK YOU EXHIBITORS

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Chennai, India
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CORCON 2024
20th - 23rd November
Chennai, India
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automa

BLASTLINE

CIMCON Software (India) Pvt. Ltd.

CLEAN BLAST
Clean Technologies In Surface Preparation

CORMIT
CORMIT ELECT PROJECTS PRIVATE LIMITED

DE NORA

www.gicgroup.co.in

GROWEL
SINCE 1957
www.growel.com

ITW Chemin

JAGUAR
SURFACE COATING EQUIPMENTS

JOHN GALT ZINGA TECHNOLOGIES

PARAM
Hydraulics Pvt Ltd
Industry Innovation Integrity

Petrobot

Prabha Enterprises

Prism
SURFACE COATINGS (P) LTD.

PSS
CORPORATION

PYRAMID

IMPAC Group

TDS

TubeFit
ENGINEERS

VKVC
Vee Kay Vikram & Co. LLP

VIJAY COAT

ASSOCIATES

C. V. RAMAN GLOBAL UNIVERSITY
ODISHA
ESTD - 2020

COATINGS AND ANTI CORROSION
ENGINEERING REVIEW

ISNT
INDIAN SOCIETY FOR NON DESTRUCTIVE TESTING

ASNT
India | India Section

ASME
SETTING THE STANDARD

CORCON 2024
20th - 23rd November
Chennai, India
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EXPO LAYOUT

Stall No	Company
A1	John Galt Ziga Technologies
A2	CPCL
A3	ONGC
A6	3X Engineering
A7	Blastline India Pvt Ltd
A9	Jotun India Pvt Ltd
A10	Jotun India Pvt Ltd
A11	Vasu Chemicals LLP
A12	Halliburton Vasu Solution LLP
A13	BSS Technologies
A14	BSS Technologies
A15	Product Presentation Area
A19	Dehn India Pvt. Ltd.
A21 A	C V Raman Global University Odisha
A21 B	I S N T
A23	Allied Engineers
A24	Growel & Weil (India)
A27	Demech Chemical Products Pvt
A28	Marine Solutionz
A29	Metal Samples
A30	Pyramid Technical Services
A31	Trenton Corporation
A33	Automa S R I
A34	Conference Kit Issuance
A52	Electrotherm (India) Ltd.
A53	Kansai Nerolac Paints
A54	Henkel Adhesives Technologies
A55	Vee Kay Vikram & Co LLP
A56	Detchwerk
A57	Seal for Life India Pvt Ltd

Stall No	Company
B1	Global Instument Company
B2	Cimcon Software (India) Pvt. Ltd
B3	Berger Paints India Ltd
B4	Prabha Enterprises
B5	Cormit Elect Projects
B6	Blastline India Pvt Ltd
B7	Coatings and Anti Corrosion Engineering Review
B8	The American Society for Nondestructive Testing India
B9	The American Society of Mechanical Engineers India
B10	Vijay Enterprises Pvt. Ltd.
B11	Jeff Techno Solution
B12	Technical Drying Services (Asia) Pvt Ltd.
B13	Clean Blast
B14	Shri Narayan Impac India LLP
B15	Jaguar Surface Coating Equipments
B16	Akzo Nobel India Ltd
B17	V R Coatings Pvt Ltd
B18	Electro Corr-Damp Pvt. Ltd
B19	Tubefit Engineers
B20	PPMTS Permsnabsbyt JSC
B21	Prism Surface Coating Pvt. Ltd.
B22	Ti Anode Fabricators Pvt. Ltd
B23	Alleima
B24	Alleima
B25	ITW India Pvt Ltd
B26	De Nora India Ltd
B27	Petrobot Technologies Pvt. Ltd
B28	Param Hydraulics Pvt Ltd
B29	LIN Scan Advanced Pipeline
B30	Sark Projects Pvt Ltd
B31	Clean Coats Pvt.Ltd
B32	Rosen India
B33	Rosen India

Organised By AMPP INDIA CHAPTER

Hosted By NACE INTERNATIONAL INDIA SECTION

Name	**Pankaj Panchal**	
Designation & Affliation	Director & Ceo Corrosion Protection Specialist Pvt. Ltd.	

Biography :

Mr. Pankaj Panchal is working as Director & CEO at Corrosion Protection Specialist Pvt, Ltd. since 2016.

He was working at Abdulla Foaud Impalloy Ltd. Co, Saudi Arabia as General Manager (UAE) and Engineering Manager since 2001 to 2016. He was working in India since 1993 to 2000 at India in cathodic protection industry.

Mr. Pankaj Panchal is an Electrical Engineer. He has more than 30 Years of Experience for Corrosion Assessment, Cathodic Protection systems and Corrosion control systems.

Mr. Panchal is AMPP (Formerly NACE International) Certified Corrosion Specialist and AMPP Certified Cathodic Protection Specialist.

Mr. Panchal is AMPP Lead Instructor for Cathodic Protection Level-1, Level -2 ,Level-3 and Level-4 since 2014.

He was Awarded` “Excellence in Corrosion Science and Technology (2018) By AMPP (NACE International) India Section.”

Mr. Panchal has published more than 12 papers in Various Corrosion Solutions papers in USA, Bahrain, Abu Dhabi and Canada.

Mr. Panchal has Designed and successfully commissioned CP systems for 5,500+ Single and Multiple Well Casings (Saudi & UAE).

He has Designed and successfully commissioned CP systems 10,000+ KM Cross Country Pipelines mostly on multiple pipeline corridor with AC/DC Interference Mitigation work (India and Saudi Arabia).

He has Developed Concept of Multiple well casing (3 to 15) protected with asingle power source in the year 2002. This concept was developed with Saudi Aramco, Consulting Service Department. “First time designed in Saudi Aramco,MiddleEast, and WORLD”.

Mr. Panchal was session chair for 12+ AMPP conferences in Middle East and India.

Name	**Vemuri Padmanabha Sastry**	
Designation & Affliation	Proprietor M/s Asset Integrity and Materials Engineering Services	

Biography :

A. **Total professional experience 45 years**

a) L& T Powai– 14 years

b) RIL – 26 years

At Patalganga (In-charge of Corrosion and Inspection)

At Ghansoli with Reliance Engineering

At Jamnagar with C2 Complex for project execution inspection.

c) Consultancy - July 2019 onwards

A. **Total professional experience 45 years**

a) L& T Powai–14 years

b) RIL–26 years

At Patalganga (In-charge of Corrosion and Inspection)

At Ghansoli with Reliance Engineering

At Jamnagar with C2 Complex for project execution inspection.

c) Consultancy - July 2019 onwards

Highlights

- Developed Corrosion and Materials department in L&T.
- Field experience in Chemical, Petrochemical , Refinery processing plants
- Developed laboratory facilities – hands on corrosion and materials testing experience.
- Established Materials Engineering Services department in RIL-Engg. at RCPTIL Ghansoli.
- Key role in revival of two-year mothballed NOCIL plant, at Ghansoli (RCPTIL of RIL).
- Proficient in process knowledge of refinery and petrochemicals, chemical plants and have H2SO4, Single super phosphate plant and HNO3 concentration plant commissioning experience.
- Participated in plant shutdowns over 25 times.

Conference paper presentations

Total : 46 nos.

Investigations

More than 100 case studies

Training

* Co-ordinated all mechanical related training modules preparation at Patalganga.
* Corrosion, Materials selection, Paints and Coatings, Static equipment and piping, Integrity management, Refinery processes – Over 800 hrs.of lecturing.

Awards : Received Corrosion Awareness (2004 & 2011), Meritorious (2022), three times best paper awards.

Name	**Dr. -Ing.: Smrutiranjan Parida**	
Designation & Affliation	Professor Department of metallurgical Engineering and Materials Science, IIT Bombay	

Biography :

Dr.-Ing. Smrutiranjan Parida, Professor at the Department of Metallurgical Engineering and Materials Science, Indian Institute of Technology Bombay. He specializes in corrosion analysis and alloy development, smart & functional coatings, galvanized coatings, and application of nanomaterials in corrosion mitigation.

Prof. Parida's research led to ninety publications in international journals and conference proceedings, three patents, and two book chapters on coatings and atmospheric corrosion (published by Springers).

Supervised sixteen Ph.D. students, six postdoctorates, and several M. Tech. students. He has developed several academic curriculums, training modules, and study materials on corrosion for industry, and organized several QIP, CEP, and workshops on corrosion and coating for the industry.

Recently, he received the Prestigious "S.K. Seshadri Memorial MASCOT National Award– 2021" for outstanding contribution to the field of corrosion from the Electrochemical Society of India. Prof. Parida is also the recipient of the prestigious DAAD fellowship from Germany.

Name	**Dr. R Baloji Naik**	
Designation & Affliation	Scientist-E, Protective Coating Division, Naval Material Research Laboratory, Defence Research & Development Organisation, Ministry of Defence, Govt of India Shil-Badalapur Road, Anadnagar P.O. Ambarnath, Maharashtra-421506 Tel: +91-251-2623059	

Biography :

Dr. R. Baloji Naik did his M. Sc (Organic Chemistry) from Osmania University, Hyderabad and Ph. D from Mumbai University, Mumbai. R. Baloji Naik has been working as a Scientist in Naval Materials Research Laboratory (Defence Research and Development Organization-DRDO), Ambernath, Maharastra for the last 16 years and involved in the development of various organic coatings for Indian Navy. Indian Navy is using some of his developed coatings regularly on naval ships. He is also involved in the paint failure analysis of paint samples received from naval ships. He is continuously providing technical support to Navy and NMRL ToT firms in the field of marine coatings. Dr R Baloji Naik has made significant contributions to the corrosion field in terms of publications. He has seven (3 granted and 4 filed) Indian patents and more than twenty five technical reports to his credit. He published more than twenty five research papers in reputed international peer reviewed journals and presented more than 30 papers in national and international conferences. He has also provided guidance to two PhD and eight M Tech/M Sc project students and presently guiding three Ph Ds. He was runner up for 5th National Award for Technology Innovation, 2015 organized by CIPET, India and Ministry of Chemicals & Petrochemicals, Govt. of India. He has received Distinction in Corrosion Science and Technology award in the year 2016 and three best paper awards in CORCON 2016, 2019 and 2022 respectively from NACE International Gateway India section. He has awarded prestigious DRDO Young Scientist Award for the year-2016. His name has published in the Paint square journal for prestigious award as top people in the category of top formulator. He has received Lab level technology group award for the year 2020 as one of the team members. He has bestowed with National Science Day Oration 2021 medal and certificate from DRDO. He has received runner up award of 11th National Award for Technology Innovation, 2021 organized by CIPET, India and Ministry of Chemicals & Petrochemicals, Govt. of India as one of the team members. Recently, He has received Meritorious Contribution Award-2023 under Research and Development Organization category from AMPP India Chapter.

Name	**Dr. Veena Subramanian**	
Designation & Affliation	SO/G, Water and Steam Chemsitry Division, BARC Facilities, Associate Professor (Chemical Sciences), Homi Bhabha National Institute, Kalpakkam – 603102 Tamilnadu	

Biography :

With twenty-seven years of experience in nuclear reactor water chemistry, I have conducted both basic and applied research. Key projects include developing a computer code to predict activity transport in the primary heat transport system of pressurized heavy water reactors (PHWRs) and developing a steam generator cleaning formulation for tube sheet deposits. My research also focuses on electrochemical corrosion measurements and oxide characterization on structural materials at high temperatures. Specific studies examined chromium's role in altering oxide films on mild steel alloys and magnesium's effect on zircaloy corrosion. I have employed online electrochemical methods at 288°C to assess titanium alloys and Incoloy for localized and uniform corrosion susceptibility. My Ph.D. research explored alloy microstructure influence on the corrosion behavior of stellite alloys, and my postdoctoral work developed a model for water and vapor radiolysis at high temperatures, extending mechanisms to supercritical water. Additionally, I tested candidate materials' corrosion in supercritical conditions with and without added oxygen. Currently, I am evaluating octadecylamine's effectiveness in inhibiting corrosion in the secondary coolant circuit of Indian PHWRs.

<table>
<tr><td>Name</td><td>Sankaran Srinivasan</td><td rowspan="2"></td></tr>
<tr><td>Designation
& Affliation</td><td>Asst General Manager (Central Quality – Field Quality)
Academic Qualifications
1. ME Metallurgical Engineering from NIT Trichy in 1995
2. MBA (International Business) in 2008</td></tr>
</table>

Biography :

Field of work / interests

1) Quality Metallurgist in Rane Madras Limited handling HT and special processes.
2) R&D Metallurgist for 9 years in Brakes India Limited
3) Currently working as AGM in Ashok Leyland in Central Quality Department
4) Strong believer of Industry Institute relationship

Awards & Achievements

1. Awarded by ASM and MMS as the Best Metallurgist award in 2015
2. Presented 12 technical papers including one Application of Nano Technology in automobiles in ZOZ-GERMANY in 2010
3. Invited member from Anna University for the syllabus framing committee for BE Materials Science Course
4. Life Member in SAE, NIQR and MMS with active membership in ASM also
5. National Secretary in SAE in 2008 and President of MMS in 2010 and has been the co convener for ASM International conference 2023 held in Chennai
6. Visited countries – Germany, Korea, China and Taiwan and Japan for Technical Material Developments activities.

<table>
<tr><td>Name</td><td>Denzil D'Costa</td><td rowspan="2"></td></tr>
<tr><td>Designation
& Affliation</td><td>Mechanical Engineer with a Management Diploma in Quality control & ISO certification</td></tr>
</table>

Biography :

Mr. Denzil D'Costa is a Mechanical Engineer with a Management Diploma in Quality control & ISO certification, A NACE Certified Coating Inspector, Presently working as National Sales Manager for Graco Hong Kong Ltd, over 22 Years experience in Paints and Coating Applications equipments in India and Abroad.

He has presented papers at various conferences and is a regular faculty member of educational institute & organization. Mr. Denzil is coordinator of NIGIS educational corrosion awareness program on Coating Applicator.

Name	**Dr. Anil Bhardwaj**	
Designation & Affliation	Former, Group General Manager and ONGC & Head of Materials & Corrosion Section, IEOT	

Biography :

Superannuated as Group General Manager and Head of Materials & amp; amp; Corrosion Section, IEOT after 35 years of service in ONGC. He has executed / coordinated / supervised more than 200 projects on various aspects of corrosion, viz. material selection, failure analysis, paint & coating, MIC, CP, corrosion monitoring and corrosion audit etc. He has Published / Presented more than 100 papers, edited three books as main contributor: Internal Corrosion of Pipelines, Published by Narosa Publications, Corrosion Case Studies, Published by NACE International Gateway India Section, Learning from Failure Case Studies, Published by ONGC.

He written a Chapter “Petroleum fluids properties and production schemes: Effect on Corrosion” in book, “Trends In Oil and Gas Corrosion Research and Technologies: Production and Transmission”, published by Elsevier. He has Co-inventor of three patents awarded in the USA and Canada and Five patent applications pending in India. He is Faculty in several corrosion courses in oil and gas industry. He received NIGIS “Meritorious Contribution Award” for the year 2016 and Corrosion Awareness Award” for the year 2000, NCCI Meritorious Contribution Award – 2016.

Name	**Dr. Kannan Chandrasekaran**	

Biography :

Dr. Kannan Chandrasekaran Superannuated Indian Oil Corporation Limited. Dr. Kannan specializes in Material selection for Corrosion prevention, Failure analysis, Condition monitoring &Advanced Non Destructive Test techniques, Fitness for purpose evaluation and Life extension of refinery components.

He has over twenty six years of experience in working with the materials related issues of refining industry. He graduated in Metallurgical Engg. from Indian Institute of Science, Bangalore and obtained his masters degree in Industrial Metallurgy from Indian Institute of Technology, Madras. He is a Doctorate from the Indian Institute of Technology, Delhi. He is a member of the National Association of Corrosion Engineers (NACE), USA and also the executive committee member of NACE Gateway India section.

Dr. Kannan has More than thirty five technical publications in Journals &conferences of repute. He has authored more than hundred technical / project reports. He has been conferred with the Petrofed Innovator of the year – Team Award for 2015.

Name	**Dr. Jaya Rawat**	
Designation & Affliation	Academic Qualifications Executive MBA from S.P. Jain College, Mumbai, 2020 Ph.D., Z.H. Engg. College AMU Aligarh, 1998, “Physico-chemical studies on some metallic Corrosion inhibitors”	

Biography :

Experience in the area of Corrosion & Research Corrosion failure analysis Pipeline internal corrosion Development & Commercialization of cost effective corrosion inhibitors and additives Corrosion due to oxygenates used fuels on automotive parts Processing high tan crudes using corrosion inhibitors Rust preventive/corrosion protective coatings/paints Developing innovative techniques to monitor corrosion in non-aqueous media Microbiological corrosion Coatings and paints for industrial usage Heat exchangers fouling studies Water corrosion studies Corrosion and fouling related issues with crude compatibility Fouling in heat exchangers, industrial problems remediation.

Publications & Patents : 95 in International and national Journal and book chapters, 12 patents granted and 3 filed Member of NACE/AMPP Reviewer of many research journals of Elsevier Publications, guided Ph.D. and M. Tech students, Delivered talks at various conferences, institutes and National/International Forums, Received prestigious award of Best Ph.D. Best Paper and Excellence in Corrosion Science, Best Lab award from NACE, Best paper awards from NCCI, Petrotech award for Best Innovator, Frost & Sullivan awards for research projects etc. Coordinated research based industrial projects with IIT Madras, ICT Mumbai, IICT Hyderabad, M.S. University Vadodara, Osmania Agricultural University Odisha, BITS Plani, Goa Campus and other PSUs like EIL R&D for various research developmental projects.

Name	**K Sadanand**	
Designation & Affliation	Sadanand is a Chemical Engineer from AC Tech and has done his PG Ex Dip in International Business & Finance from LIBA.	

Biography :

He started his career as a Trainee Engineer in a Public Sector National Aluminium Company and then shifted to Technical Sales in Water Treatment in Ion Exchange and has worked in many Leading Water Treatment Companies as GM- GE Water, VP Nalco water , pus and other PSUs like EIL R&D for various research developmental projects. Regional Sales Director - SEA -IWT Solenis and now currently is CEO of Kurita India !

He has around 35 Years experience in the field of Water & Waste Water Treatment solutions both in Engineering and Speciality Chemicals field and his Key Success with his customers has been Differentiated Technical Services and Providing Total Water Management Solutions. He has travelled extensively in the world and has had wide exposure in Middle East, India and SEA Markets in the Water & Waste water treatment field.

He is the Hon Secretary of IICHE CRC Chapter and has been elected IICHE Council member for 2025-2027 and is the Secretary of Ac tech Alumni association.

He is a regular speaker at many IICHE forums.

Name	**Prof. N Rajendran**	
Designation & Affliation	Ph.D from the department of Analytical Chemistry, University of Madras, Chennai	

Biography :

Prof N Rajendran obtained his Ph.D from the department of Analytical Chemistry, University of Madras, Chennai in 1996 and joined as a faculty in the department of Chemistry, Anna University, Chennai in 1998. He did his Post doctoral research at Corrosion Resistant Design Group, Steel Research Centre, National Institute for Materials Science (NIMS), Tsukuba, Japan and he has been a guest faculty at NIMS, Japan. Prof. N Rajendran is an internationally respected corrosion science and technology specialist. He has a long standing reputation within the corrosion community for his research into many facets of the associated corrosion phenomena of different metals, particularly stainless steels and titanium with an orientation towards biomaterial development. In particular, Prof. N Rajendran is a recognized expert in the field of biomaterial and other polymer composites. Dr. Rajendran's research results have also influenced the corrosion fraternity and the biomaterial community at large. In the wider materials/biomaterials community, he has served on numerous committees, advisory boards and steering groups.

He has guided more than 26 Ph.D scholars besides more than 15 master students. He has completed major research projects sponsored by AICTE, CSIR, UGC-DAE, ICMR, UGC, DST, CSIR, AERB, and UGC. He has published more than 150 papers in the International journal and more than 160 conference proceedings. He has received more than 40 best paper awards.

Dr. Rajendran's contributions in the field of corrosion science and technology, he has been recognized by many awards which include “The Excellence in Corrosion Science & Technology for the year 2009” from NACE International Gateway India Section, Mumbai, MASCOT National Award-2014 from Electrochemical Society India at IISc, Bengaluru, the Meritorious Contribution Award - 2014 from National Corrosion Council of India (NCCI), at CSIR-CECRI Karaikudi, Active Researcher award-2013 from Anna University, Tamil Nadu Scientist(TANSA) award -2014 from Government of Tamil Nadu, Mid Career Award -2017 from UGC, New Delhi, TUSHAR JHAVERI award-2017 from East Asia Pacific Area-NACE International and Meritorious contribution award-2017 from NIGIS, Mumbai.

Most significantly, he was elected Fellow to the Indian National Academy, Chennai (FASC) Fellow of Royal Society of Chemistry, UK(FRSC) and Fellow of NACE International, USA (FNACE).

Name	**Professor (Dr.) Mohammad Mobin (FRSC)**	
Designation & Affliation	Vice Chancellor, Cluster University of Srinagar, Jammu & Kashmir	

Biography :

Professor Mohammad Mobin is an internationally recognized researcher in the field of Materials and Corrosion. He obtained his PhD in Chemistry in 1988 from Aligarh Muslim University and subsequently joined as Lecturer and later promoted to Professor in 2005. During the period 2001 to 2006, he worked as

Professor Mohammad Mobin is an internationally recognized researcher in the field of Materials and Corrosion. He obtained his PhD in Chemistry in 1988 from Aligarh Muslim University and subsequently joined as Lecturer and later promoted to Professor in 2005. During the period 2001 to 2006, he worked as Corrosion Researcher at Seawater Desalination Research Institute, SWCC, Al-Jubail, Saudi Arabia and carried out industrial, academic and Root Cause Failure Analysis/Trouble Shooting projects. Prof. Mobin has supervised 17 PhD, 2 M.Phil. and 12 M.Sc. Tech students, authored 188 research papers and contributed 05 books and 38 Book chapters. Prof. Mobin has also completed 40 research projects including three projects under international collaboration. He has also attended 40 corrosion conferences/workshops in India and abroad and delivered keynote talk/invited talks. Dr. Mobin was awarded the NIIS corrosion awareness award 2007, NIGIS Meritorious Contribution Award 2022 and NCCI Meritorious Award 2023 for his meritorious contribution in the field of Corrosion Science & Technology. He has been listed in top 0.05% of all scholars worldwide and 25th globally in the field of Corrosion by ScholarGPS over the past 5 years. He has also figured in World Top 2% Scientists by Stanford University, USA for the last 5 years.

Name	**Dr. C. Umarani, Ph.D**	
Designation & Affliation	Professor & Director (Centre For Research) Email ID : umarani@annauniv.edu +91 44-2235 7409	

Biography :

Expertise

Earthquake Structural Engineering

Finite Element Analysis

Construction Engineering

Educational Qualifications : PDF (2006) - Structural Engineering , University Of Canterbury, New Zealand.

Ph.D (2002) - Civil Engineering, Bharathiar University.

M.E (1991) - Structural Engineering , Anna University.

B.E (1986) - Civil Engineering, Bharathiar University.

Experience : Professor, College of Engineering, Guindy, Anna University, Chennai – 2014 - present.

Associate Professor, College of Engineering, Guindy, Anna University, Chennai – 2009 - 2014.

Associate Professor, College of Engineering, Guindy, Anna University, Chennai – 2006 - 2009.

Associate Professor, Institute of Road and Transport Technology, Erode – 2006 - 2006.

Associate Professor, Institute of Road and Transport Technology, Erode – 2004 - 2006.

Selection Grade Lecturer, Institute of Road and Transport Technology, Erode – 2003 - 2004.

Senior Lecturer, Institute of Road and Transport Technology, Erode – 1994 - 2002.

Lecturer, Institute of Road and Transport Technology, Erode – 1988 - 1994.

Associate Lecturer, Institute of Road and Transport Technology, Erode – 1986 - 1987.

Name	**Raman Vedarajan, PhD, Scientist**	
Designation & Affliation	Centre for Fuel Cell Technology International Advanced Research Centre for Powder Metallurgy and New Materials (ARCI)	

Biography :

Education

Jan 2002 – Jun 2006 Anna University, Chennai, Doctor of Philosophy, Electrochemical Surface Modification, Mophological Investigation, Electrochemistry, Chennai

Aug 2000 – Aug 2001 Anna University, Chennai Master of Philosophy, Materials, Coatings, Electrochemistry, Chennai

Apr 1998 – Mar 2000 Sri Sathya Sai Institute of Higher Learning. Master of Science, Chemistry Puttaparthi, Andhra Pradesh

Apr 1995 – Mar 1998 Sri Sathya Sai Institute of Higher Learning Bachelor of Science (Hon's), Chemistry Puttaparthi, Andhra Pradesh.

Research Experience

Aug 2017 – present Scientist – ARCI, Chennai

May 2012 – Jul 2017 Professor (Assistant) - JAIST, Japan

Apr 2010 – Apr 2012 Scientist - ARCI, Chennai

Oct 2006 – Oct 2009 PostDoc Fellow – NIMS, Japan

Apr 2004 – Mar 2006 International Exchange Researcher - Osaka University, Japan

Awards & Grants

1. MEXT–MHRD – Japanese Government Scholarship Exchange Fellow 2004 – 2006, Osaka, University Japan.
2. Co-Investigator of India-Japan Co-operative Science Program – JSPS-DST Collaborative Research between JAIST, Japan and Center For Fuel Cell Technology, ARCI, India – Project entitled “Organoboron organic- inorganic hybrids as solid electrolyte for Li batteries with graphene based anodes” (2013-2015).
3. Member of Toyota National Project [TherMAT (NEDO)]

<table>
<tr><td>Name</td><td>Prof. Ralf Feser</td><td rowspan="3"></td></tr>
<tr><td>Designation & Affliation</td><td>University of Applied Sciences South Westphalia,
Laboratory of Corrosion Protection,
Iserlohn, Germany</td></tr>
<tr><td>Topic</td><td>A new zinc alloy for galvanizing of steel</td></tr>
</table>

Abstract

Zinc is a widely used metal, to protect steel against atmospheric and other types of corrosion. Zinc and the steel industry are closely related because zinc is primarily used to galvanize steel to protect it from corrosion.

Zinc naturally forms a passivation layer when exposed to air. A thin coating of zinc oxide forms that stops the corrosion of the metal (galvanization). Galvanization prevents the steel or iron it coats, from rusting. In addition, galvanization offers many other advantages, such as :

- **Longer Life** : A piece of galvanized industrial steel is expected to last more than 50 years in typical environments and 20 years with major water exposure.
- **Durability** : A finished galvanized product is more durable and more reliable than unfinished metal products.
- **Cost Effectiveness** : Galvanized steel is immediately ready to use upon delivery and does not require additional preparation of the surface, inspections, painting, or coating, saving the company expenditures.

Around 50% of steel is protected against corrosion by zinc. The forecast for the amount of steel produced continues to rise sharply. It is therefore necessary to reduce the thickness of the zinc coating on steel while at the same time improving the corrosion protection effect in order to reduce the amount of zinc consumed. Various zinc alloys for hot-dip galvanizing have been developed, some of which have had a negative effect on the galvanizing process.

Zinc-chromium alloys represent a promising new development for the hot-dip galvanizing of steel. Although the solubility of chromium in the molten zinc is relatively low, approx. 0.4 %, it has very positive effects. The coating thickness is reduced and corrosion resistance is improved. Other properties of the zinc coating are not affected by the addition of chromium. Metallographic cross-sections and electrochemical tests as well as atmospheric corrosion tests demonstrate the properties of the new alloy.

Biography:	
	1980 - 1985 Study of materials sciences at the Friedrich-Alexander-University Erlangen-Nürnberg, Germany, specializing corrosion and surface technology. 1986 - 1990 Research assistant Max-Planck-Institut für Eisenforschung in Düsseldorf, Germany in the working group Corrosion PhD-work "Corrosion of polymer coated iron" under supervision of Prof. H.-J. Engell, Prof. Dr. M. Stratmann and Prof. K. Heusler, Clausthal-Zellerfeld , Germany. 1991 - 1995 Group leader for materials application technology Central Research Laboratory Metallgesellschaft in Frankfurt am Main, Germany from 1994 : Group leader corrosion and materials consulting. 1995 Group leader electrochemical application technology, Chemetall GmbH 1995 - 1999 Lectureship at the University Erlangen-Nürnberg, Germany. since 1996 Professor for corrosion and corrosion protection at the University of Applied Sciences in Iserlohn, Germany, Head of the Laboratory for Corrosion Protection Technology. since 1999 Lectureship corrosion science at the RWTH Aachen University, Germany. 2005 - 2019 CEO of Institute for Maintenance and Corrosion Protection gGmbH at the University of Applied Sciences in Iserlohn, Germany. since 2021 Additional Head of the Laboratory for Instrumental Analysis at the University of Applied Sciences in Iserlohn, Germany. - Chairman of the competence platform "Centre for Strategic Corrosion Protection" - Foundation and head of the GfKORR working party on corrosion and corrosion protection of copper materials until 2019. - Member of GfKORR board since 2004 till today. - President of the German Corrosion Society GfKORR (Gesellschaft für Korrosion und Korrosionsschutz e.V., Frankfurt, Germany) 2013 – 2022. - Member of the GfKORR advisory board. - Former president of the research board of the hot dip galvanizing industry GAV (Gemeinschaftsausschuss Verzinken e.V., Düsseldorf, Germany) for 6 years, still member. - Member of working party materials in drinking water of Federal environmental organisation UBA (Umweltbundesamt, Germany). - Member of working group corrosion of Water and gas organisation DVGW in Germany (Deutscher Verein des Gas- und Wasserfachs e.V., Germany). - Member of the board of WCO (World Corrosion Organisation). - Member of Science and Technology Advisory Committee (STAC) of the European Federation of Corrosion (EFC) 2013 – 2022. - Head of working party Hydrogen technologies of the University of Applied Sciences in Iserlohn.

Name	**Jim Marr, P. Ag**	
Designation & Affliation	President, Marr Associates Pipeline Integrity	
Topic	**Stress Corrosion Cracking within the Pipeline Industry**	
Abstract	Stress corrosion cracking (SCC) can be a significant time dependent threat that can impact the safety and reliability of a pipeline. Given the initial failure that was identified as SCC was in the mid 1960's there has been ongoing research and development activities to address the causes and differences of the actual mechanisms with more emphasis on two of the three known related parameters. The three parameters are well known and illustrated by a widely published Venn diagram consisting of environment, stress and material. The latter two parameters have been heavily "researched" since the late 1960's through to the present time. Attempts were made to understand the "environmental relationships" between soil characterization and geochemistry that required "very specific" sampling and laboratory analysis protocols that were then associated to similar site conditions where SCC had been detected or was absent. This was the initial data integration challenge that attempted to address the location, absence or presence and severity of SCC. SCC investigations were prompted by an event in 1965 when a 32-inch pipeline near Natchitoches, Louisiana, USA exploded at 6:00 am with a fireball that killed 17 and injured 9 individuals but also burnt and destroyed 7 homes that were 450 feet (137 meters) from the initiation point. Since 1965 through 1974, environmental data integration was attempted but it was not until the mid 1980's that a different approach was undertaken. This was in response to three in-service ruptures located in Ontario, Canada. Research and field activities were reinitiated with the integration of environmental data to manage the SCC threat. This integration resulted in the development and implementation of SCC predictive models based on consistently mapped terrain conditions that were matched to direct examination results and integrated with pipe (material and construction attributes) and operational (i.e. stress and temperature) characteristics.	

	Since the mid 1980s' to the present there has been some success with the use of various environmental "tools" but the variability of individual inputs has spatial, temporal and inter-relationships resulting in complex, non aligned or inconsistent correlations that continues to be disconcerting to industry. Even ILI crack tools can suffer without any additional program inputs mainly from SCC environmental attributes but also always include stress and material parameters. The incidence of integrating environmental data with stress and pipe characteristics with ILI analysis has resulted in decreased false positives and negatives and run to run issues when addressing the SCC threat. ILI Crack tools emerged in the mid 1990's but it was not until the mid 2000's to late 2010's depending on the technology when these tools were fully commercialized but have now become expensive and have established limitations when utilized independently for SCC threat management. While ILI "true positives" are always welcome this technology is not always 100% reliable. Data integration and modelling has been critical to the management of the SCC threat across the development, testing and post commercialization of ILI services. SCC threat management is more confident and reliable when all the tools are available for the pipeline threat. The future success of SCC threat management is only going to improve with new technological developments that may become integrated with known historical methods.
Biography:	Jim Marr, P.Ag (retired) is and has been President of Marr Associates Pipeline Integrity Ltd from 1990 to the present. Jim and then Marr Associates has been associated with the pipeline integrity business for 35+ years. Has performed pipeline assessment programs in almost all continents worldwide. From late 2008 to October 2016, he went "corporate" as the SCC Program Planning Manager for TransCanada Pipelines. He has been recognized as a Subject matter expert (SME) related to integrated pipeline integrity threats and management techniques – environmental interaction, direct examination (DE), stress corrosion cracking (SCC), external corrosion (EC), manufacturing threats, coating evaluations, CP related interactions for SCCDA, ECDA and ILI (EMAT, MFL and UT) programs and the integration of data required for program support to establish the extent, location and severity of the threat and the ongoing risk management of the threat. He graduated with a degree in earth sciences (geology, geochemistry) in 1986 from the University of Guelph, Ontario, Canada. He has been part of the core team to develop and instruct several courses related to pipeline integrity and SCC for Clarion group, AMPP/ NACE etc. He was the past co-chair of the 2012 "Joint Industry Project for SCC in HCA's and has been past vice-chair of the NACE SCCDA committees. Presently he serves as the "Deputy Project Manager for AMPP SCCDA SP0402.

Name	**Vijayamohanan K Pillai**	
Designation & Affliation	Professor IISER - Tirupati	
Topic	**Importance of Suppressing Corrosion in Li/Na Rechargeable Batteries**	
Abstract	In this lecture I plan to discuss various aspects of controlling the corrosion of cathode, anode and current collectors of Li/Na ion rechargeable Batteries. The last decade has seen the development of many innovative materials with excellent corrosion resistance in normal battery electrolyte environment and some of these 2D materials have intrinsic advantage of surface functionalization to prevent self-discharge. Reactive anodes like Mg, Na and Li undergo serious electro-chemical corrosion under open circuit conditions resulting in unacceptable self-discharge rates and also rapid capacity loss during the initial cycling itself often resulting in cell failure. Controlled passivation is an elegant strategy to offset the damaging effects of solid electrolyte interface involving dissolution, reprecipitation and solvent reorganization involving several anions. Inn addition, both anodic and cathodic current collectors undergo corrosion and the life of batteries depend on several such parameters including the separator failure. In this talk some of these critical issues are discussed with respect to the ongoing work in our group with respect to the van der Waal's gap engineered electrode materials for Li/Na ion Batteries	
Biography:	Prof. Vijayamohanan K Pillai is a leading Electrochemist from India, who after his Ph.D from the Indian Institute of Science, worked in many areas of electrochemistry for about two decades at the NCL, Pune. He has authored over 280 publications and 30 patents related to many innovations in both Electrochemistry and Materials Chemistry, while advising about 28 Ph.D. students. His group has developed highly sensitive nanostructured electrocatalysts for Fuel Cells and many two-dimensional electrocatalysts include graphene and phosphorene as quantum dots. His research interests include Materials Electrochemistry, functionalization of carbon nanotubes/graphene nanoribbons and hybrid materials using many 2D systems for energy storage applications. His books on “Functional Materials: A Chemist's Perspective” published by university Press and “Multi functional Electrocatalysis” published by the Royal Society of Chemistry, UK are well known. He has received many honors and awards like The MRSI Medal, Bangalore in 1996 and CRSI Bronze Medal in 2004. He is a Member of the Editorial Board of many journels like Electrocatalysis and Scientific Reports 2015 and is a Fellow of many academies. He has also visited many foreign countries for giving invited lectures and chairing conferences. In addition to being Director of CSIR-CECRI (2012 – 2018), he held the additional charge as Director, CSIR-NCL, Pune from June 2015 to February 2016. He has become a J C Bose Fellow of SERB in 2020 after joining IISER-Tirupati in2019. He may be contacted at vijay@iisertirupati.ac.in	

Name	**Prof. Amir Eliezer**	
Designation & Affliation	Immediate Past Chair 2024, AMPP Shamoon College of Engineering, Israel	
Topic	**Nano-Biotechnology and Development of Advanced Medical Devices**	

Abstract

The presentation will focus on the fascinating use of the relationship between nanoparticles to Biotechnology and its correlation to corrosion management within the field of medical devices. It will explore the challenges and highlight as well as the obstacles answering the requirements.

The presentation will delve into case studies, initiatives, and best practices that underscore the importance of standardized policies, technological innovation, training, and knowledge sharing. Additionally, it will address the economic and strategic advantages of effective corrosion management, and conclude by outlining potential future.

The importance of corrosion management understanding the relationship between materials and process properties

A few of the key objectives for this presentation include:

- The needs for advanced medical devices
- The Challenges
- The importance of understanding the corrosion
- The need for creating awareness for the implement of advanced medical devices in humans

Technologies offer innovative solutions for early detection, monitoring, mitigation, and maintenance, ultimately enhancing operational readiness, safety, and cost-efficiency.

Research and innovation play a pivotal role in advancing corrosion-resistant materials, driving significant advancements in industries such as defense, infrastructure, transportation, energy, and more. The importance of research and innovation in this field cannot be overstated, as they lead to the development of materials that withstand corrosive environments, contribute to longer equipment lifespans, enhance safety, and drive economic and environmental sustainability

Today there is an increasing demand for healthy long- and short-term medical implants.

	Within the last years regulatory approval became more difficult for medical implants. For example once taking into account ISO 10093 the implant surface is a key role to the overall obtained results. Bio function surface behavior should include surface engineering and surface control efforts comprised of policies, processes and procedures that address corrosion across the complete lifecycle of the implant, from design to decommissioning. The lecture will also describe the development in biodegradable implants as well as no degradable implants.
Biography:	Prof. Amir Eliezer is the Immediate Past Chair 2024, AMPP - Association for Materials Protection and Performance) Board of Directors. Has studied BSc, MSc, PhD in Materials Engineering (Summa Cum Laude) and an additional M.B.A. He has received several awards and recognitions including the H.H. Uhlig 2013 award. He has published more than 250 scientific publications and has presented over 160 invited seminars and lectures He has a vast range of experience and expertise in different technologies of medical implants and medical oriented surface manufacturing devices. He gained expertise within the Automotive Industrial Innovative products with leading companies such as Volkswagen, General Motors and Fiat on advanced materials, light structures, and nanomaterials. He is the former President of the WCO (World Corrosion Organization- U.N. NGO and NACE International Director of European Area. He served as an elected deputy mayor and municipality leadership for the last 20 years and currently on several national and international committees.

Name	**Dr. R. Vijay**	
Designation & Affliation	Director, ARCI	
Topic	**Ushering into a self-dependent India in Energy Storage materials : Bridging the Gap between Lab to Pilot Scale Manufacturing @ARCI**	
Abstract	Lithium-ion batteries (LIBs) are currently used in most electric vehicles (EVs) due to their high energy density, better nominal voltage, enhanced temperature stability, low maintenance, eco-friendliness, long cyclic stability and low self-discharge. As the cost of electrode materials is very high when compared to other components of LIB, development of indigenous electrode materials technology is essential for the manufacturing of Li-ion batteries within the country. Among the cathode chemistries used in LIBs, Lithium ferrous phosphate (LFP) cathode material has a safer chemistry because it avoids self-oxidation and thermal runaway due to strong covalent bond between P and O in PO4 structure of LFP. ARCI has developed an innovative and low-cost high energy milling process for the synthesis of in-situ carbon modified LFP for Lithium-ion batteries and demonstrated the technology at pilot scale in collaboration with Industry under public private partnership (PPP) mode. Technology Know-how for the production of LFP was transferred to Indian industries and the technology was successfully demonstrated1. The technology receiver (M/s. ALTMIN) is being incubated at ARCI incubator and LFP cathode powder material produced by M/s. ALTMIN is being validated by various Li-ion cell manufacturing companies. Further, ARCI also developed a simple, economical scalable, and energy-efficient process for the production of lithium titanium oxide (LTO) anode material with a performance at par with commercial LTO. A large-scale demonstration of ARCI's developed LTO process has been initiated in collaboration with Industry. The LTO innovation has been filed in National and worldwide2 and technology transfer is in progress.	

	References : 1. Vijay et al "A method of producing high performance in-situ carbon coated lithium iron phosphate cathode material for lithium ion battery applications and the product thereof," Indian Patent No. 412586 (granted) dated 28/11/2022; US Patent Application No. 18/254,730 dt. 29/05/2023; Australia Patent Application No. 2021412505 dt. 1/05/May 2023; Europe Patent Application No. 21914895.4 dt. 9/06/2023; Brazil Patent Application No: BR112023012812-9 dt 26/06/2023; Israel Patent Application No: 1L304060A dt. 26/06/2023; Chinese Invention Patent Application No: CN116686109 dated 20th June 2023; UAE Patent Application No. P6001377/2023 dt 6/06/2023. 2. Vijay et al "A method of producing high performance lithium titanate anode material for lithium ion battery applications" Indian Patent No. 365560 (granted) dated 28-04-2021, PCT International Application No. PCT/IN2018/050080; US Patent No.11001506 (granted) on11/05/2021; Germany Patent No. 112018000205 B4 (granted) on 17-07-2023; Japan Patent No.7121734 (granted) on 09-08-2022; Chinese Patent No. IIC190527 (granted) on 01/12/2021; South Korea Patent No.03079 (granted) on 29/12/2022.
Biography:	Dr. R. Vijay obtained his B.Tech and M.Tech in Chemical Engineering from Regional Engineering College Warangal and Ph.D. in Mechanical Engineering from IIT Madras. He joined International Advanced Research Centre for Powder Metallurgy and New Materials (ARCI), an autonomous R&D Institute under Department of Science and Technology, Govt. of India as Scientist-B in 1996. He has 30 years of experience in Research and Development of materials and processing technologies. His research interests are Nanomaterials, High Kinetic Processing (Mechanical Alloying), Oxide Dispersion Strengthened Steels, Li-ion/Na-ion battery materials, Super capacitors, Biomaterials, Additive manufacturing, Hydrogen Storage Materials. He has 5 technology transfers namely (i) Production of battery grade Lithium Iron Phosphate (LFP) cathode material for Li-ion batteries, (ii) Dispersion Strengthened Tungsten Jet wanes, (iii) Silica Aerogel based Thermal Insulation Sheets, (iv) Lead free Copper Alloys for bimetal bearings and (v) Heat Pipe based Heat Sinks to his credit. He executed about 15 prestigious sponsored projects from DAE, DRDO, DST, MNRE and international projects of IGSTC and GITA as a Lead PI. He has 25 patents and 55 publications to his credit. He is recipient of DAAD fellowship, Indo-US fellowship, Engineer of the year award from Institution of Engineers and Distinguished Researcher award from FTCCI. He is a fellow of Institution of Engineers (India) and Telangana Academy of Sciences. Presently he is Director, ARCI

KEYNOTE TALK

Name	**Rogelio de las Casas Monasterio**	
Designation & Affiliation	Engineering Operations Manager, DeLasCasas CP, LLC. AMPP CP IV, Cathodic Protection Specialist. AMPP Member.	
Topic	**Potential Theory Applied to Cathodic Protection Design**	

Abstract

The potential theory behind the equations used for cathodic protection (CP) groundbed designs: resistance and potentials developed by the groundbeds with different configurations. The interaction of the groundbeds with nearby underground structures and remote earth calculation. Field testing to determine the pipeline attenuation characteristics before design and to verify simulation results during CPS commissioning. The interaction between pipelines with different attenuation characteristics and with the CP groundbeds. The presence of recirculating currents, their impact during On/Off pipe to soil readings, correct interruption processes to avoid their effects, and how to measure them in the field.

Biography :

Education : Havana University, Physics Faculty– Havana City, Cuba.
Bachelor of Physics Science, 1985, Metal Physics.

Certifications : National Association of Corrosion Engineers International (NACE) – Cathodic Protection Specialist and Senior Corrosion Technologies, #6291, 2000, recertified in 2005, 2009, 2013, 2016, 2019, & 2022.

Summary of Experience : Twenty-eight (28) years (1988-1991 and 1997-2024) in corrosion-related jobs, cathodic protection, DC, and AC interference.

Main papers :

- New Earth Potential Equations and Applications
- Resistance Equation For Multiple Horizontal Anode Groundbed
- Methodological Approach to the Average Potential Method to Obtain a Generalized Equation for the Resistance of Vertical Electrodes.
- Methodological Approach to the Average Potential Method to Obtain a Generalized Equation for the Resistance of Vertical Electrodes-II.
- Longitudinal Electric Field Simulation, a Methodological Approach
- Modeling of Pipe-to-Soil Potential Couple with Groundbed Potential Profile
- Modeling of Multi-Pipeline Corridor CP Potential Profile with Common Cathodic Protection System (to be presented at NACE Conference 2017)

Book :

- Potential Theory Applied To Cathodic Protection Design-2022.

Publisher : AMPP

CP Instructor for all levels.

Cathodic protection (CPS) design of offshore/onshore structures, including installation and troubleshooting of CPS, computerized CIS, DCVG, PCM, telluric current, DC interference, and simulation of existing and new CPS. Installation, inspection, and commissioning of cathodic protection systems in English and Spanish.

Name	**Marcelo Cordoba**	
Designation & Affliation	Senior Technical Sales Advisor, Halliburton, USA	
Topic	**Corrosion Related Challenges in Oil Refineries Processing Opportunity Crudes**	
Abstract	Current Refining Industry faces serious challenges to the processing of Opportunity Crudes which included increased variability in crude oil quality, tightening environmental and product quality regulations and maintaining high equipment reliability and throughput. Such opportunity crudes are often treated with chemistries in upstream oil wells, terminals or pipelines that can cause serious adverse impacts on downstream refinery units and metallurgies. For example, crudes from certain locations such as Brazilian offshore production crudes contain calcium naphthenates, and due to this issue, they need to be treated with organic acids like acetic acid. These organic acids can cause corrosion related challenges in refinery units such as distillation tower overheads. Further, many crudes processed in India are imported and are transported in Marine Cargos. Marine transportation only allows 10 ppm of H2S in the vapor space due to safety concerns and protection of the inspection personnel. This triggers the need to treat these crude oils with H2S Scavengers. These H2S scavengers also arrive into refineries with the crude blend and can cause further corrosion related challenges. This work will help summarize the impact of these chemistries and the subsequent corrosion challenges experienced by Indian refineries due to such upstream contaminants and will also discuss possible mitigation solutions to enable refineries to process difficult crudes reliably.	
Biography :	30 Years of Experience Marcelo earned a BSc in Chemical Engineering and MBA from UTN in Argentina. Serving refineries and petrochemical plants around the world. Mostly dedicated to technical roles. Technical Marketing and Product Development. Specializes in ethylene furnace antifoulant (PPA-321) and Coker furnace antifoulant (RPA-301). His involvement includes the development, start-up, monitoring and the global sales/support of these two unique technologies. Actively involved in the development of antifoulants, anti-polymerants, emulsion breakers, corrosion inhibitors, naphthenic acid corrosion inhibitors and finished fuel additives.	

Name	**Dr. (Mrs.) Geogy J. Abraham**	
Designation & Affliation	Scientific Officer-H, Material Processing and Corrosion Engineering Division, Bhabha Atomic Research Centre, Mumbai 400094. Professor, Homi Bhabha National Institute, Anushaktinagar, Mumbai – 400085	
Topic	**Understanding Material Performance in HTHP Steam environment**	
Abstract	The corrosion resistance of super alloy (SG) materials in high temperature and high pressure (HTHP) steam environments is critical for ensuring longevity and reliability of components in power generation industries. This study investigates the corrosion behaviour of various SG alloys when exposed to high-temperature steam conditions, focusing on factors such as alloy composition, microstructure, and protective oxide layer formation. Through a combination of electrochemical testing, weight loss measurements, and surface characterization techniques, we evaluate the mechanisms of corrosion and the influence of operating condition, such as temperature. The interplay between oxidation and SCC in Ni-Fe-Cr alloys is complex. While a stable oxide layer can protect against corrosion, any failure in this layer may expose the alloy to aggressive environments, promoting SCC. Additionally, the oxidation process can lead to the formation of brittle oxides that may contribute to crack initiation. Understanding this relationship is crucial for predicting the longevity of components made from Ni-Fe-Cr alloys and for developing strategies to mitigate SCC through material selection, surface treatments, and environmental control. Results indicate that certain alloying elements significantly enhance the corrosion resistance by promoting the stability of the protective oxide layer. This research contributes to the understanding of material performance in steam environments, paving the way for improved strategies in corrosion management and alloy development.	
Biography :	Dr. (Mrs.) Geogy J Abraham is currently working as Scientific Officer H in Material Processing and Corrosion Engineering Division of BARC, Mumbai and Professor, Homi Bhabha National Institute. She graduated as a Metallurgical Engineer and did her post-graduation in M.E. (Material Technology) from M.S. University of Baroda. She did her Ph.d. (Corrosion Science & Engg.) from IIT Bombay. She completed her Post-Doctoral Fellowship from Federal Institute of Materials Research and Testing, Berlin, Germany. Her area of specialization includes Material degradation of nuclear materials, Failure analysis, Metallurgical evaluation, aqueous corrosion, molten salt corrosion, high temperature oxidation, stress corrosion cracking and micro corrosion. She has contributed a chapter in the book "CORROSION OF AUSTENITIC STAINLESS STEELS". She is recipient of Young Research Award for her M.Tech Thesis presented by IUMRS. She received Best Ph.D. Thesis award from NACE India in 2013. She delivered prestigious "Mayanna Endowment lecture" ECSI in 2013 at IISc Bangalore. She has to her credit about 120 technical publications in international conference proceedings and journals.	

KEYNOTE TALK

Name	**Balasubramani Bakthavatchalu**	
Designation & Affliation	Saudi Aramco Consulting Serviced Department, Dhahran, Saudi Arabia Fellow member of Institute of Corrosion, UK Professional Member of AMPP, AMPP Course Instructor.	
Topic	**Ignore Factors that affect Cathodic Protection System Performance : At your own peril**	

Abstract : Cathodic Protection (CP) is a well-known, well recognized and proven method to combat corrosion of various metallic materials in contact with aqueous medium. Whilst cathodic protection is a simple electrochemical concept, various factors that affect cathodic protection system performance are knowingly or unknowingly ignored and, in the process, it gets challenging to effectively manage and control corrosion.

With advent of cutting-edge technologies and fast phased transformation in this digital world, it is important to stay focused not to lose the basic aspects. Staying focused and addressing things that matter is more important for every cathodic protection engineer or a practitioner. This key-note speech will present details from multiple cases and scenarios of such factors that have affected the cathodic protection system performance and the lessons learned with an aim to bring it to the listeners attention that these indeed matter and shall not be ignored. How the system gets affected as a result of design and operational changes and or modifications made elsewhere without factoring these into the Cathodic Protection aspects will be discussed.

Each of the structure including process vessels, well casings, underground pipelines, marine structures, tank external bottoms & plant facilities are no exception to this challenge. Right from people, site conditions, design, installation, operation, monitoring & maintenance, materials used, neighboring structures & systems, coating type all play a vital role in this challenge and each and every aspect should be properly addressed.

Keywords: Cathodic Protection, Pipelines, Marine, Process Vessels; Current; Corrosion; Monitoring; Protective Coating; Corrosion Control; Anodes; Inspection.

Biography : Over 25 years of experience in corrosion control. A fellow member of Institute of Corrosion, UK & a AMPP course instructor. AMPP (NACE) certified CP Specialist & Corrosion Specialist.

I am currently an Engineering Consultant with Saudi Aramco leading the Cathodic Protection Team at Saudi Aramco, Consulting Services Department. Chairman for the cathodic protection standards committee. I am responsible for providing expert advice and assistance to various company departments, vendors, manufacturers, and design firms on matters relating to corrosion and cathodic protection, development and maintenance of Saudi Aramco Engineering Standards, Best Practices, Design Manuals as well as conducting training programs for employees.

My work responsibilities include project design reviews, support company facility and operations, develop and pursue added value new technologies. Participating in multi discipline review of condition assessment of field issues and failure analysis. Vendor review and approval, materials inspection. Witnessing field installation, testing & commissioning and conducting training programs. Well versed with various international standards such as AMPP, DNV & ISO etc.

Member of AMPP course development committee for cathodic protection courses. As an AMPP course instructor, have trained over 500 people in the past 10 years.

Joint Patents

- Oleophobic And Hydrophilic Conductive Coating for Impressed Current Cathodic Protection Anode
- System and Method for Analyzing Cathodic Protection Current Shielding of A Coating Presented Paper on Well Casing Cathodic Protection in the European Corrosion Conference Eurocorr-2024

Joint Author of following papers

- Corrosion Risk Assessment Model of Subsea Pipelines Network.
- Laboratory Evaluation and Characterization of Mixed Metal Oxides Catalytic Coated Titanium Anodes for Cathodic Protection Applications.

KEYNOTE TALK

Name	**Dr. P. Sriyutha Murthy**	
Designation & Affliation	Scientific Officer F & Prof. HBNI, Biofouling and Biofilm Processes Section, Water & Steam Chemistry Division, BARC Kalpakkam 603102, Tamil Nadu	
Topic	**Penalty of Biofouling on Ship Hulls & dvancements in Antifouling Polymeric Coatings for Naval Applications**	
Abstract	Biofilm and biofouling of ship hulls and propellers, increases frictional resistance and drag resulting in increased fuel consumption. Skin frictional drag accounts for 90% of total drag. Presence of biofilm on antifouling coating surfaces increases frictional resistance by 5 to 25% & hard fouling by 85%. Naval fleets operating in deeper water with speeds above 10-30 knots use coatings having low frictional resistance and fouling release properties based on polydimethylsiloxane (PDMS). PDMS-FRC's with its inception in 1995 has now entered into the 3rd generation with the use of amphiphiles, zwitterions, biocidal nanofillers for preventing biofilm accumulation. Parallely for naval vessels operating at lower speeds of 6 – 15 knots use self-polishing coatings (SPC) with silyl acrylate technology with pendant biocides and increased hydrophobicity. In addition, physical methods like underwater grooming is in practice to increase the time interval between dry dockings and for increased performance. Hybrid FRC's incorporating biocides and other polymers like polyurethane have also been developed which have also shown promising performance. Current development has been focused on improving the foul release properties of the PDMS-FRC as well as the antifouling properties of silyl acrylate-SPC antifouling technology. Biomimicing shark scales into polymer matrices has improved antifouling performance as well as reducing frictional drag. The articles discusses the development in underwater hull coatings in vogue and future research needs for more efficient antifouling solutions.	
Biography :	Dr. P. Sriyutha Murthy, Scientific Officer F & Professor Homi Bhabha National Institute, (HBNI), is currently working at the Biofouling and Biofilm Processes Section, WSCD, Bhabha Atomic Research Centre, Kalpakkam, India. His major research and technological development interests are Biofilm and biofouling control in industrial cooling water systems, Development of antifouling coatings, Evaluation of ecotoxicity of biocides, Deep sea biofouling, Bioprospecting, Superhydrophobic Antimicrobial surfaces. He has 1 patent, 5 books, >55 papers and 17 book chapters, etc with h index of 21 and ~1869 citations. Professor. P. Sriyutha Murthy is the recipient of two DAE Group Achievement of awards for high impact research on Biocidal regimes for heat exchangers at Biofouling Test Loop Facility (2011) & Antifouling Coatings for prevention of biofouling and corrosion (2018). He has executed several research project with DST, NRB, BRNS and MoES.	

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<tr><td>Name</td><td>Mr. Gouranga Charan Rout</td><td rowspan="3"></td></tr>
<tr><td>Designation & Affliation</td><td>Sr. Vice President, ISU</td></tr>
<tr><td>Topic</td><td>Special Steel Grades for Sustainable Construction</td></tr>
<tr><td>Abstract</td><td colspan="2">Advanced special steel grades play a pivotal role in sustainable construction, aligning with global net-zero goals. Key high-performance Thermo-Mechanically Treated (TMT) rebars—Vanadium Micro-alloyed, Fusion Bonded Epoxy Coated, and Stainless Steel rebars—offer significant environmental and economic benefits for infrastructure projects. Vanadium Micro-alloyed TMT rebars enhance structural performance while reducing steel consumption, thus lowering carbon emissions and providing improved seismic resilience. Fusion Bonded Epoxy Coated rebars offer exceptional corrosion resistance, especially in marine and chemically aggressive environments, extending infrastructure lifespan and reducing maintenance needs. Stainless Steel TMT rebars, known for durability and corrosion resistance, are ideal for coastal and industrial applications requiring long-term stability. A comparative analysis of these TMT rebars reveals their contributions to sustainable construction, focusing on CO_2 emissions reduction, resource efficiency, and lifecycle cost savings. In addition to that GFRP (Glass Fiber Reinforced Polymer) rebars exhibit highly corrosion resistant, as well as has net-zero carbon emissions. However, the inherent technical constraints inhibit wide-range adoption in high rise applications. These advanced steel grades support resilient, eco-efficient infrastructure that meets current structural demands while promoting a circular economy through recyclability and reduced resource consumption. Special steel grades hold significant potential to resh ape construction practices, creating enduring, sustainable structures that align with global environmental objectives.</td></tr>
<tr><td>Biography :</td><td colspan="2">With over three decades of expertise in the steel industry, Mr. Rout brings an exceptional background in Iron Making, Steel Making, and Rolling Technology. He holds an M. Tech in Mechanical & Material Science, an M.B.A. in Finance, and M.Sc. in Total Quality Management, showcasing his dedication to both technical excellence and managerial insight. Recognized early on with the prestigious Best Graduate Award from Rotary International Club in 1996, Mr. Rout has since built an impressive career, having contributed to renowned organizations like IISCO Burnpur, NISCO, TATA Sponge Iron Ltd, and Adhunik Metaliks. Currently, he serves as the Sr. Vice President of Integrated Steel Unit (ISU) at Electrotherm (India) Ltd, where his experience continues to shape the industry. As a Lifetime Member of the Indian Institute of Metals and with connections to the World Steel University in Belgium, he remains committed to advancing material science and engineering within the steel sector. His wealth of knowledge and practical insights make him a valuable contributor and sought-after speaker on the evolution and innovations in steel manufacturing.</td></tr>
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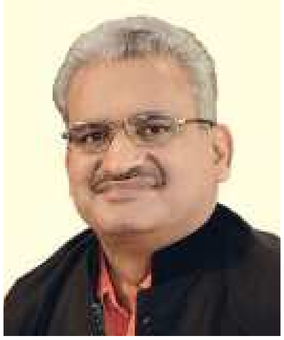
Name	**Dr. Ing. Jyotsna Dutta Majumdar**	
Designation & Affliation	Institute Chair Professor, Dept. of Metall. & Maters. Engg. Indian Institute of Technology Kharagpur West Bengal	
Topic	**High Temperature Oxidation Resistance of Laser Direct Energy Deposited Titanium Aluminide (Ti45Al5Nb5Si)**	
Abstract	In the present investigation, titanium aluminide with the composition of Ti45Al5Nb0.5Si has been developed by laser additive manufacturing with Nd-YAG laser with the power of 500 W, scan speed of 300 mm/min and powder feed rate of 2.2 g/min using Ar shroud in a heating chamber at constant temperature of 780°C (corresponding to the optimum parameters derived through detailed structure-property-process parameters correlation). Followed by fabrication of the coupons (of dimension: 10 mm × 10 mm ×10 mm) a detailed investigation of the microstructure has been carried out by scanning electron microscopy, the phases present in the clad zone has been determined by X-Ray diffraction analysis. Finally, the residual stresses introduced in the coupons were evaluated by stress goniometer attached with the X-Ray diffraction technique. Finally, the high temperature oxidation resistance property (700-900°C) has been evaluated in terms of cyclic oxidation behaviour. The effect of Si addition (up to 10 wt.%) on the microstructures and high temperature oxidation resistance property has also been evaluated. Si addition leads to development of silicide (Ti5Si3) dispersion in alpha matrix. The cyclic oxidation behaviour also showed significant improvement in oxidation resistance property. The detailed kinetics analysis showed an increase in activation energy from 227.99 kJ/mol to 287.49 kJ/mol due to addition of Si. The mechanism of oxidation is investigated. **Keywords :** Titanium aluminide, laser direct energy deposition, microstructure, oxidation resistance.	
Biography :	Professor Jyotsna Dutta Majumdar is serving in the Department of Metallurgical and Materials Engineering as the Institute Chair Professor. Her areas of specialization are laser materials processing, surface engineering, corrosion, and wear. She has supervised 17 PhD students, publishing 250 papers in peer reviewed journals, 8 book chapters and edited one book. She conducted sponsored research projects worth over Rs 10 crore, developed full-fledged laboratory for laser/plasma/spray coating. She received several prestigious fellowships and awards like POWER fellowship (2021) awarded by the Science and Engineering Research Board, Friedrich Wilhelm Bessel Research Award under Alexander von Humboldt Foundation (AvH) (2015), MRSI MEDAL awarded by the Materials Research Society of India (2013), Metallurgist of the Year, awarded by the Ministry of Steel, India (2012), BOYSCAST fellowship by the Department of Science and Technology (DST) (2004), Young Engineer Award awarded by Indian National Academy of Engineering (INAE) (2003), Young Metallurgist of the Year by the Ministry of Steel, India (2000), Young Scientists Award by the Indian Science Congress Association (2000) and elected as the Fellows of the International Advanced Association of Materials (IAAM), Sweden (2022), Indian National Academy of Engineering (2021). Institute of Engineers (2017) and West Bengal Academy of Science and Technology (2016).	

Name	**Tobias Braun Dipl.-Ing. (FH)**	
Designation & Affliation	Head of Global Portfolio Management Industry, DEHN SE Germany	
Topic	**Importance of earthing design in AC mitigation systems**	
Abstract	A large portion of pipeline networks is affected by AC interference due to collocation with overhead HVAC powerlines, Traction, substations, transformers, underground cables etc. imposing risks of personnel safety and pipeline integrity under normal operation as well as short-circuit conditions. Such effects can be studied with computer modelling & simulation helping in identification of affected pipeline section and designing AC mitigation. Earthing connected to pipeline through DC Decoupler is recognized as the most practical and effective solution for AC mitigation across the globe. Knowing the affected pipeline section, designing of earthing system for effective AC mitigation is very challenging and requires consideration of various parameters like soil layer resistivity, electrode configuration, material selection, backfill requirement and installation techniques. This paper discusses importance of proper earthing design covering these aspects for effective AC mitigation of pipeline. Authors' observations and experience is discussed with the help of case studies.	
Biography :	■ Study in Electrical Engineering at the University of Applied Science in Nuremberg, Germany. Degree : Diplom-Ingenieur (FH) ■ Electrical Engineer and Head of Product Development at Baer Industrie-Elektronik GmbH in Nuremberg ■ Product Manager at DEHN SE ■ Business Development Manager Oil&Gas at DEHN SE ■ Team Leader Global Business Development at DEHN SE ■ Head of Global Portfolio Management Industry at DEHN SE in Neumarkt/Opf.	

Name	**Kothandaraman Ramanujam**	
Designation & Affliation	Professor, Department of Chemistry, IIT Madras	
Topic	**Boron Doped Diamond Coated Graphite Felt Electrodes as Corrosion Free Positive Electrodes for Energy Storage Systems**	
Abstract	The commercialization of soluble lead redox flow battery (SLRFB) is challenging due to its limited cycle life, lower areal capacity, Pb dendrite formation, and positive electrode corrosion. The coulombic efficiency and areal capacity were improved using suitable additives. Since carbon felt is used as a substrate for PbO_2 deposition in the positive electrode, during charging, the associated oxygen evolution reaction through water electrolysis corrodes the electrode. There is minimal literature on this aspect. Given this, a boron-doped diamond-coated carbon felt (BDD-CF) electrode has been explored for SLRFB to improve the electrochemical performance. BDD-CF in principle can be used as positive electrode in any electrochemical systems. This coating enhances the life of the battery systems.	
Biography :	Dr. Kothandaraman Ramanujam is currently working as professor in the Department of Chemistry, Indian Institute of Technology Madras. Dr. Ramanujam has focused his expertise in applied electrochemistry on contributing to realize India-centric solutions for the ever-growing need of energy storage and conversion. His interest in applied chemistry is evident from the number of technologies he has developed and shared with industries. He has developed kilowatt scale vanadium flow battery technology for ONGC. Along with industry partner HEB, the 10kW stack was demonstrated in the Indi Energy Week at Goa last February. He licensed a modified Zn-Br2 battery to Archean Chemicals. His applied research fetched him two awards: Amara Raja Award 2021 from Electrochemical Society of India and the India Energy Storage Alliance's (IESA) Researcher of the Year-2024 award. Besides, he has received awards from well-known academic societies in India for his fundamental work: CRSI Bronze Medal 2023 from the Chemical Research Society of India and SMC-BARC Bronze Medal 2023 from the Society of Materials Chemistry-Bhabha Atomic Research Centre. He has performed numerous outreach activities on popularizing electrochemistry through the ECS-IITM Student Chapter (ecsiitm.com)	

Name	**Dr Piyush Saxena**	
Designation & Affliation	Sr Vice President (Retd) Reliance Industries : omitted Nariman Pt, Mumbai	
Topic	**How to Prevent Human Corrosion**?	

Abstract

How to prevent Human Corrosion?
Nature planned for us to live in forests and eat raw food. Cooked food, pollution and possession give corrosion to our body. Thus efficiency of our various organs has been reduced. We believe in 'Naturopathy'. Using commonly available mostly natural ingredients we cleanse different organs of our body. Thus we developed Cleansing Therapy, This therapy has benefitted lacs of people across the globe. I charge no fee, accept no donation, and promote no products. In recognition of this outstanding work, the Department of Research, Ministry of Health has primarily considered our proposal for recognition of Cleansing Therapy. Now our detailed proposal has been submitted for consideration.
This Therapy is followed and practiced from patients home. Liver Cleanse and Kidney cleanse give immediate boost to energy level. Many ailments are cured soon just like cleaning of a carburettor jump starts your vehicle. These Cleanses are completely safe and have no known or reported side-effects.
A few Cleanse include Kidney Cleanse Mouth Cleanse Acidity Cleanse Uterus Cleanse Parasite Cleanse Fertility and PCOS Cleanse Liver Cleanse Fallopian Tube Cleanse Joint Cleanse Vagina Cleanse Colon Cleanse Conceive Naturally. We have total 28 cleanses.
Cleansing Therapy cures 90% of health problems. After doing a liver cleanse the patient drops lot of LDL Cholesterol in diarrhoea thus preventing heart attack for a minimum 6 months. An infertile couple will conceive naturally in 100 days if they have no major abnormality.

Biography :

Dr Piyush Saxena has been working towards betterment of mankind through a variety of works. He filed PIL (01/2012) in High Court Mumbai for transgenders. His efforts resulted in following. Eunuchs were not officially marked to any ministry under the Allocation of Business Rules, 1961. Now, government has assigned the subject of eunuchs to Ministry of Social Justice and Empowerment. MoSJE has notified that chela eunuchs have the right to leave their guru, thereby abolishing 'leti' bonded labour.
Ministry of Health has formed Standing Panels of doctors to examine transgender persons willing to undergo voluntary Gender Re-assignment Surgery.

ADOPTION OF ORPHANS

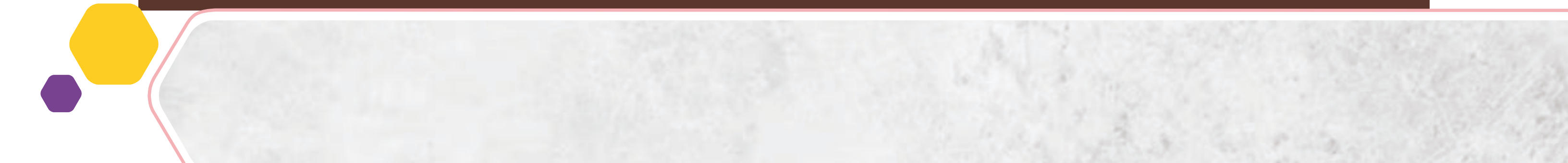
India has 3.1 crore orphans while only 4000 are adopted every year. Adoption is the best rehabilitation for an orphan. Piyush filed a PIL 1003/2021 in Supreme Court for simplification of adoption procedure. He personally argued 9 times before bench of Chief Justice Dr D Y Chandrachud, Mr. Justice A.S. Bopanna, and Mr. Justice J.B. Pardiwala. Hindu adoption is now very simple. India had been Orphan capital of the world. We shall make it adoption capital of the world.
Travelogue: Dr Piyush has also travelled to Antarctica, Mt Kailash, Pakistan, North Korea etc.

Name	**S. T. Aruna**	
Designation & Affliation	Chief Scientist, Surface Engineering Division CSIR-National Aerospace Laboratories Bengaluru, India	
Topic	**TopicCorrosion resistant electrodeposited Ni and sol-gel composite coatings : An overview**	
Abstract	There is an increasing demand from the industries for the development of superior surface coatings with higher wear and corrosion resistance for improved performance of engineering components. Several fillers are being utilized efficiently to reduce the effect of a corrosive environment. Among the various surface engineering techniques, the electrodeposition method and sol-gel methods are highly promising due to their simplicity, cost-effectiveness, good compositional control, etc. Electrodeposited nickel (~40 m) is utilized in a large number of applications due to its strength, toughness and resistance to corrosion and wear. Nickel based composite coatings containing ceramics have been explored to combine the corrosion resistance and strength of nickel with the hardness, oxidation and wear resistance of ceramic particles and with the sole aim of achieving properties similar to hard chrome. Similarly, sol-gel based organic-inorganic hybrid coatings containing nanoparticles are explored as corrosion-resistant coatings for aircraft grade alloys. In the first part of the talk, the effect of addition of different types of nanosized ceramic oxides on the wear and corrosion-resistant properties of electrodeposited Ni-composite coatings will be discussed. In the second part of the talk, the effect of different shapes of cerium oxide nanoparticles on the corrosion-resistance of Al-Si based inorganic organic hybrid sol-gel coatings (<10 m) will be discussed in detail. **Keywords** : Composite; Electrodeposition; Corrosion; Sol-gel	
Biography :	Dr. S. T. Aruna is currently working as a Chief Scientist & Head, Director`s Technical Secretariat at the Council of Scientific and Industrial Research - National Aerospace Laboratories (CSIR-NAL), Bangalore, India. She has a Master's Degree in Chemistry from Mysore University (1994) and she secured the first rank and won 4 gold medals. She obtained her Ph.D. from the Indian Institute of Science (IISc), Bangalore in the year 1998. She worked as a postdoctoral fellow at Bar-Ilan University, Israel in the area of dye-sensitized solar cells from 1998-1999. She has authored ~ 140 research papers in international peer-reviewed journals, 8 proceeding papers, 11 patents, co-authored a book, coedited 2 books and written 14 book chapters and 4 encyclopedia chapters.	

	Her research papers have been well-cited and her publications have an h-index of 45(10369 citations). Her name features in the list of the top 2 percent of world scientists released by Stanford University since 2021. Her current research interests include the development of tape cast ceramic substrates for electronics applications, nanomaterials, plasma-sprayed thermal and environmental barrier coatings, oxygen sensors and reversible solid oxide fuel cells (SOFCs) for hydrogen generation. She has guided 5 Ph.D., 18 Masters and 13 Bachelor students. One of her review papers has received the best-cited paper award twice which was published in Current Opinion in Solid State and Materials Science. She is on the editorial board of Surface Engineering Journal and Journal and Manufacturing Technology Today. She is the recipient of Prof. Satish Dhawan Young Engineers Karnataka State Award-2021, MRSI Medal-2022, CSIR NAL's outstanding award (4 times), NM Sampat award -2016, Pavan Nagpal Memorial award-2019 and ISAMPE award-2019. She is also the recipient of Prof. Sasadhar Ray Memorial award-2023 for industrial excellence. Currently, she is the President of the Electrochemical Society of India and Chairperson of Indian society for Advancement of materials and Processing Engineering (ISAMPE) Bangalore Chapter. She is on the Board of Studies of BMS College, Bengaluru; Academic committee of Maharaja Institute of technology, Mysore and Professor of Practice at VIT, Chennai. She is a life member of many professional bodies. She has transferred 3 technologies to 4 industries.

KEYNOTE TALK

Name	**Patel Pratik**	
Designation & Affliation	Pricipal Manager – Asset Integrity And Advance Ndt	
Topic	**Corrosion Monitoring by various Advance NDT Testing**	
Abstract	Corrosion monitoring is critical for ensuring the safety, efficiency, and longevity of oil and gas refineries. As corrosion threatens the structural integrity of pipelines, tanks, and process vessels, advanced Non-Destructive Testing (NDT) methods have become essential in detecting, monitoring, and mitigating corrosion-related risks. Techniques like Ultrasonic Testing (UT), including Time of Flight Diffraction (ToFD) and Phased Array Ultrasonics (PAUT), enable precise wall thickness measurements and flaw detection within metals, providing real-time data on material degradation. Eddy Current Testing (ECT) offers another non-invasive solution for detecting surface and near-surface corrosion, while Magnetic Flux Leakage (MFL) effectively evaluates storage tanks and pipelines for corrosion pits and material loss. Emerging techniques such as Guided Wave Testing (GWT) allow for long-range corrosion assessments along pipelines without requiring disassembly, making it particularly valuable for remote or hard-to-access areas. . The combination of these NDT technologies, supported by advanced data analytics, enables proactive maintenance, helping refineries reduce unexpected downtime, optimize inspection schedules, and ensure compliance with industry safety standards. By implementing these advanced NDT methods, the oil and gas sector can better predict corrosion rates and implement timely preventive measures, ensuring safe, sustainable, and cost-effective operations.	
Biography :	Pratik Patel is a Principal Manager at SGS India with over 15 years of diverse experience in Quality Management, Asset Integrity, and Corrosion Control within the oil and gas sector. He holds a BE in Mechanical Engineering and is a certified professional in Risk-Based Inspection (RBI), holding credentials like API 580 and certifications in various NDT techniques (RT, UT, MPT, LPT, VT). At SGS, Pratik has successfully led RBI projects for major refineries, including BPCL and Nayara Energy, and played a pivotal role in establishing the Asset Integrity and NDT team. Pratik's expertise extends to incident investigation, quality control, and inspection planning, supported by his strong leadership skills. He has a proven track record of developing customized solutions for asset integrity management, overseeing large teams, and collaborating effectively with clients and regulatory agencies. His contributions have significantly enhanced operational efficiency and safety compliance in refinery projects across India.	



TECHNICAL INTERACTIVE FORUM

CATHODIC PROTECTION

Convener

Mr. Pankaj Panchal

21st November 2024

Cathodic protection systems are essential for preventing corrosion in various buried metallic structures, such as pipelines, plants, tanks, mounded bullets and offshore structures. However, over time, these systems can degrade in quality, leading to a decrease in their effectiveness. Certainly, main causes of degraded cathodic protection system performance:

- Poor quality of Survey and designs.
- Duplicate / inferior quality materials.
- Underrated equipment.
- Installation issues.
- Suboptimal Design and Sizing
- Interference Problems
- Inadequate Personnel Training
- Regulatory Non-Compliance
- Several improvements can be made to address the degraded quality of cathodic protection systems.
- Proper Survey and Designs
- Detailed Specifications for Materials
- Regular Maintenance and Inspection
- Optimized Design and Sizing
- Adequate Mitigation of AC/DC Interference
- Enhanced Personnel Training
- Environmental Considerations
- Consideration of Regulatory Changes
- Corrosion Rate Assessments

In summary, maintaining the quality and effectiveness of cathodic protection systems is crucial for preventing corrosion and preserving the integrity of metallic structures. It is mandatory to have quality of surveys Optimised Designs, Good quality original vendor materials, Installation by Qualified people, AC/DC Interference mitigation by Experienced and Certified People and O&M by Experience and Trained People.

TECHNICAL INTERACTIVE FORUM

WATER TREATMENT

Convener

Mr. S M Madadik

21st November 2024

Mitigating Corrosion in usage of Recycled Water, Recycling plants and Zero Liquid systems

Water treatment plants used for recycling/reuse of water are subject to contaminants which create corrosive environment. This aggressive environment causes premature deterioration of concrete and metal structures forcing operators and owners to perform repair or replace expensive equipment and hence causing downtime. Usage of recycled water requires specialised water treatment solutions to ensure that the corrosion impact is minimised. Materials used for Water recycling systems and zero liquid discharge systems need to be judiciously selected. Best Practices coupled with advance corrosion protection technologies provide cost effective solutions will be discussed in this forum.

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TECHNICAL INTERACTIVE FORUM

PIPELINE INTEGRITY MANAGEMENT SYSTEM

Convener

Mr. Ashish Khera

21st November 2024

Pipeline Integrity Management techniques are essential for maintaining a safe and reliable pipeline asset. Based on the operators need, a pipeline may be assessed with a combination of various integrity tools during the life of pipeline. Essentially, there are three ways to confirm the physical condition of pipelines; Monitoring, Testing and Inspections covering under Integrity Management. This will also dig deeper into the pivotal role of Coating, Cathodic Protection (CP), AC/DC Interference detection and mitigation and how it relates to the overall pipeline integrity.

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www.naceindia.org

TECHNICAL INTERACTIVE FORUM

CORROSION IN PETROCHEMICAL PLANTS AND REFINING

Convener

Mr. N Chandrasekhar

21st November 2024

Corrosion in Refining industry is a big challenge which requires an integrated corrosion management enabling protection of refinery assets and opportunity to process different kind of crude oil for better economics. The corrosion problems in refineries are mainly due to various corrosive components present in crude oil, distillation and cracking processes involved in production of various hydrocarbon streams, environmental issues and chemicals used in refinery processes. Starting from the choice of appropriate metallurgy and then process related corrosion mitigation strategies help refiners to combat corrosion processes.

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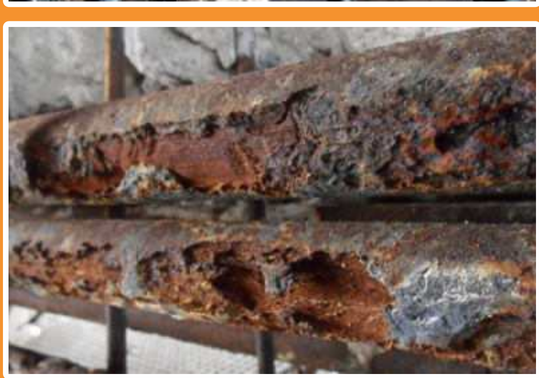

TECHNICAL INTERACTIVE FORUM

CORROSION MONITORING INSPECTION & TESTING

Convener

Mr. Amish Gandhi

22nd November 2024

SCOPE

Corrosion monitoring and testing is the primary step to identify the causes of failure of components, plants and equipment, which in some cases can be catastrophic. This program enables one to assess the extent of damage, find out the root cause, take preventive actions and as a long term strategy integrate these into preventive maintenance schedules and plant safety management. Last but not the least, a judicious decision can be arrived at for better material selection and training of personnel for specific skill sets, remaining life assessment and adoption of cost-effective solution to corrosion control and management.

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20th - 23rd November Chennai, India
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NACE INTERNATIONAL INDIA SECTION

Jung se Jung

Convener
Mr. Sandeep Vyas

22nd November 2024

Jung Se Jung technical interactive forum will be focused to discuss and share the experience and knowledge on various issues/challenges/new technological developments in the field of **"Integrity Management of Non-piggable Pipelines"**. The current program is being part of **CORCON 2023** to include participation across India / Asia for disseminating the knowledge about the corrosion related concerns/mitigation measures of the Pipeline Operator's group.

Key Speakers:

Subject Matter Experts / Instructors of AMPP (NACE), & Industry leaders from Indian CGD & Pipeline Operators.

It is our pleasure to invite you and your team for this Technical Interactive Forum. This would enrich the knowledge and experience with a goal to address the challenges being faced by the pipeline industry with respect to internal & external corrosion and Integrity Management of Non Piggable Pipelines. We are sure that entire industry participants would definitely be benefitted from this TIF.

Round Table Conference on Protective Coating Industry

AMPP India Chapter has been organizing TIF-Technical Interactive Forum on various topic concerning corrosion management and on of the most successful of them Coating Specifications in CORCON.

Panel Members to represent the Paint Manufacturers, Project Consultants, Research Bodies, Paint Test Houses, Third party coating inspection agencies, Facility owner and application contractors. The discussion on the way to improve the coating management in and industry and improve the performance of the coating system. The points for improvement were brain stormed to address the challenges faced in implementation of good painting practices in our prevalent conditions.

A few of the points which have been decided to be discussed in the Round Table Conference are listed under and outcome of the implementation shall be communicated by AMPP India Chapter to all concerned suitable after the completion of the conference :

- **Educational Training Program by AMPP India Chapter**
- **Industry Connect Program by AMPP India Chapter**
- **Balster & Painter training program by AMPP India Chapter**
- **Corrosion Awareness Programs for Industry by AMPP India Chapter**

Convener : Mr. Denzil D'Costa, Graco India

Panel Members :

Mr. Sujit Sinha, Growel & Weil (India) Pvt. Ltd.
Mr. Bishwajit Singh, Jotun India Pvt. Ltd.
Mrs. J Bhide, Demech Chemical Products Pvt. Ltd.
Mr. Dhirendra Singh, Akzo Nobel India Ltd.
Mr. Sanjay Chowdhury, Berger Paints India Ltd.
Mr. H Shankar, Clean Coats Pvt. Ltd.
Mr. Prasad Talvelkar, Kansai Nerolac Paints Ltd.

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Workshop on "Marine Corrosion in Defense Industry"

Technical Program / Schedule

Hall A: – 23 Nov 2024 (09:00 hrs to 11:00 hrs)

09:00 - 09:10	**Introduction of Program** **About Speakers**	**Dr. R Baloji Naik**, Scientist (E), NMRL, Ambernath
09:10 – 09:35 09:35 – 09:40	**Corrosion Problems in Defence and its Protection** Q/A & Discussions	**Dr. G Gunasekharan** Scientist (G), NMRL, DRDO, Ambernath
09:40 – 10:05 10.05 – 10:10	**Importance of Coatings for Marine Corrosion** Q/A & Discussions	**Mr. Denzil Dcosta,** Country Manager, Graco India
10:10 – 10:35 10:35 – 10:40	**Corrosion Challenges in Marine Environment and Prevention by Cathodic Protection** Q/A & Discussions	**Mr. Pankaj Panchal** Director – Corrosion Protection AMPP Certified CP Instructor
10:40 – 11:00 11:00 – 11:05	**Marine Corrosion in Defence: User's Perspective** **Live Demonstration** Q/A & Discussions	**Cdr I S Makkar,** Senior Naval Construction Overseer, Warship Overseeing Team (Kochi), Indian Navy
11:05 – 11:10	**Vote of Thanks**	**Mr. Manoj Mishra**, Manager Admin. AMPP India AMPP HQ Award -2023 "*Elaine Bowman Distinguished Service Award*"

CULTURAL PROGRAM

22nd November 2024

CORCON 2024 - Detailed Program Schedule

20th November 2024

20 November 2024 : 15:00 - 18:30 - Delegate Registration

20 November 2024 : 19:00 - 20:00 - Conference & Expo Inauguration

20 November 2024 : 20:00 - 21:30 - Dinner

21st November 2024

09:00 – 11:00	Cathodic & Anodic Protection - 1	Hall-A

Paper No.	Paper
CAP11 Keynote Talk	**Potential Theory Applied to Cathodic Protection Design** **Rogelio de las Casas Monasterio, Engineering Operations Manager, DeLasCasas CP, LLC. AMPP CP IV, Cathodic Protection Specialist.**
CAP12	Catching the IR-free potential: an overview of the remaining IR components in Off measurements, and importance of the design for PRE with integrated coupon. I.Magnifico1, 1 Automa S.r.l., Ancona, Italy
CAP13	How to arrive at suitable parameters of a DC Decoupler for AC Mitigation? Samir Shankar1, Anshul Jain1, Tobias Braun2 1Dehn India Pvt Ltd, Gurggaon, India 2Dehn SE, Neumarkt, Germany
CAP14	Role of Soil Mechanics in External Corrosion Dynamics and Mitigation Approaches Mallesh G, GAIL India Ltd, Bangalore and Santosh Gedam, GAIL (India) Ltd, KLL-Dabhol
CAP15	Impressed Current Cathodic Protection for Carrier Pipe within Microtunnel -Installation Methods and its Advantages E. Gopal, SGB BrandSafway Private Limited, Ahmedabad
CAP16	ICCP System for Multiple Pipelines in Plant Corridors Nilesh Hiralal Gohil and Mathiyalagan Mari, Reliance Industries Limited (RPMG Group)
CAP17	Case Study: Relevance of CP in underground steel pipelines in an area with high native iron content? How to assess integrity in such a case? Prankush M. Bujarbaruah1, Sukungta Monlai1, James E. Marr2, Ashish Khera2 and Bidyut B. Baniah2 1Oil India Limited, Duliajan, Assam, India 2Allied Engineers, New Delhi, India

09:00 – 11:00	Corrosion in Oil and Gas Sector – 1	Hall-B

Paper No.	Paper
COG11	Technical Decision Making Related to a SCCDA Program James E. Marr1, Ashish Khera1, Naim M. Dakwar2 and Bidyut B. Baniah1 1Allied Engineers, New Delhi 2Saudi Aramco, Saudi Arabia
COG12	Failure of Hydrocarbon Piping in Petroleum Refinery Due to Organic Acid Corrosion Muntashir Hayat, Subir Kumar Mitra, Indian Oil Corporation Limited, Gujarat Refinery, Vadodara
COG13	Materials Selection for Corrosion Mitigation in a Gas Injection System for Oil Production S. Jose, R. Bouresli and A. Alhashem, Kuwait Institute for Scientific Research, Safat, Kuwait
COG14	Pipeline Life Cycle Management using Predictive Analytics Keshav Kumar Dewangan, Arjun Patil, Rituraj, Bharat Petroleum Corporation Limited, Mumbai
COG15	Evaluating synergistic effects between cationic and anionic surfactants for corrosion inhibition of steels: A quantum chemical and experimental approach Dharmendr Kumar1*, Vinay Jain1, Beena Rai1, Brij M. Moudgil2 1Tata Consultancy Services Limited, Pune 2University of Florida; Gainesville, Florida
COG16	Fatigue in PSA vessels – a case study Savio Roy Rebello, Reliance Industries Limited, Kakinada, India
COG17	Comprehensive Characterization and Performance Evaluation of Aldol -Based Corrosion Inhibitors Derived for Use in Acidic Environment: Insights from EIS, Weight Loss, and DFT Studies Varsha Choudhary1, Sachin Dua1,2, Nishtha Arora1,2, B G Prakashaiah1,2, T Senthilkumar1,2 1CSIR-Indian Institute of Petroleum, Dehradun 2Academy of Scientific and Innovative Research, Ghaziabad

09:00 – 11:00	Corrosion in Petrochemical, Refineries and Fertilizer Industry - 1	Hall-C

Paper No.	Paper
CPR11 Keynote Talk	**Corrosion Related Challenges in Oil Refineries Processing Opportunity Crudes** **Marcelo Cordoba, Senior Technical Sales Advisor, Halliburton, USA**
CPR12	Case study on Polythionic acid SCC of SS304L elbows in pipeline. Vishwajeet R Ekbote, Reliance Ethane pipeline Limited, Navi Mumbai
CPR13	Flange Leak at Inlet Joint of the Hydrogen Reformer – A Case Study Manoranjan Singh, Indian Oil Corporation Limited, RHQ, New Delhi, India
CPR14	Investigations of De-zincification induced Failure in Aluminum Brass Heat Exchanger in Oil Refinery Jyoti Shankar Jha, and Rohit Ojha, Alleima India Pvt Ltd, Pune
CPR15	Long Term Insidious Corrosion in a Combined Feed Effluent Exchanger of a Hydrocracker Unit Jayson Anil Pinto, Arun Murali Padman, Mangalore Refinery and Petrochemicals Limited, Mangalore
CPR16	Case study on frequent failure of Top Pump Around (TPA) Vs Crude Heat Exchanger in an Oil Refinery Unit Alok Ranjan Sahoo, Amit Kumar Mishra, P L Chakraborty, Indian Oil Corporation Limited, Paradip Refinery
CPR17	Case Study on Failure of Centrifugally Cast Hot Collector and Repair Methodology in Hydrogen Generation Unit Nagendra P,Samarendra Das, Kapil Sahu, Aadarshini and SP Velavan Chennai Petroleum Corporation Limited, Chennai

09:00 – 11:00	Corrosion in Nuclear Industry & MIC - 1	Hall-D

Paper No.	Paper
CNI11 Keynote Talk	**Understanding Material Performance in HTHP Steam environment** **Dr. (Mrs.) Geogy J. Abraham, Scientific Officer-H, Bhabha Atomic Research Centre, Mumbai & Professor, Homi Bhabha National Institute, Mumbai**
CNI12	Corrosion Control in the Nuclear Industry Dr. Sundar Kataria, Prof. Sudesh Sharma , International Certification Services Pvt. Ltd., Mumbai
CNI13	Effect of Film Forming Amines on Corrosion Behavior of SS-321 in Simulated Secondary System Sinu Chandran, Santanu Bera, TV Krishnamohan, Veena Subramanian, BARCF, Kalpakkam
MIC11	Mitigation of corrosion using green inhibitors through modern electrochemical methods Ambrish Singh, Nagaland University, Nagaland
MIC12	Capsicum Chinense Jacq. Fruit Extract as Eco-Friendly Corrosion Inhibitor for Mild Steel In 15% HCL Solution Therola Sangtam, and Ambrish Singh, Nagaland University, Zunheboto
MIC13	Influence of Sensodyne mouthwash on the corrosion behaviour of Thermo-active orthodontic wire immersed in artificial saliva K.Narmatha, S.Juvairiya Fathima, S.Harshitha, A. Afsheen Fazeela , G Yuvasri, Susai Rajendran, St.Antony's college of arts and sciences for women, Dindigul, Abdulhameed Al Hashem, Kuwait Institute for Scientific Research, Kuwait and J Jeyasundari, SVN College, Madurai
MIC14	Investigation of biomass-mediated synthesis of nanoparticles as efficient corrosion inhibitors Akhiu K Yimchunger, Ambrish Singh, Nagaland University, Zunheboto
MIC15	Environmentally Benign Corrosion Inhibitors for Mild Steel in Acidic Conditions Vilabeilie Rutsa, Ambrish Singh, Nagaland University, Zunheboto

11:00 - 11:30	**Tea / Coffee (Expo Visit & Networking)**

11:30 – 12:15 Plenary Talk	**A new zinc alloy for galvanizing of steel** **Prof. Ralf Feser, University of Applied Sciences South Westphalia, Germany**	**Hall A**
12:15 – 13:00 Plenary Talk	**Importance of Formal Training and Certification to prevent Corrosion – A Perspective** **K B Singh**	

13:00 - 14:00	**Lunch (Expo Visit & Networking)**

14:00 - 16:00	**Technical Interactive Forum - 1** **Cathodic Protection Systems**	Hall-A

14:00 - 16:00	**Corrosion in Oil and Gas Sector - 2**	**Hall-B**

Paper No.	**Paper**
COG21	Troubleshooting of Thermal Stress Corrosion & Galvanic corrosion issue of Aluminium Bus bar installed in an Electrical Power distribution panel at a Substation of an IOCL plant. Saptarshi Ray, Indian Oil Corporation Ltd., Kolkata
COG22	On-stream Robotic Tank Inspections by ATEX Certified PetroBot Robotic Tools - An Alternative to Conventional Tank M&I Sahab Gurjar, PetroBot Technologies Pvt Ltd, Jaipur
COG23	Keys to a Successful On-Field Application of ICDA for 20 Critical Natural Gas Pipelines: A Case Study Arnab Saikia1, Pranjyoti Dutta1, Ashish Khera2, Sudhanshu Mishra2, Carlos A. Palacios3 1Assam Gas Company Limited, Duliajan, 2Allied Engineers, New Delhi 3Allied Engineers SME (CIMA-TQ, LLC), USA
COG24	Methodology to find CUI (Corrosion Under Insulation) in Insulated Piping Using Infrared Thermography Camera Sanal S, Mohammed Babu M A and Mohammed Anwar, Bharat Petroleum Corporation Ltd
COG25	Corrosion Growth Rate is Never Linear: RLA obtained without the application of Direct Assessment (DA) principles is non-representative! Aison P. Joseph1, Sandeep Kumar1, Ashish Khera2, Patrik J. Teevens3 and Bidyut B. Baniah2 1BPCL Kochi Refinery, Kochi 2Allied Engineers, New Delhi 3Broadsword Corrosion Engineering, Canada
COG26	Stress corrosion cracking of an AISI 321 stainless steel seamless pipe of Hot High-Pressure Separator (HHPS) vessel in VGO HDT Unit exposed to saline environment Laxmi Prasad Patley, Ankur Bora, P L Chakraborty, Indian Oil Corporation Limited, Paradip
COG27	Corrosion protection of mild steel in acidic environment using fatty acid-PEG hybrid inhibitors Mansi, Aruna Kukrety, Varsha Choudhary, Prakashaiah B G, T Senthil Kumar CSIR-Indian Institute of Petroleum, Dehradun, Uttarakhand

14:00 - 16:00	**Corrosion in Petrochemical, Refineries and Fertilizer Industry - 2**	**Hall-C**

Paper No.	**Paper**
CPR21	Dead Leg Management in Risk Based Inspection of Process Plants Vemuri P Sastry, Asset Integrity & Materials Engineering Services
CPR22	Mitigating Sulphur-Induced Corrosion in RCC Structures: A Case Study of Sulphur Pit Rehabilitation Ravindra Lanjewar and Somnath Sadhukhan, Bharat Petroleum Corporation Limited, Mumbai Refinery
CPR23	Design and Construction Strategies for Corrosion Protection in Modularised Chemical Plants Selvaraj Kuppusamy, Sriraman Chandrasekaran, Kathirvel Nagappan and Ananthanarayanan Muthukrishnan, Kellogg Brown & Root Engineering and Construction India Pvt. Ltd., Chennai
CPR24	Corrosion testing and applications case studies of Sanicro 35: A new alloy with high performance-to-cost ratio for Refineries and Chemical Process Industry Rohit Ojha, Jyoti Shankar Jha, Alleima India Pvt Ltd, Pune, India
CPR25	Life assessment analysis of heater tubes in Atmospheric & Vacuum Distillation Unit (AVU) in a Refinery and Petrochemical plant A Divvela, A K Gautam, S P Singh, M Pal and Q M Amir, Indian Oil Corporation Ltd, Faridabad
CPR26	Extractive distillation (ED) Column Reboiler Preheater Tube Failure in Shell Sulfolane Unit (SSU) of a Petroleum Refinery: Analysis and Prevention Mahendra Kumar Pal, Ujjwal Kundu, Yadav Vishal Fulchand, Mangalore Refinery and Petrochemicals Limited, Karnataka
CPR27	Failure of 1.5” Stub in the Inter Reactor Exchanger outlet line to Fractionator Feed Furnace in OHCU unit due to High Temperature Sulfidation

CPR27	Failure of 1.5" Stub in the Inter Reactor Exchanger outlet line to Fractionator Feed Furnace in OHCU unit due to High Temperature Sulfidation Ashish Kumar Singh, Sukant Dev, Vikas Sharma, 1Indian Oil Corporation Limited, Mathura Refinery
CPR28	Failure Investigation of Tail gas piping in SRB (Tail Gas Treating Unit) Pragya Joshi, C.P. Rao and Ashish Kumar Dane, BPCL Bina Refinery, Bina

14:00 - 16:00	**Technical Interactive Forum - 2** **Water Treatment**	Hall-D

16:00 - 16:30	**Tea / Coffee (Expo Visit & Networking)**

16:30 - 18:00	**Technical Interactive Forum - 3** **Corrosion in Petrochemical Plants and Refineries**	Hall-A

16:30 - 18:00	**Corrosion and its Mitigation in Renewable Energy Sector**	**Hall-B**

Paper No.	Paper
CRE11 **Keynote Talk**	**Boron Doped Diamond Coated Graphite Felt Electrodes as Corrosion Free Positive Electrodes for Energy Storage Systems** **Prof. Kothandaraman Ramanujam, IIT Madras, Chennai**
CRE12	Moving ahead from E10 to E20: Challenges and Way forward Amrutha MS, Kannan Perumal, Deepashri Nage and S N Sheshachala Hindustan Petroleum Corporation Limited, Bengaluru
CRE13	Hydrogen Ready Thread Sealants to Prevent Corrosion & Leakages Nilesh Adkar, Henkel Adhesives Technologies India Pvt Ltd, Pune
CRE14	Comprehensive Corrosion Management in Renewable Energy Generation by Offshore Wind Farms: From Real-Time Monitoring to Predictive Maintenance Chandra Shekhar Sharma and Priyanka Kediyal, Vision Power Analytics Private Limited
CRE15	Corrosion in Electrocatalysts of Fuel Cells: Mitigating by 2D Materials Sreejitha Raj, Akhila Raman, Appukuttan Saritha, Vikas Rajan, Amrita Vishwa Vidyapeetham, Kerala and Priji C, International Advanced Research Centre for Powder Metallurgy and New Materials, Chennai
CRE16	Environmental Corrosion and Its Mitigation in Busbar Conductors of Solar Power Plants: A Multiphysics Simulation Study Priyanka Kediyal and Chandra Shekhar Sharma, Vision Power Analytics Private Limited, Mumbai

16:30 - 18:00	**Technical Interactive Forum - 4** **Pipeline Integrity Management System**	Hall-C
16:30 - 18:00	**Corrosion Control in Water Treatment Utilities**	**Hall-D**

Paper No.	Paper
WTU11	Crevice Corrosion in Cooling Water Plate Heat Exchangers Vemuri P Sastry, Asset Integrity and Materials Engineering Services
WTU12	Corrosion in Pipeline Ductile Iron Pipe a lifeline for sustainable water management RBV Prasad Rao, G Varaprasada Rao & Ketan Panchal, Electrotherm (India) Limited, Kutch
WTU13	Corrosion Control Water Treatment with the Help of a Ring Merus GmbH, Germany and Vikram Ghorpade, Suvira Energy, Mumbai
WTU14	Case Study on Roof tube Failure in Boiler (CPP) Deepesh K, Abhilash R, Samarendra Das and SP Velavan Chennai Petroleum Corporation Limited, Chennai

18:00 - 19:00	* Product Presentation - Hall A , Visit to Expo & Poster Presentation - Exhibition	
19:00 - 20:30	Corrosion Awareness Award - 2024 Ceremony	Hall-A
20:30 - 21:30	Dinner	

22nd November 2024

09:00 – 11:00	**Cathodic & Anodic Protection - 2**	**Hall-A**

Paper No.	Paper
CAP21 **Keynote Talk**	**Ignore Factors that affect Cathodic Protection System Performance: At your own peril** **Balasubramani Bakthavatchalu, Saudi Aramco, Consulting Serviced Department, Saudi Arabia** **Fellow member of Institute of Corrosion, UK, AMPP Course Instructor.**
CAP22	Case Study on Mitigation of AC Interference on Cross Country Petroleum Pipeline Irfan Ali Rangrej, Indian Oil Corporation Ltd, Jaipur
CAP23	Impacts of AC Interference on an LPG Pipeline and its Mitigation Mukkanti Mekala, Gail(India) Limited, Hyderabad and Mohammad Shums Abbas, Gail(India) Limited, Noida
CAP24	Integrated Approach for AC Corrosion Defect Identification and Risk Assessment: A Case Study Uttam Kumar Sahu, Bharat Petroleum Corporation Limited, Mumbai and Manish Mauta, Bharat Petroleum Corporation Limited, Anand
CAP25	Comprehensive Analysis and Mitigation of Alternating Current (AC) Interference in Co -located Pipelines: A Case Study Sunil Khode, Deepak Agarwal, Allaka Pavan Kumar, P. Kungumeswaran, Sayan Roy IndianOil Corporation Limited, Noida
CAP26	Optimization of Mitigation of AC Interferences on Cross Country Pipelines Gopal Garg, Hindustan Petroleum Corporation Limited, Mumbai
CAP27	Co-relation of findings/results of DCVG Survey, ILI Survey and Real time monitoring of Pipe-to-Soil Potentials for a better Pipeline Integrity Management of underground LPG Pipeline - A Case Study Abhishek Kumar and Siddhant Singh, Hindustan Petroleum Corporation Limited
CAP28	Misconceptions of CP Interference – A Case Study KVV RamaRao, GAIL (India) Limited, Bidadi

09:00 – 11:00	**Corrosion in Oil and Gas Sector – 3**	**Hall-B**

Paper No.	Paper
COG31	Statistical Evaluation of Inline Inspection Tool Performance: An ANOVA -Based Approach to Error Analysis Across Multiple Pipelines Sunil Khode, T. Ravindra, Deepak Agarwal, Mohammad Amid1, Santosh Kumar Indian Oil Corporation Limited, Noida
COG32	Corrosion despite protection & Live leak repairs Gokul Jayanth, Metalyte Pipeworks Ltd, Oman, Russell Carless and Beatrice Gundry, Metalyte Pipeworks Ltd, UK
COG33	Enhancing Corrosion Management through Integration of IOWs and RBI: A Proactive Approach to Risk Mitigation in the Oil & Gas Industry Ajay Kumar, Jayakumar Pai, Vidya Ranganath, QuEST Global Engineering Private Limited, Bangalore
COG34	Reliability enhancement of Boiler tubes by maintaining water chemistry & preventing overheating Chandrakesh Prasad1, Bhupendra Raj, Ranjeet Kumar Singh, Arun Kumar Kar, Bongaigaon Refinery, Indian Oil Corporation Limited

COG35	Role of Microstructure and Heat Treatment in Corrosion, Cracking and Material integrity Ravi*, Asis Isor, Suraj Makkar, Simran Bareja, Mangesh P Kekre, Institute of Production, Engineering and Ocean Technology, ONGC, Navi Mumbai
COG36	Combating Corrosion in Harsh Marine Environments: A Case Study on the Rehabilitation of A 70 -Year-Old Marine Jetty Structure Prabal Kothari, Manojkumar Kadani and Sunil Agawane, Bharat Petroleum Corporation limited, Mumbai
COG37	In-line Inspection of 10" LPG Transfer Pipeline (Non -Piggable) using High Resolution Ultrasonic In -Line Inspection Pipeline Integrity Gauge (ILI PIG) Tanuj Ram Ch, Vasanth Kumar A, Manoj Kumar E and Velavan SP Chennai Petroleum Corporation Limited, Chennai

09:00 – 11:00	Coatings Linings and Thermal Insulation	Hall-C

Paper No.	Paper
CLI11	Superhydrophobic Coating: Benefits, Challenges, And Industrial Applicability Debarati Pal and Anupom Sabhapondit, Shell Technology Centre, Bengaluru
CLI12	New generation activated Zinc rich epoxy primer as an alternative to the traditional Inorganic Zinc Silicates Manoj Abraham, Hempel Paints Middle East, United Arab Emirates
CLI13	Insulation- The Coating Approach Randhirsinh Parmar and Prasad Bhusari, Asian Paints PPG Pvt. Ltd., Navi Mumbai
CLI14	Evaluation of the influence of the surface preparation of the base metal before coating on the under-film corrosion Keiichi Yoshino, Gemba Kikuchi, Takehiro Kanai, Teruhisa Tatsuoka, Tokyo Electric Power Company Holdings, Inc., Tepco Research Institute, Japan and Hiromitsu Ijichi, Takuro Miyajima, Motoyuki Yamazaki, Tomonori Shiraishi, TEPCO Power Grid, Inc., Transmission Dept., Japan
CLI15	Troubleshooting of corrosion in Acid service Ion exchange vessels using specialized chemical coatings Mitesh Yadav, Indian Oil Corporation Limited, Kolkata, India
CLI16	Internal Pipe Coating with Innovation in application Methods Ajeet Tripathi, Demech Chemical Products Pvt. Ltd, Pune
CLI17	Water Borne Coating Technology for Protective Coating Application Vijay Jadavani, Asian Paints Ppg Pvt Ltd., Mumbai

09:00 – 11:00	Marine Corrosion	Hall-D

Paper No.	Paper
MCR11	Selection of Corrosion & Cracking Resistant Metallurgy for Downhole Equipment and Well Fluid Pipeline of Offshore Oil & Gas Field. Suraj Makkar, Simran Bareja, Maushumi K Talukdar & Mangesh P Kekre, IPEOT, ONGC, Navi Mumbai
MCR12	FPSO / Fixed Offshore Platform Pipe Support Corrosion - Causes and Mitigation in Design Priya Anandharaj, Vignesh V B and Pamula Mani Chandana, Kellogg Brown & Root Engineering and Construction India Pvt. Ltd., Chennai
MCR13	Studies to measure the Impact of atmospheric and industrial corrosion in Indian Coastal Peninsula over structural steel in industrial plant service Khalid, The Tata Pigments Ltd. Jamshedpur
MCR14	A Complex Approach to the Electrochemical Protection and Marine Grouth Prevention of the Vessel Hull, Andrey Burkov, PSS Corporation, Russia
MCR15	Pitting Corrosion Resistance in offshore Water Injection well environment: L80's edge over 13Cr material Simran Bareja, Suraj Makkar, Ravi, Ranjana Khanna, Mangesh P. Kekre, IPEOT, ONGC, Navi Mumbai
MCR16	Enhancing Durability and Sustainability of Marine Structures Using FRP-Reinforced Seawater Sea-Sand Concrete: A Review Jidnyasa Raut 1,2, Dr. Harish Chandra Arora 1,2 ,1AcSIR (Academy of Science and Innovative Research), Ghaziabad and 2CSIR-Central Building Research Institute, Roorkee
MCR17	Particle Size-Dependent Corrosion Behavior of Green Graphene for Use in Coating of Carbon Steel Under Safe Sequestration Principle Anu Verma, Chandra Sekhar Tiwary, Jayanta Bhattacharya, Indian Institute of Technology, Kharagpur
MCR18	Corrosion Behavior of Steels Used in Marine Applications Anup Kumar Maurya, Pranjal Bhagat, Pankaj Sablaniya, Rahul Chhibber, IIT Jodhpur and Harsh Zala, IIT Madras

MCR19	Investigations on the effect of chromic oxide flux powder on the corrosion characteristics of Super Duplex Stainless Steel welds Vysakh K B and A Mathiazhagan, Cochin University of Science and Technology, Kerala,

11:00 - 11:30	**Tea / Coffee (Expo Visit & Networking)**

11:30 – 12:15 Plenary Talk	**Stress Corrosion Cracking within the Pipeline Industry** **Jim Marr, P.Ag, President, Marr Associates Pipeline Integrity, Canada**	**Hall A**
12:15 – 13:00 Plenary Talk	**Importance of suppressing corrosion in Li/Na ion Batteries** **Prof. Vijayamohanan K Pillai, Chair, Chemistry and Dean (R&D), Indian Institute of Science Education and Research (IISER), Tirupati**	

13:00 - 14:00	**Lunch (Expo Visit & Networking)**

14:00 – 16:00	**Technical Interactive Forum - 5** **Corrosion Monitoring, Inspection and Testing**	**Hall-A**

14:00 – 16:00	**Cathodic & Anodic Protection - 3**	**Hall-B**

Paper No.	**Paper**
CAP31 Keynote Talk	**Importance of earthing design in AC mitigation systems** **Tobias Braun, DEHN SE, Neumarkt, Germany**
CAP32	Case Study on Mitigation of DC Interference on Buried Pipelines Caused by Plant CP System Mohammad Shums Abbas, Palli Ajay Surya and Suraj Pal, Gail (India) Limited
CAP33	Influence of AC Interference on CP Potentials Anshul Jain1, Samir Shankar1, Tobias Braun2, 1 Dehn India Pvt Ltd, Gurggaon and 2 Dehn SE, Neumarkt, Germany
CAP34	Review Paper: Study of Pulsed Current Cathodic Protection (PCCP) for LPG Mounded LPG Storage Tanks Mr. Meesam Imam and Dr. P K Bharti, Integral University, Lucknow, India Professor and Head, Dept. of Mechanical Engineering, Integral University, Lucknow
CAP35	Excavation and evaluation of AC coupons connected to an AC-interfered pipeline Anshul Jain1, Samir Shankar1 and Tobias Braun2, 1Dehn India Private Limited, Gurgaon and 2Dehn Se, Neumarkt, Germany
CAP36	Interference Effect on Cross Country Pipeline due to AC Railway Traction Sivaraman R1 and Gowrishankar Manickam1 1JEF Techno Solutions Private Limited, Bangalore
CAP37	Rate-Determining Cathodic Reactions of Copper Based Alloys in the Presence of Benzotriazole (BTA) as an Inhibitor D.Mahalakshmi and R. C. Barik, Corrosion and Materials Protection Division (CMPD), CSIR - Central Electrochemical Research Institute, Karaikudi
CAP38	Corrosion Protection of Carrier Pipe Inside the Micro Tunnels by Cathodic Protection Nivedita S. Bhattacharya and Samiran Das, Engineers India Limited, Gurugram

14:00 – 16:00	**Corrosion in Defence Sector - 1**	**Hall-C**

Paper No.	**Paper**
CDS11 Keynote Talk	**Penalty of Biofouling on Ship Hulls & Advancements in Antifouling Polymeric Coatings for Naval Applications** **Dr. P. Sriyutha Murthy, Scientific Officer F & Prof. HBNI, Biofouling and Biofilm Processes Section, Water & Steam Chemistry Division, BARC, Kalpakkam**
CDS12	Advoguard 3370 PHE: A High -Performance Epoxy Phenolic Coating for Tank Lining in Naval Platforms and Other Areas Dr. Jagadish C. Dalal, Aayush Parikh, Advance Paints Pvt Ltd, Mumbai

CDS13	Graphene and Functionalized Chitosan Coatings to Prevent the Biofilm -associated Corrosion on Medical Implants Mahesh ML and Rajendra Kurapati, Indian Institute of Science Education and Research, Kerala
CDS14	Aluminium coated Hollow Ceramic Spheres based Heat barrier coatings for thermal management of Naval platforms Rupesh S Naik1,2, S. S. Pawar 1, R Baloji Naik1 and T.U. Patro2 1Naval Materials Research Laboratory, Ambernath 2DIAT, DRDO, Pune
CDS15	Logarithmic Frequency Modulated Thermal Wave Imaging for Corrosion Under Insulation in Naval Applications Banda S S1, V. S Ghali 1V.G.Tialk2and R. Baloji Naik3 1 K L Education Foundation, Vaddeswaram, 2 SoE, Mallareddy University, Hyderabad 3Naval Materials Research Laboratory, Ambernath
CDS16	The Cannons of Dindigul Fort represent an extraordinary achievement in Indian metallurgical craftsmanship-free from corrosion S Kavipriya1, G Yuvasri1, K Gayathri1, S Vincent Claudia1, S Swetha1, T Umamathi2, A Krishnaveni3 Abdulhameed Al Hashem4 and Susai Santhammal Rajendran1 1 St.Antony's College of Arts and Sciences for Women, Dindigul, 2 Sri Meenakshi Government Arts College, for Women (A), Madurai, 3 Yadava College, Madurai, 4 Kuwait Institute for Scientific Research
CDS17	Advanced Nano Ceramic Coatings for Dual Protection: Combating Corrosion Under Insulation and Improving Thermal Efficiency in Marine Environments Surajith Kanakam, New Nano Technologies Pvt. Ltd., Navi Mumbai.
CDS18	Nano Material Based Surface Tolerant Epoxy Coating For Steel Structure & Bilge Area Of Naval Ships Jay Jagdish Vyas, Ramdev Resins Pvt. Ltd., Gujarat

14:00 - 16:00	**Round Table Conference - Protective Coatings and Lining Industry**	Hall -D

16:00 - 16:30	**Tea / Coffee (Expo Visit & Networking)**

16:30 - 18:00	**Jung Se Jung**	Hall -A

16:30 - 18:00	**Corrosion Monitoring and Testing - 1**	**Hall - B**

Paper No.	**Paper**
CMT11	Quantification of MIC-Causing Microbes Using RT-PCR and Network-Based Analysis of MIC Potential Deepak Agarwal, Santosh Kumar, Allaka Pavan Kumar, Indian Oil Corporation Limited, Noida
CMT12	Leveraging Digital Solutions to Optimise Asset Integrity Management Anurag Gautam, Ramaprasad Baral, Bharat Petroleum Corporation Limited, Kochi, India
CMT13	Crude column overhead piping corrosion - Never ending battle Paresh Goswami, U. Anand, Reliance Industries Limited, Jamnagar
CMT14	Evaluating Preferential Weld Corrosion in Ni Welds: A Laboratory Approach to Qualify Welds Shimjith Madayi, Manoj Gonuguntla and Anupom Sabhapondit, Shell Technology Centre, Bangalore
CMT15	Advancement in Hydrocarbon Dew Point Measurement in Natural Gas Industries: Evaluating the RTD PT100 Against Traditional Methods P. Kombaiah, GAIL India Limited, Rajahmundry
CMT16	Case Study on AC Interference Risk Assessment, Mitigation Strategy and Monitoring Keshav Kumar Dewangan, Umesh Swami, Bharat Petroleum Corporation Limited, Mumbai

16:30 - 18:00	**Corrosion in Petrochemical, Refineries and Fertilizer Industry - 3**	**Hall-C**

Paper No. **Paper**

CPR31	Root Cause Analysis of Failure in Refractory Lined Piping of Petro Fluidized Catalytic Cracking Unit (Pfccu) Arjun P M, Yadav Vishal Fulchand, Suresh Kumar J., MRPL, Mangalore
CPR32	Failure Investigation of Hot Collector of Hydrogen Generation Unit (HGU) of a Petroleum Refinery - A case study D S Rao, A K Gautam, Dr. S P Singh, Mahendra Pal, Q M Amir, Indian Oil Corporation Ltd, Faridabad
CPR33	Warm Separator Failure Analysis and Rectification Kamlesh Khandhar, Viral Talati and Karshan Kandoria, Nayara Energy Limited, Jamnagar
CPR34	Failure of a Highly Stressed Dissimilar Austenitic Stainless Steel to Nickel Alloy Weld due to Liquation Cracking Arun Murali Padman, Saurabh Vats, Vishal Fulchand Yadav, MRPL, Mangalore
CPR35	Corrosion in Top Section of Main Fractionator Column of Delayed Coker Unit – A Case Study Shyam Shankar Pandey, P. Vijaya Chitti, Engineers India Limited, New Delhi
CPR36	Failure of Continuous Catalytic Reformer Inter Stage Heater Tubes Due to Coking Vinay Kumar Prasad And Ramawatar P Asawa, Bharat Petroleum Corporation Ltd., Mumbai

16:30 - 18:00	**Workshop - How to Prevent Human Corrosion, Dr. Piyush Saxena**	Hall -D

18:00 - 19:00	*** Product Presentation - Hall A, Visit to Expo & Poster Presentation - Exhibition**

19:00 - 20:30	**Cultural Program**	Hall -A

20:30 - 21:30	**Dinner**

23rd November 2024

09:00 - 11:00	**Workshop - Marine Corrosion in Defence Industry**	Hall - A

09:00 – 11:00	**Materials and Composites – 1**	**Hall-B**

Paper No.	Paper
MAC11 **Keynote Talk**	**High Temperature Oxidation Resistance of Laser Direct Energy Deposited Titanium Aluminide (Ti45Al5Nb5Si)** **Dr.-Ing. Jyotsna Dutta Majumdar, Institute Chair Professor, Dept. of Metall. & Maters. Engg. Indian Institute of Technology Kharagpur**
MAC12	A complete solution against seizing of flange joints through noble Anti-seizing compound Anil K Gautam, S P Singh, N K Pokhriyal and Mahendra Pal, Indian Oil Corporation Limited, Faridabad
MAC13	Integrity Assessment of cleaning pig brushes in sour conditions Aruna V T, Ajay Krishnan, Shell India markets private limited, Bengaluru, India
MAC14	Evaluating the corrosion performance of AA2024 aluminum alloy with Sn and Ce additions under different saltwater environments Sourav Ganguly, CSIR-Institute of Minerals and Materials Technology (CSIR-IMMT), Bhubaneswar

MAC15	Tailored cerium phosphate/silica hybrid epoxy for enhanced corrosion protective coating Nithyaa Jayakumar1 2 and Nishanth Karimbintherikkal Gopalan1 2 * 1 CSIR-National Institute for Interdisciplinary Science and Technology (NIIST), Thiruvananthapuram 2 Academy of Scientific and Innovative Research (AcSIR), Ghaziabad
MAC16	Influence on Al2O3 particles, carrier gases on the microstructures and corrosion properties of cold sprayed composite coatings G. Chandra Mouli and Radha Raman Mishra, Birla Institute of Technology and Science, Pilani
MAC17	Water Based Zero VOC Coating Technology for corrosion mitigation in aggressive environment Sachin Joshi, Greenovoc Specialty Coatings Pvt. Ltd.

09:00 – 11:00	**Corrosion in Concrete and Infrastructure**	**Hall-C**

Paper No.	**Paper**
CCI11 Keynote Talk	**Special Steel Grades for Sustainable Construction Gouranga Charan Rout, Sr. Vice President, Electrotherm (India) Limited, Gujarat**
CCI12	Field Studies on Atmospheric Corrosion of Steel in South-Eastern Region of Tamilnadu J. Daniel Ronald Joseph, M. Ashok, G. Velmurugan, CSIR- CECRI, Karaikudi
CCI13	Revitalizing waste: Next generation sacrificial anodes from Activated Pig Iron (API) Manish Kumar Bhadu, Suryaa Arun Bhatia, Saurabh S Hadas, A N Bhagat, Tata Steel Limited, Jamshedpur, K. Mondal, IIT Kanpur, and Pankaj Panchal, CORPS, Ahmedabad
CCI14	Fine-recycled concrete aggregate based composite coatings to enhance the corrosion and biocorrosion resistance of concrete reinforcing steel bar Liju Elias and S. M. A. Shibli, University of Kerala, Thiruvananthapuram
CCI15	Corrosion Performance Evaluation of Mild Steel and Epoxy-Coated Steel Reinforcing Bars in Cementitious and Chloride-Contaminated Environments Abinesh M, Ashok M, and J Daniel Ronald Joseph, CSIR CECRI, SIVAGANGA
CCI16	The pitting corrosion inhibition ability of alkanolamine (HEPZ) for steel corrosion in simulated concrete pore solution environment Yoganandan Govindaraj, Masatoshi Sakairi, Koji Fushimi, Ryoma Kitagaki, Yogarajah Elakneswaran, Hisanori Senboku, Akira Nishid, Hokkaido University, Japan and Ryosuke Saito, Keiichi Yano, Yuya Yoda, Masato Tsu-jino, Shimizu Corporation, Japan
CCI17	Evolution of Electrochemical Behavior of FBE-TMT Rebars in Chloride Environment: A Long-Term Comparative Study Krishna Chetnani, Prajnadatta Meher, Gouranga Charan Rout, Electrotherm (India) Ltd., Gujarat
CCI18	Proactive Assessment of RC Structures with Half-Cell Potential Mapping and Gradient Analysis for Predicting Corrosion Zameel D.V., Build Aid, Vadodara and Dhruvesh Shah, Vector Corrosion Technologies, Vadodara

09:00 – 11:00	**Microbial Corrosion & Inhibitors - 2**	**Hall-D**

Paper No.	**Paper**
MIC21	Microbial Influenced Corrosion (MIC) for a water Injection plant in Sour Oil Production Field S. Mukadam, R. Bouresli, Kuwait Institute for Scientific Research, Safat , Kuwait
MIC22	Corrosion resistance of ever silver vessel in buttermilk in the absence and presence of sodium chloride K Abinaya, I Suganya Vinnarasi , Nilavan Anitha, M Joslin Jency, A. Afsheen Fazeela, Susai Santhammal Rajendran, St.Antony's college of arts and sciences for women, Dindigul, Abdulhameed Al Hashem, Kuwait Institute for Scientific Research, Kuwait and A Krishnaveni, Yadava College, Madurai
MIC23	Effect of Metallurgy on Thiourea Performance – Computational Insight Venkata Muralidhar K., Vinay Jain1, Beena Rai, TCS Research, Tata Consultancy Services Limited, Pune
MIC24	A Combination of Chemical, Microbiological and Morphological Analyses can Reliably Identify MIC Related Failures Sandip Kuthe, Independent Researcher, Mumbai and Moavin Islam, Corrosion Forensics LLC, USA
MIC25	Efficient Management of Injection Water Treatment and Risk Assessment Nazima Habibi, Saja Fakhraldeen, Saif Uddin, Montaha Behbehani, Nasreem Abdulrazack, Anisha Shajan, Farhana Zakir, Kuwait Institute for Scientific Research, Kuwait
MIC26	Water-Soluble Co-MOF Adsorption Kinetic Studies on Mild Steel - X65 Corrosion Inhibition Sabari E & R. C. Barik, CSIR - Central Electrochemical Research Institute, Karaikudi
MIC27	Microbially Induced Corrosion of X65 Pipeline Material Induced by a Facultative Sulphate Reducing Bacteria Shefeena C. A. and C. B. Sudheer, Cochin University of Science and Technology (CUSAT), Ernakulam

MIC28	Sarcandra Glabra Leaves Extract as a Potential Green Inhibitor in Prevention of Corrosion of Mild Steel in 1 M HCL Solution Limasenla Longkumer, Dr. Ambrish Singh, Nagaland University, Zunheboto

11:00 - 11:30	**Tea / Coffee (Expo Visit & Networking)**

11:30 – 12:15 **Plenary Talk**	**Nano-Biotechnology and Development of Advanced Medical Devices** **Amir Eliezer, Shamoon College of Engineering, Israel, Immediate Past Chair 2024, AMPP**	**Hall A**
12:15 – 13:00 **Plenary Talk**	**Ushering into a self-dependent India in Energy Storage materials: Bridging the Gap between Lab to Pilot Scale Manufacturing @ARCI** **Dr. R. Vijay, Director, ARCI, Hyderabad**	

13:00 - 14:00	**Lunch (Expo Visit & Networking)**

14:00 - 16:00	**Corrosion in Defence Sector – 2**	**Hall-A**

Paper No.	**Paper**
CDS21	Coatings for autonomous damage repair and detection C Suryanarayana1, B BalojiNaik2, S K Panigrahi1, G Gunasekhar2 1.Director General Naval Systems & Materials Technical cluster office, Visakhapatnam 2. Naval Materials Research Laboratory Ambernath
CDS22	Study on effects of camphor soot and ZnO nano fillers in self-stratifying coating influencing hydrophobic foul release property Sushil S. Pawar, Rupesh Naik, R. Baloji Naik, T. K. Mahato, Naval Materials Research Laboratory, Ambernath
CDS23	Use of Computer Vision for Corrosion Detection Pranav Somasekhar, Krithik Eeswar S, Suraj Shinde and Kavita Chaudhary Naval Construction Wing, IIT Delhi, New Delhi
CDS24	Effect of cathodic protection on crack tip driving forces and influence of fatigue crack growth in HSLA steels Srinivas Pilli, Dhruv Lal, G Gunasekaran , Naval Materials Research Laboratory, Ambernath
CDS25	Green Optimization of Self-Stratifying Coatings with PANI-ZnO Nanocomposite for Effective Antifouling and Anticorrosion Applications Prasad R. Deshpande1,2, R. Baloji Naik2, Geeta K. Sharma1, Anjali A. Athawale1* Savitribai Phule Pune University, Pune 2. Naval Material Research Laboratory, Ambernath
CDS26	Epoxy-Siloxane Incorporated Flexible Anti-Corrosive Protective Coatings Anil S. Aswar 1, Pranit B Patil 1, Dipak V. Pinjari 1*, Abhijeet D. Goswami 2 1 Institute of Chemical Technology, Mumbai (India) 2 Supreme Silicones India Pvt. Ltd., Aurangabad
CDS27	Nanocomposite embedded polymer for mitigating marine corrosion Vandana A. Mooss, MIT World Peace University, Pune

14:00 - 16:00	**Materials and Composites – 2**	**Hall-B**

Paper No.	**Paper**
MAC21 **Keynote Talk**	**Corrosion resistant electrodeposited Ni and sol-gel composite coatings: An overview** **S.T. Aruna, Chief Scientist, CSIR-National Aerospace Laboratories, Bengaluru**

MAC22	On-Line Pipe Bottom Corrosion Protection by Composite Wear Pads in Petroleum, Petrochemical & Fertilizer Industries. Harisha Kumar AP, Henkel Adhesive Technologies India Pvt Ltd, Pune India
MAC23	Role of modified and unmodified mixed fillers in corrosion protection of nano composite coatings. Vundavalli Venkata Sravanth, S Parida, Indian Institute of technology Bombay, Mumbai
MAC24	Innovative coating solutions for Tinplate in Food packaging applications with Superior Corrosion Resistance and Adhesion strength Priyadharshini A, Vinodhini S P and Joseph Raj Xavier*, Saveetha School of Engineering, Chennai
MAC25	Benzotriazole-Encapsulated Polyaniline-Enwrapped Poly(urea-formaldehyde) Microcapsules-Based Coatings: A Novel Approach for Self-Healing and Remarkably High Corrosion Inhibition Performance Ravi Saini, Ramesh N. Goswami, and Om P. Khatri, CSIR-Indian Institute of Petroleum, Dehradun

14:00 - 16:00	**Corrosion Issues in Biomaterials**	**Hall-C**

Paper No.	**Paper**
CIB11	Challenges in Material Selection for Bio-Atf Plant P. Vijaya Chitti, Uttam Kumar, Rajesh Chitara, Engineers India Limited, New Delhi
CIB12	Can People Clipped with Ni-Cr Orthodontic Wire Take Vodka Orally? M.Geetha1, M. Joslin Jency1, A. Afsheen Fazeela1, K Gayathri1, P Shanthi2, Susai Santhammal Rajendran1, Abdulhameed Al Hashem3 1St.Antony's College of Arts and Sciences for Women, Dindigul 2 Sri Meenakshi Government Arts College for Women(A), Dindigul 3 Kuwait Institute for Scientific Research, Kuwait
CIB13	Influence of oracool mouthwash on the corrosion behaviour of Ni - Cr orthodontic wire immersed in artificial saliva A. Afsheen Fazeela, M. Devika, P. Sharmila, S Vincent Claudia, Susai Santhammal Rajendran, Abdulhameed Al Hashem and T Umamathi 1 St.Antony's College of Arts and Sciences for Women, Dindigul 2 Kuwait Institute for Scientific Research, Kuwait 3 Sri Meenakshi Government Arts College, for Women (A), Madurai
CIB14	The ability of 21 K gold to resist corrosion when exposed to simulated sweat that includes sodium chloride and glucose evaluated by polarization study I Suganya Vinnarasi, Nilavan Anitha, M Joslin Jency, A Afsheen Fazeela, Susai Santhammal Rajendran, St.Antony's College of Arts and Sciences for Women, Dindigul and Abdulhameed Al Hashem, Kuwait Institute for Scientific Research, Kuwait
CIB15	Tuning the microstructural characteristics and corrosion properties of titania nanotubes by varying fluoride ion concentration S. Manju Bharathi, N. Rajendran, Department of Chemistry, CEG Campus, Anna University, Chennai, India
CIB16	Dual-Step Anodized Titania Nanotube Arrays for Superior Corrosion Resistance in Biomaterial Applications, Swathi Puli and N. Rajendran, Anna University, Chennai
CIB17	Custom-Engineered Bioactive Glass Coating on Titanium implants for Enhanced Bioactivity and Durability K. Saranya and T. Palvannan, Molecular Therapeutics Laboratory, Periyar University, Salem
CIB18	Bioactivity and corrosion resistance of zirconia naotubes in stimulated body fluid solution A. Dharshini and N. Rajendran, CEG Campus, Anna University, Chennai

14:00 - 16:00	**Corrosion Monitoring and Testing - 2**	**Hall-D**

CMT21 **Keynote Talk**	**Corrosion Monitoring by various Advance NDT Testing** **Pratik Patel, Principal Manager, SGS India Pvt. Ltd, Baroda**
CMT22	Advance Earth Resistance Monitoring in Cathodically Protected Pipelines: Necessity of earth resistance monitoring, Solutions for Long-Term Measurement and Electrode Corrosion Arunima Shukla, Sunil Saini, Himanshu Mohan Tyagi, Romy Saini, DEHN India Pvt. Ltd.
CMT23	Enhancement of Corrosion Resistance of Mild Steel with Zinc-Rich and Hydrophobic Bi-Layer Coating J. S. John Tizzile1,2, J. Jyothy Mol1,2, S. Abirami1,2 B. Nithya1 and C. Arunchandran 1,2 1CSIR-Central Electrochemical Research Institute, Karaikudi 2Academy of Scientific and Innovative Research (AcSIR), Ghaziabad

CMT24	Self-Healing Bi-Layer Coating Incorporated with Corrosion Inhibitor Loaded Polyurea Capsules And Silica Nanocontainers for Active Corrosion Protection of Mild Steel Nithya Balakrishnan1 and Arunchandran Chenan1,2 1CSIR-Central Electrochemical Research Institute, Karaikudi 2 Academy of Scientific and Innovative Research (AcSIR), Ghaziabad
CMT25	Water uptake by Organic Coatings and Role of hydrophobicity J. Jyothy mol,1,2 J. S. John Tizzile,1,2 S.Abirami 1,2, Arunchandran Chenan 1,2* 1CSIR-Central Electrochemical Research Institute, Karaikudi 2Academy of Scientific and Innovative Research (AcSIR), Ghaziabad
CMT26	Development of A Hydrophobic Corrosion Sensing Sol-Gel Coating using Encapsulated Nanocontainers for Mg Az31 B Mary Mathews,1 Nithya Balakrishnan,1 J. S. John Tizzile,1,2 J. Jyothy mol,1,2 Arunchandran Chenan 1,2 1 CSIR-Central Electrochemical Research Institute, Karaikudi Academy of Scientific and Innovative Research (AcSIR), Ghaziabad
CMT27	Application of Cloud-Computing for Designing of Integrity Management System with Risk Analysis in City Gas Distribution System P. K. Dixit, Ashish Moyal, MECON Ltd, New Delhi and Debasish Bora, CORRXPERTS Pvt Ltd, Vadodara

Poster Presentation

Paper No.	Paper
PP01	Formulation of Schiff Base with Alkyl Halide as a Corrosion Inhibitor for Oil and Gas Industries Nishtha Arora, Varsha Choudhary, Sachin Dua, B G Prakashaiah*, T Senthilkumar*, Sudip K Ganguly CSIR-Indian Institute of Petroleum, Dehradun, Uttarakhand
PP02	Photocathodic Corrosion Protection of photovoltaic panels using TiO2/CuO Heterostructure Manoja Tharmaraj, Abinaya Radhakrishnan Nagarajan Srinivasan, Manonmaniam Sundaranar University, Tirunelveli and Anuradha Ramani, Annai Hajira Women's College, Tirunelveli
PP03	TiO2/C3N4 Heterostructures for Sustainable Photocathodic Protection of AA2024 Alloy in Solar Energy Systems Abinaya Radhakrishnan, Manoja Tharmaraj and Nagarajan Srinivasan, Manonmaniam Sundaranar University, Tirunelveli
PP04	Development, stability aspects of encapsulants based on thermoplastic polyurethanes for perovskite solar cells Rohith Kumar Raman, Sivashankar Parameshwaran, Ravikumar Gurusamy, Ananthanarayanan Krishnamoorthy, SRM Institute of Science and Technology, Tamil Nadu
PP05	Enhancing the Corrosion Resistance of Steel Rebar in Concrete with Corrosion-Resistant Mineral Additives Ashok M, J. Daniel Ronald Joseph, Velmurugan G and Abinesh M, CSIR- CECRI, Karaikudi
PP06	Effect of Mechanical Milling on Aqueous Corrosion of Thermal Sprayed CoNiCrAlY on Inconel 718 Substrate Annadaa Shankara Dash, Jyotsna Dutta Majumdar, IIT Kharagpur, West Bengal and Satish Tailor, Metallizing Equipment Co. Pvt. Ltd., Jodhpur
PP07	Influence of multifunctionalized oxide and sulphide of manganese nanoparticles incorporated graphene oxide on the Corrosion Resistance and Mechanical Performance of Epoxy Coatings in harsh environment Somila.B,Vinodhini.S.P. and Joseph Raj Xavier, Saveetha School of Engineering, Saveetha Institute of Medical and Technical Sciences, Chennai
PP08	Effect of incorporation of Epoxy/silanes/Nano Alumina composite coatings for the protection of mild steel in reinforced concrete structures Kandasamy A, Ramesh B and Joseph Raj Xavier, Saveetha School of Engineering, Chennai
PP09	Nanocomposite Modified Anticorrosive Coatings Kalyani Sunil Malpani, Vandana A. Mooss, MIT World Peace University, Pune
PP10	Mechanical, Tribology and Corrosion Properties of Ceramic Coated Mg Alloy Through Thermal Spray Coating methods S. Manivannan, Department of Mechanical Engineering, Karpagam Academy of Higher Education, Coimbatore, Tamil Nadu

PP11	Revolutionary Superhydrophobic Concrete Integrating Reduced Graphene Oxide and Silanised NanoZirconia for Enhanced Durability and Self-Cleaning Capabilities Sujitha V.S, Ramesh B and Joseph Raj Xavier, Saveetha School of Engineering, Chennai
PP12	Enhancing mild steel corrosion resistance in the acidic medium through schiff base combined with inorganic compounds Sachin Dua1,2, Varsha Choudhary1, Nishtha Arora1,2, T Senthilkumar1,2*, B G Prakashaiah1,2*, Sudip K Ganguly1,2, 1CSIR-Indian Institute of Petroleum, Dehradun, 2Academy of Scientific and Innovative Research (AcSIR), Ghaziabad
PP13	Corrosion behavior of Strontium incorporated Titania nanotube arrays for orthopedic applications P. Muniyan & N. Rajendran, Anna University, Chennai
PP14	Zirconium with hyaluronic acid coating AZ31 Mg alloy: Electrochemical characteristics and In-vitro bioactivity for biomedical applications M. Kalaiyarasan1, Adhiyamaan College of Engineering, Tamil Nadu
PP15	Influence of Voltage and Fluoride Concentration on the Formation of Zirconium Nanotubes and their Electrochemical Behaviour For Biomedical Applications Sushmi Shree G and Rajendran N, Anna Univeristy, Chennai
PP16	Designing of Anti-Corrosion Surface with PCL Composite Coating on LYS-TNTS for Bone Implant P.Cheranmadevi and N.Rajendran, Anna Univeristy, Chennai
PP17	A Novel Multifunctional Mxene/Nanoalumina Hybrid for Epoxy Resin with Simultaneously Improved Anticorrosion and Mechanical Properties Priyadharshini.R1, Vinodhini S.P2 and Joseph Raj Xavier3, Saveetha School of Engineering, Chennai
PP18	Enhancement of Corrosion Resistance in Low-Carbon Steel Using Silicon Carbide (Sic) Nanoparticles-Infused Calcium Aluminate Cement Coatings J Vignesh, B Ramesh And Joseph Raj Xavier, Saveetha Institute of Medical & Technical Sciences, Chennai

CATHODIC & ANODIC PROTECTION

CATCHING THE IR-FREE POTENTIAL : AN OVERVIEW OF THE REMAINING IR COMPONENTS IN OFF MEASUREMENTS, AND IMPORTANCE OF THE DESIGN FOR PRE WITH INTEGRATED COUPON

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As known, main international standards (ISO 15589-1 and SP0169) protection criteria refer to IR-Free potentials values to be met by applying CP to limit corrosion rate and at the same time to avoid overprotection: in this respect, according to the type of currents influencing the metallic structure, EN 13509 proposes different measurement techniques for measuring IR Free potential.

Off potential measurements are usually performed, both on pipeline and by means of coupon, to try catching the best approximation for the IR-free potential value: for this reason, a fully understanding of all the components that contribute to the obtained potential measure is of very great importance for making better assessment.

In this paper, an overview of the IR components remaining in Off measurements is shown, to give a better understanding of the results obtained while performing a method or another.

Particularly, when performing instant-off measurements on coupon, both the effects of measurement timing and the importance of the design of the permanent reference electrode with coupon used will be shown by means of real field data.

Keywords : Remote-monitoring, Cathodic protection, coupon, IR-free potential

HOW TO ARRIVE AT SUITABLE PARAMETERS OF A DC DECOUPLER FOR AC MITIGATION?

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AC Interference on pipelines can be mitigated but cannot be avoided. In present conditions where overhead powerlines and pipelines are sharing route for a longer-lengths causing induced voltages and current on pipelines. At the same time there exists risk of conductive coupling during fault scenarios at powerlines towers, underground cables, nearby located substations and transformers.

Connecting pipeline with a suitable earthing system is the most feasible solution for protecting pipelines against AC interference under normal operation and fault conditions. Such earthing systems are designed with computer modelling & simulation. To avoid influence on adequate operation of cathodic protection, the earthing is connected to pipeline through DC Decouplers.

Although AC mitigation is provided by the earthing system, but electrical connection is provided by the DC Decoupler. Hence, selection and performance of DC Decoupler is of key importance.

This paper highlights the key parameters for selection and performance of DC Decoupler under various scenario.

Keywords : AC mitigation, earthing system, computer modelling, inductive coupling, conductive coupling

ROLE OF SOIL MECHANICS IN EXTERNAL CORROSION DYNAMICS AND MITIGATION APPROACHES

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Soil mechanics form the foundational basis for grounding studies and are crucial in addressing external corrosion and its mitigation. This paper covers selection, soil resistivity measurements across various environments. A case study is included, focusing on external corrosion resulting from coating pinhole defects and its impact under both low and high soil resistivities. Case study also examines the influence of soil resistivity for inducing AC voltages on buried pipelines, at crossing & parallel-running HVAC lines and touch/step voltage during fault conditions. Paper also explains how grounding systems designing done for mitigation of HVAC induced voltages based on soil resistivity. Output analysis of grounding resistance data done w.r.t design values and post mitigation actual site grounding resistance measured values and its challenges. Finally, the paper deliberates with results of effective grounding for HVAC mitigation approaches, severity analysis of soil resistivity and its ranking concerning interference

Keywords : 3LPE (3-layer polyethylene), LPG (Liquefied Petroleum Gas), PSP (Pipe to soil potentials), DC Interference, Transformer Rectifier Unit (TRU), Anode bed, CIPL (Closed Interval Potential Logging), DCVG (Direct Current Voltage Gradient), Alternating Current (AC), High Voltage Alternating Current (HVAC)

IMPRESSED CURRENT CATHODIC PROTECTION FOR CARRIER PIPE WITHIN MICROTUNNEL -INSTALLATION METHODS AND ITS ADVANTAGES

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Leakage in carrier pipe installed within microtunnel due to soil/water side corrosion posses' significant threat for the safety of the personnel, asset, and environment. The replacement of pipelines at such critical crossings also found to be very costly. External surface of the carrier pipe installed through the concrete tunnel are having coating as the primary protection against external corrosion from water or soil and the cathodic protection is the supplementary protection to the pipeline.

Suitably designed Cathodic Protection system for the coated pipeline is the appropriate protective measure to ensure the integrity of the pipeline against corrosion for a longer life.

Specialized linear anodes are required for cathodic protection of carrier pipe within micro tunnel, in this paper we will discuss the details of such linear anodes. In ICCP system, the variable current capability enables the operator to optimize current on an as needed basis for the pipelines as the use of sacrificial anodes have some limitations and dis-advantages.

In this paper we will discuss the importance and advantage of impressed current cathodic protection system, details of ICCP system materials, installation aspects of anodes and monitoring facilities within the tunnel, installation of Rectifiers, junction boxes and test facilities outside the tunnel etc.

Keywords : Cathodic Protection (CP), Microtunnel, carrier pipe, Direct Current (DC), anode, Impressed current cathodic protection (ICCP), mixed metal oxide (MMO) and Potentials.

ICCP SYSTEM FOR MULTIPLE PIPELINES IN PLANT CORRIDORS

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Effective corrosion control in industrial plant corridors, where multiple pipelines are often closely grouped, is critical for maintaining infrastructure integrity and safety. This paper introduces an innovative approach to corrosion mitigation through the deployment of Double Vertical Distributed Impressed Current Cathodic Protection (ICCP) anodes. Unlike traditional single-line ICCP systems, our method integrates a dual vertical anode configuration strategically positioned along the length of multi-pipeline systems. This configuration ensures uniform current distribution and enhanced protection coverage, addressing common issues such as uneven anode current distribution and localized over / under protection areas. Software simulations were also used to verify the CP design.

This paper details the design principle, implementation strategy, and performance evaluation of the Double Vertical Distributed ICCP anodes, highlighting their potential to transform corrosion management practices in industrial environments.

Keywords : Corrosion control, Multiple pipelines running parallel in plant corridors, Cathodic protection, Dual vertical anode configuration, multi anode groundbed system, CP Software Simulation

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CASE STUDY : RELEVANCE OF CP IN UNDERGROUND STEEL PIPELINES IN AN AREA WITH HIGH NATIVE IRON CONTENT? HOW TO ASSESS INTEGRITY IN SUCH A CASE?

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It is often pondered regarding the complexities of maintaining an impressed current cathodic protection (CP) to an area where there are diversified pipelines with underground coated, un-coated (inadvertent) to aboveground coated and un-coated (intentional) ferrous pipelines exist. Blended into the thought process is the fact that the pipeline assets belong to multiple asset owners without a common maintenance & inspection framework. The commissioning years of the subject pipeline range from the 1960's to the 2020's with vastly varying coating systems. Operationally, there are multiple pipelines feeding into each other.

The assessed pipeline lengths that were cathodically protected under this study were approximately 50%, whilst the remainder 50% did not have any kind of CP since their commissioning. There has been a history of clamp repairs, cut outs and replacements, re-routings, decommissioning of certain segments and all with limited documentation.

This paper assesses the results of a complex engineered approach to almost 100 pipelines belonging to different pipeline owners/ operators within a 16,000 Km2 area. The total length of all pipelines under this assessment was approximately 1,200 Kms. The geographical axial extent of the study area would be approx. 110 Kms (geo-spatially). The objective of this paper is to sequentially illustrate the importance of performing advanced continuous "most accurate" mapping of a spider-web pipeline network. This becomes the backbone for initiating any type of asset integrity management program. Subsequently, the paper discusses the critical role of the environment (soil) and understanding the complexities of other non-conventional environmental parameters and its effect on the buried pipeline in terms of management and assessment related to the time-dependent threat of external corrosion only.

Keywords : Cathodic protection, soil environment, native iron content, integrity.

CASE STUDY ON MITIGATION OF AC INTERFERENCE ON CROSS COUNTRY PETROLEUM PIPELINE

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Cross country petroleum pipelines traverse through different terrain. Various utility lines cross the pipelines such as transmission lines, foreign pipelines, Railway traction lines etc.

HT Transmission lines & nearby switchyard to ROU interfere with cross country pipelines and creates interference to pipelines. The nature of AC interference depends on the field/site conditions. Proper survey & data acquisition is crucial for mitigation measures. This paper describes the various steps taken to identify the source & type of AC interference & then designing the suitable mitigation measures. Troubleshooting & Implementation of mitigation measures. Evaluation of findings with pre & post mitigation measures.

Keywords : Interference, right of user, switchyard

IMPACTS OF AC INTERFERENCE ON AN LPG PIPELINE AND ITS MITIGATION

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As the pipelines are designed and constructed for long service life, ensuring the integrity of pipelines is crucial for safe and continuous operation of pipeline system. The Collocation between pipelines and powerlines is common nowadays, which poses risk to personnel safety and pipeline integrity. The various effects of AC interference on buried pipelines is an area that industry experts continue to explore in order to better understand its underlying concepts and mechanisms. AC corrosion on Cathodically protected buried pipelines is typically due to combined effect of AC voltage, AC current, cathodic protection status, coating condition and soil resistivity.

This paper presents a case study of LPG pipeline on which AC Corrosion features were identified during In-Line Inspection (ILI) and more AC voltages observed during regular PSP Monitoring. It discusses AC interference study during steady state and fault conditions, implementation of AC mitigation and subsequent field monitoring. The paper also examines the past and present status of AC interference on the pipeline. Observations and learnings of the whole project from study, implementation and monitoring are listed.

Keywords : AC corrosion, Computer modelling, AC Mitigation, Field data.

INTEGRATED APPROACH FOR AC CORROSION DEFECT IDENTIFICATION AND RISK ASSESSMENT : A CASE STUDY

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The identification and risk assessment of AC corrosion-related defects become increasingly challenging when the varying results from different pipeline surveys—such as In-Line Inspection (ILI), AC-DC interference surveys, and coating health assessments—are not effectively integrated. The effective integration of survey data, combined with in-situ assessments, is crucial for accurately identifying AC corrosion defects, evaluating associated risks, and developing a comprehensive mitigation strategy. This case study integrates different pipeline integrity surveys like In-line Inspection, AC-DC Interference, Coating health assessment etc to identify AC corrosion type defects in cross-country pipeline and accordingly derives a step-by-step action plan for collecting site-specific data at AC corrosion type defects and accordingly evaluate their risk level. Multiple different variables have been considered for identification and integrity assessment of AC corrosion type defects. Various inspection techniques were adopted for a given AC corrosion location viz. in-situ pH level checking, soil investigation, chemical analysis of metal corrosion sample etc. Comparison of site-specific measurement of AC corrosion defect with metal loss data of last & subsequent ILI surveys revealed corrosion growth patterns subject to a given AC current density. A comprehensive procedure, accompanied by a data collection template, has been developed for the identification and integrity assessment of AC corrosion-related defects, as well as their risk evaluation and mitigation. This procedure is based on sample data collected from multiple pipeline locations. The methodologies and insights derived from this study provide valuable guidance for addressing AC interference challenges in comparable petroleum pipelines.

Keywords : AC Interference, Cathodic Protection, In-line Inspection, Coating Health survey, AC Current Density, Pipeline Integrity, Pipe to soil Potential, Electromagnetic Induction, Mitigation Strategy.

COMPREHENSIVE ANALYSIS AND MITIGATION OF ALTERNATING CURRENT (AC) INTERFERENCE IN CO-LOCATED PIPELINES: A CASE STUDY

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This study presents a comprehensive analysis of Alternating Current (AC) interference along the common ROW pipelines, which are co-located with various utilities, including high - voltage power lines, railway systems, and communication cables. The primary objective is to develop a robust AC interference model capable of predicting potential threats to pipeline integrity and ensuring safe operation by mitigating adverse effects.

The AC interference simulation study was conducted using advanced software modelling techniques on GIS based data. The model integrates various parameters such as pipeline material properties, soil resistivity, utility configuration, and environmental conditions. It accounts for capacitive, inductive, and conductive coupling effects, which are critical in understanding the interference mechanisms between the pipeline and neighboring utilities.

Field data collection played a pivotal role in this study. It involved profiling the powerlines and pipeline sections along the Right of Use (ROU), installing AC corrosion coupons at selected locations to measure steady-state touch and step voltages, and determining current densities at susceptible locations. This empirical data provided a real-world benchmark to validate the simulation results, emphasizing the importance of field data in refining theoretical models.

Additionally, pipeline current and coating conductance were measured to identify any coating leakage resistance. Soil resistivity measurements, a critical factor influencing AC interference, were incorporated using the Wenner four-point method to enhance the model's accuracy. These measurements provided a detailed resistivity profile along the ROW, allowing for a more precise representation of soil conditions and their impact on AC interference.

The simulation results and mitigation recommendations are summarized, with further comparative analysis between simulation data and other survey data such as Close Interval Potential Surveys (CIPS), Direct Current Voltage Gradient (DCVG) surveys, and In-Line Inspection (ILI) findings. The key insights from this comparative analysis are also presented in this report, providing a comprehensive understanding of AC interference and its mitigation in co-located pipelines.

Keywords : AC Corrosion, Software modelling, Pipeline Integrity.

OPTIMIZATION OF MITIGATION OF AC INTERFERENCES ON CROSS COUNTRY PIPELINES

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AC DC Interferences are the most prominent threat to cross country pipeline integrity in India due to colocation limitation of various energy transmissions like Pipelines, HT Lines in the same ROU. It has been observed that the AC voltage on a pipeline could occur due to HT/LT power lines crossing the Pipelines or running parallel to it for a longer spans. AC Corrosion is a Corrosion initiated and propagating under the influence of alternating current. As per NACE SP21424-2018[4] the criteria for AC corrosion has been defined in conjunction with NACE SP0177[18] and NACE SP0169[17].Identification of AC/DC interference vulnerable points is best achieved by software simulations. These simulations use critical parameters like Voltage data logging, Soil resistivity profile, HT line operating parameters, crossing angles and parallelism as inputs and give the mitigation locations on the pipeline for limiting the AC corrosion due to steady state and fault state conditions. The AC corrosion mitigation can be done in several ways, in accordance with NACE SP0177. Major mitigation measures are use of Zn/Mg Anodes, Zn ribbons and other voltage draining sources in conjunction with Solid state Polarization cells or SSDs. This paper/presentation will be highlighting the above said points in detail along with the case study on Optimization measures adopted on Cross Country Pipeline of Hindustan Petroleum Corporation Limited (HPCL) thereby saving 30% of the mitigation cost while keeping all the standards under consideration.

Keywords : Pipelines, Cathodic protection, Transmission line, AC Corrosion, Alternating current, Mitigation.

CO-RELATION OF FINDINGS/RESULTS OF DCVG SURVEY, ILI SURVEY AND REAL TIME MONITORING OF PIPE-TO-SOIL POTENTIALS FOR A BETTER PIPELINE INTEGRITY MANAGEMENT OF UNDERGROUND LPG PIPELINE - A CASE STUDY.

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Pipeline Integrity Management System (PIMS) ensures operators that their pipelines are fit for purpose and regularly inspected to avoid the shortening of pipeline service lifetime. External corrosion of underground pipelines is one of the major challenges faced by operators costing millions annually in identification, mitigation and repair. The problem is also enhanced by the presence of various electrical utilities present in the Right-of-Way (RoW) of pipeline corridors in terms of stray current interference. This paper aims to gain meaningful insights by deep delving into the results of various integrity surveys carried out for underground pipeline and real time monitoring of Pipe-to-Soil potentials made possible due to IoT based remote monitoring. The data insights enable operators for taking data driven decisions for better corrosion management of their assets. The digital innovation along with corrosion expertise has resulted in enhanced Asset Integrity Management (AIM) of critical assets.

Keywords : Pipeline Integrity Management System (PIMS), DCVG Survey, In-Line Inspection (ILI), AC Interference, Asset Integrity Management (AIM), Internet of Things (IoT).

MISCONSEPTIONS OF CP INTERFERENCE – A CASE STUDY

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The DC interference, particularly from railways, electric traction systems, and high-voltage DC transmission systems, can induce stray currents in pipelines, potentially leading to corrosion and stress on coatings. Field measurements and monitoring data from various pipeline operators have shown that variations in Pipe-to-Soil Potential (PSP) and corrosion rates can be correlated with DC interference. However, while DC interference is a significant factor, PSP can also be influenced by other environmental and electrical conditions.

DC interference is just one of many factors affecting PSP. Although it can contribute to corrosion, it is not the sole determinant of PSP variation. PSP monitoring typically assumes that the ground is at zero potential. However, elevated ground potentials can occur due to factors such as nearby electrical installations, fault currents, or grounding systems. For instance, fault currents from high-voltage systems can raise ground potential and create a voltage gradient. When measuring PSP under such conditions, the readings may not accurately reflect the true pipe-to-soil potential because the soil is at an elevated potential rather than the ideal zero. In areas with high soil resistivity, this elevation will be more pronounced, and during monsoon seasons, PSP variations can be significant due to fluctuating soil resistivities. This can lead to misconceptions that the pipeline is experiencing DC interference when it may not be the case.

This paper explores strategies and important considerations for conducting DC interference surveys and outlines methods for mitigating PSP variations caused by elevated ground potentials.

CASE STUDY ON MITIGATION OF DC INTERFERENCE ON BURIED PIPELINES CAUSED BY PLANT CP SYSTEM.

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Interference poses a significant challenge in preserving the integrity of buried pipelines, especially in complex industrial environments like fertilizer plants where multiple CP systems coexist. This paper presents a detailed case study of GAIL's 315 km Auraiya-Babrala-Dadri Pipeline (HVJ) network, which supplies natural gas to fertilizer plants such as KSFL Shahjahanpur, IFFCO Aonla and YARA Babrala in Uttar

Pradesh, with some sections of the pipeline running through the fertilizer plant complex. The metallic structures like towers and tanks within the fertilizer plant are cathodically protected by injecting CP currents into the soil, which affects the cathodic protection (CP) of GAIL's pipeline in vicinity. Due to interference from the plant CP system, under-protection is observed on GAIL's Pipeline inside the fertilizer plant area and ove r- protection outside the plant area. The study employed a combination of surveys and testing methods such as On-Off PSP, CIPL, and DCVG surveys etc. The interference survey results in identification of discharge and pickup locations of stray currents on GAIL's pipeline. The installation of zinc galvanic anodes at identified discharge points successfully mitigated the under-protection issues in GAIL's pipeline. This case study offers valuable insights for managing CP system interference, particularly in environments where multiple CP systems coexist, and highlights the importance of site-specific solutions, regular monitoring, and collaborative interference management in maintaining pipeline integrity.

Keywords : Cathodic Protection Interference, CIPL & DCVG surveys, Discharge locations, Stray currents.

INFLUENCE OF AC INTERFERENCE ON CP POTENTIALS

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AC interference on pipelines causes issues like AC PSP, AC corrosion, and damage to pipe wall, coating, and (or) equipment. Besides this operation of the cathodic protection system is also affected due to AC interference on pipelines. Adequate operation of Cathodic protection system is a must to prevent corrosion and maintain pipeline integrity.

This paper investigates the influence of AC interference on the performance of CP systems in pipeline networks. By analyzing field data, the study examines how varying levels of AC interference impact CP potentials and increase complexity in measuring accurate On and Instant OFF PSP. The mechanisms through which AC interference affects CP systems and proposes mitigation strategies to enhance pipeline integrity.

Keywords : CP potentials, AC interference, monitoring of CP system

REVIEW PAPER : STUDY OF PULSED CURRENT CATHODIC PROTECTION (PCCP) FOR LPG MOUNDED LPG STORAGE TANKS

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Impressed current cathodic protection technique has been popularly deployed to mitigate corrosion in LPG storage mounded LPG vessels. Using an external power source known as a transformer-rectifier unit (TRU), direct current is impressed from the permanent anode ground bed onto the vessel surface. A lot of research has been done on studying the effect of pulsed current cathodic protection (in place of direct current) on underground structures like oil wells, pipelines, casings etc. However very little work has been done to investigate and simulate the effect of using pulsed current in place of direct current in behavior/performance of corrosion protection in buried LPG (mounded) storage vessels. This paper aims at reviewing various research studies conducted on PCCP applied corrosion protection and gaps with respect to its application in LPG mounded storage vessels.

Keywords : Mounded storage vessel (MSV), liquified petroleum gas (LPG), impressed current cathodic protection (ICC), direct current cathodic protection (DCCP), pulsed current cathodic protection (PCCP), polyurethane (PU) coating and coal tar epoxy (CTE) coating.

EXCAVATION AND EVALUATION OF AC COUPONS CONNECTED TO AN AC-INTERFERED PIPELINE

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Criteria or AC Corrosion as per NACE SP21424 and ISO18086 are defined in terms of AC and DC current densities measured on 1 cm2 coupons. The coupons exceeding the criteria will undergo AC corrosion as holidays on the pipeline. With the deteriorated shape of the AC coupons their suitability for monitoring must be regularly assessed.

In this study, AC coupons installed on a pipeline a coastal region were excavated after four years as these ceased to provide measurements. The coupons revealed significant metal loss and the formation of hard tubercles.

This paper provides the evaluation process behind the cause of metal loss on the coupons confirming AC corrosion. The analysis explores factors such as spread resistance, alkalization, earth-alkaline ions, and soil resistivity.

Keywords : AC Coupons, alkalization, spread resistance, earth-alkaline ions.

INTERFERENCE EFFECT ON CROSS COUNTRY PIPELINE DUE TO AC RAILWAY TRACTION

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With increasing collocation of pipelines with power lines, risk of AC interference on pipelines is came into the industry and major awareness were evolved in the industry. In addition to power lines, there is threatening of AC Railway Traction which cause AC Corrosion on Pipelines.

The collocation corridor of railway line and pipeline are very complex due to increased numbers of railway lines (electrified) running parallel for large sections of pipeline and crossing at multiple locations. Also the high dielectric strength coatings on pipelines are causing induced AC voltage and AC Current to travel for many KM even out of the collocation bringing longer sections of pipelines under risk. Identification of vulnerable areas of pipeline in such complex geometrical arrangements of pipeline and railway traction line is very difficult and designing AC mitigation systems on a location specific basis can unknowingly make things worse elsewhere. Study of AC Interference can be done with computer modelling and simulation, and a reliable AC Mitigation system can be designed. The purpose of this paper is to bring out the intricacies of AC interference on pipelines and showcase how these can be eased out with modelling and pipeline integrity can be maintained. The observations are presented with the help of case studies.

Keywords : AC interference, Railway Traction, Computer Modelling, Simulation, AC Corrosion.

RATE-DETERMINING CATHODIC REACTIONS OF COPPER BASED ALLOYS IN THE PRESENCE OF BENZOTRIAZOLE (BTA) AS AN INHIBITOR

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Mass transfer plays a critical role in corrosion phenomena, involving the movement of species to and from the electrode surface. This becomes particularly significant under flow-induced or accelerated corrosion conditions where dissolved oxygen or metal ions must diffuse between the solution and the metal. In this study, the mass transfer kinetics of copper-based alloys in a 3.5 wt% NaCl solution, with and without the presence of BTA (inhibitor), were investigated using a rotating cylinder electrode (RCE). The limiting current for the cathodic reaction of dissolved oxygen reduction on copper was measured across a range of velocities (7.0 cm/s to 235 cm/s) under both flow corrosion and erosion-corrosion conditions. The study also evaluated the impact of Benzotriazole (BTA) as an inhibitor on the mass transfer kinetics. The mass transfer coefficients (km) for copper were found to range from 2.9×10^{-4} cm/s to 6.6×10^{-3} cm/s in the NaCl solution without inhibitor.This research sheds light on the crucial role of mass transfer kinetics in optimizing corrosion resistance, offering valuable insights for industries where material durability and performance are paramount.

Keywords : Benzotriazole(BTA), Saline Environment, Mass Transfer Kinetics, Corrosion Inhibition, Flow-accelerated Corrosion, Rotating Cylinder Electrode (RCE).

CORROSION PROTECTION OF CARRIER PIPE INSIDE THE MICRO TUNNELS BY CATHODIC PROTECTION

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Micro-tunnelling is an efficient trenchless technique for the tunnel construction wherein a reinforced concrete cylinder RCC casing pipe with a larger diameter is installed and smaller diameter steel carrier pipe is laid inside. Micro-tunnelling is effective in soft, unstable, and wet soils and can crush large boulders and selected for laying pipelines beneath river, highways, rail roads and other sensitive areas. All metallic components within the tunnel are subject to corrosion risk. Water, soil side corrosion of carrier pipe is a major cause of corrosion here. Supplemented with permanent cathodic protection (CP) system on the coated carrier pipeline extends the pipeline life and reduce corrosion risk. Sacrificial anode CP system which was used in protecting the carrier pipes has limited lifespan and self-life degradation leading to inadequate protection for the entire design life. This paper discusses mainly for corrosion protection of carrier pipe inside the micro tunnel by permanent cathodic protection for entire design life. Protection by impressed current Cathodic protection (ICCP) by using linear anode with innovative design validated by simulation is an effective method for protecting the carrier pipe inside the micro-tunnel.

Key words : Cathodic Protection, Micro-tunnel, corrosion, sacrificial anode, ICCP.

CORROSION IN OIL AND GAS SECTOR

TECHNICAL DECISION MAKING RELATED TO A SCCDA PROGRAM

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As per AMPP, the stress corrosion cracking (SCC) direct assessment (DA) standard has now gone through three iterations since inception in 2004. Reflectively, some operators have been using the same four-step process since the late 1980's through to 2004. It was realized in the mid to late 1980's that the identification and assessment of SCC was a multi variable integrated exercise which depending on the three major parameters was not linear nor could a "canned" approach be utilized across the pipeline industry. Each pipeline could assess the potential of the threat with common variables, but each pipeline required "tweaking" for each and every variable that was known at the time. This "tweaking" or adjustment(s) in assumed independent variables raised historical and ongoing industry confusion and complexity to the overall management of this pipeline threat. In this review the independent parameters consisting of environment, pipe material and stress with their corresponding attributes will be reviewed to bring out crack trait consistencies and/or inconsistencies, commonalities and unknowns for SCC to initiate and propagate through the SCCDA process. In addition, all four steps of the process will be present within this paper in context to SCC variables.

The primary purpose of this paper is to reiterate the known parameters and their association to the variables required or needed and how these variables within each parameter are addressed to assist with the unknown or known status of the SCC pipeline threat utilizing the SCCDA process.

Keywords : SCCDA, Predictive Model, integrated exercise.

FAILURE OF HYDROCARBON PIPING IN PETROLEUM REFINERY DUE TO ORGANIC ACID CORROSION

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Acetic acid is known as a weak acid which is partially dissociated in water. Organic acids are weak acids when compared to the common inorganic acids like HCl or H_2SO_4 but still hydrolyze well enough to act as true acids toward most metals. It is also known that weak acids act as a reservoir for hydrogen ions in the corrosion process. This phenomenon known as "buffering effect", describes the enhanced limiting current in presence of acetic acid compared to the case of strong acids at a similar pH. Additionally, un-dissociated acetic acid is also a proton donor and is able to be reduced at the surface of the steel. Therefore, corrosion produced by water containing acetic acid has been confirmed as a potential issue. The corrosion of metals by organic acid is often confounded by trace impurities such as oxygen and metallic salts. Present paper discusses the role of weak organic acid like acetic acid on the failure of hydrocarbon piping occurred in one of the Refinery of Indian Oil Corporation Limited.

Keywords : Organic Acid Corrosion, Buffering effect, Petrochemical Refinery.

MATERIALS SELECTION FOR CORROSION MITIGATION IN A GAS INJECTION SYSTEM FOR OIL PRODUCTION

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An oil company in Kuwait is planning for a successful gas injection pilot trial to improve oil recovery from one of its fields. The pilot project involves the injection of hydrocarbon gas into a small area of the oil field following an initial period of water injection. Effectively, the water flood and gas flood zones will be the same. The success of the pilot gas injection trial will be assessed on the capability to inject and sustain 30 MMscfd of dry gas into the reservoir. For carbon steel systems, corrosion inhibitors that provide high general corrosion inhibition may not always offer localised corrosion protection. Additionally, the elevated pitting risk identified for sour gas injection in west Kuwait oilfields, will require higher dose rates of inhibitor to prevent localised corrosion compared to the dose rate required to prevent general corrosion. As an option to proper mitigation strategies to prevent hydrogen sulphide related corrosion, suitable materials of construction (MOC) can be selected for sour service use. Although, this is not considered as a direct treatment of the injection or production stream, the selection and use of appropriate corrosion resistant materials will protect production wells and facilities from deteriorating in sour systems.

Keywords : Water flood, Sour service, Carbon steel alloys, Corrosion resistant material, Nickel based alloys.

PIPELINE LIFE CYCLE MANAGEMENT USING PREDICTIVE ANALYTICS

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Pipeline failures can have serious environmental and economic effects. Pipeline integrity management is a comprehensive method that ensures pipelines operate safely and efficiently throughout their lifecycle. Pipeline life cycle management comprises all processes related to pipeline design, construction, operation, maintenance, and decommissioning. Predictive analytics is redefining this field by utilising advanced data analysis approaches to enhance decision-making and operational efficiency across the pipeline life cycle.

This paper explores the integration of predictive analytics into pipeline management, highlighting its potential to improve performance, safety, and cost-effectiveness. Predictive analytics allows for the early detection of pipeline problems and probable failures by analysing historical data, Corrosion inputs and different operational variables. This proactive strategy enables optimal maintenance scheduling, timely interventions, and fewer unplanned downtimes, resulting in cost savings and improved operational reliability.

The paper will examine the numerous predictive analytics techniques, such as machine learning models, regression analysis, and anomaly detection, and how they might be used at various phases of pipeline management. Case studies of successful predictive analytics solutions in pipeline operations will be presented, highlighting increases in efficiency, safety, and regulatory compliance. Data quality, model building, and integration with existing systems will be explored, as well as techniques for dealing with these difficulties.

The potential benefits of predictive analytics in pipeline life cycle management will be highlighted, including improved risk management, optimised resource allocation, and longer asset lifespan. This study intends to demonstrate the enormous impact of data-driven insights on the future of pipeline infrastructure management by offering a detailed overview of how predictive analytics improves pipeline management techniques.

Keywords : Pipeline Integrity Management, Corrosion Control, Big Data analytics, Data analytics, Predictive Maintenance, Inspection, Inline Inspection, Cathodic Protection

EVALUATING SYNERGISTIC EFFECTS BETWEEN CATIONIC AND ANIONIC SURFACTANTS FOR CORROSION INHIBITION OF STEELS : A QUANTUM CHEMICAL AND EXPERIMENTAL APPROACH

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Corrosion inhibitors are crucial for mitigating corrosion in metals/alloys, and surfactants have emerged as highly effective options due to their low toxicity, cost-effectiveness, and high inhibition efficiency. Despite their widespread use, the underlying mechanisms of surfactant-mediated corrosion inhibition remain poorly understood, particularly concerning the interactions between surfactant mixtures and metal surfaces in acidic environments. This study aims to establish the relationship between quantum chemical descriptors and experimental corrosion inhibition efficiency and to identify the synergistic effect between dodecyltrimethylammonium bromide (DTAB) and sodium dodecyl sulfate (SDS) based on their molecular descriptors. A proper mixture of surfactant molecules can lead to synergistic effects, thus improving corrosion inhibition performance. Based on the frontier orbital matching principle, it was found that DTAB donates electrons to the metal surface while SDS accepts electrons. Similar observation was also made from the calculated fraction of electrons transferred. A mixture of DTAB and SDS enables DTAB to donate more electrons and SDS to accept more electrons, thus, strengthening the bonding interactions between DTAB, SDS and the metal surface, and resulting in a synergistic effect between DTAB and SDS. From gravimetric tests, it was found that synergy exists between DTAB and SDS and a 3:1 ratio was found to be the most effective for corrosion inhibition of carbon steel in 0.01 M Hcl.

Keywords : Corrosion Inhibition, DFT, DTAB, SDS, gravimetric analysis.

FATIGUE IN PSA VESSELS – A CASE STUDY

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Hcl is extensively utilized across various industries for a range of applications, such as oil-well acidification, acid cleaning, pickling, and descaling processes. However, the highly aggressive nature of these solutions results in severe corrosion of mild steel (MS), an extensively used material in industrial applications for its cost-effectiveness and mechanical properties, which suffers considerable damage, which in turn negatively impacts the overall efficiency and economic viability of these industries. To address this issue, corrosion inhibitors (CIs) are frequently used to slow down the corrosion process and extend the lifespan of metal infrastructure. This paper focuses on the comprehensive study of three aldol-based corrosion inhibitors (AbCIs) viz. (1E,4E)-1,5-diphenylpenta-1,4-dien-3-one (DPP), (1E,4E)-1,5-bis(4 (dimethylamino)phenyl)penta-1,4-dien-3-one (DMPP), and (1E,4E)-1,5-bis(4-(diethylamino) phenylpenta-1,4-dien-3-one (DEPP) were synthesized using benzaldehyde, dimethylaminobenzaldehyde, and 4-diethylaminobenzaldehyde respectively with acetone at room temperature, their structures were confirmed by 1H-NMR and FTIR spectroscopy. The inhibition efficiency of these AbCIs on MS was assessed using gravimetric methods, electrochemical impedance spectroscopy (EIS), potentiodynamic polarization studies (PDP) and DFT was carried out for in-depth mechanism of corrosion inhibitor. The morphology of the MS surface was examined after immersion to corrosive media, both with and without AbCIs, using contact angle analysis, and field emission scanning electron microscopy (FE-SEM). From the obtained results order of inhibition efficiency (%□): DEPP (97.56%) ~ DMPP (97.56%) >> DPP (23.14) at 303 K whereas at 343 K %□ of DEPP (94.61%) > DMPP (92.16%) >> DPP (43.54%).

Keywords : Aldol; corrosion inhibitor; DFT; Acidic environment; EIS; PDP.

COMPREHENSIVE CHARACTERIZATION AND PERFORMANCE VALUATION OF ALDOL-BASED CORROSION INHIBITORS DERIVED FOR USE IN ACIDIC ENVIRONMENT : INSIGHTS FROM EIS, WEIGHT LOSS, AND DFT STUDIES

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Pressure swing adsorption (PSA) systems are installed in various industries including Refineries, Petrochemicals, Fertilizers and Gas Processing. Typical uses include hydrogen purification and separation of gases and moisture from atmospheric air.

These systems include pressure vessels containing suitable adsorbent, which are subject to pressure cycles. Pressure is increased during the generation mode, when desired gas is produced, and reduced during the regeneration mode, when waste streams are discharged and the adsorbent is regenerated.

Vibration and thermal fatigue is generally addressed in design and as part of in-service inspection programs. However, mechanical (pressure) fatigue does not receive the same attention. This paper presents a case study of fatigue in a pressure vessel to emphasize the need for a similar focus on pressure cycles.

Keywords : Pressure swing adsorption, fatigue, stress concentrators.

TROUBLESHOOTING OF THERMAL STRESS CORROSION & GALVANIC CORROSION ISSUE OF ALUMINIUM BUS BAR INSTALLED IN AN ELECTRICAL POWER DISTRIBUTION PANEL AT A SUBSTATION OF AN IOCL PLANT.

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Electrical Power supply of IOCL locations having facilities for storage, supply & distribution of petroleum products, is taken from captive power plants or from grid power. Electrical power supply is distributed among individual process units via LT Sub Stations. Electrical Loads of process units & marketing locations is fed from Substation. LT Substations have Electrical PMCC & MCC Panels. Hence the importance of the PMCC & MCC panels is paramount. In one location's substation, PMCC panel bus bar design had some shortcomings in design. Lesser space among bus-bar conductors caused poor dissipation of heat generated during operation. In addition to that, lesser space among conductors increased electromagnetic force among bus bars. It had caused loosening of bus-bar bolted joints & increased contact resistance thereby more increase of temperature at bus-bar chamber. Abnormal thermal stress triggered stress corrosion of bus bars. This Incomer breakers had Copper Jaw contacts which were connected to Aluminium Bus bar of the PMCC Panel. Copper-Aluminium bus-bar joints also caused galvanic corrosion due to dissimilar metallurgical property. Due to thermal stress corrosion & galvanic Corrosion, bus bar joints were corroded & failed which caused flashover at Incomer Breaker to Bus bar joint contact. Due to flashover, tripping of Incomer feeder Breaker by protection relay & thereby power supply interruption of process units happened. This paper discusses the issues related to failure of Aluminium bus-bar due to Thermal stress corrosion & galvanic corrosion, design modification done to mitigate the issues. In addition to that a state of art technology – “Online Temperature Monitoring system” at LT breaker terminal is also discussed in the paper.

Keywords : Thermal stress corrosion, Galvanic corrosion, LT PMCC & MCC Panel, LT breaker, Bus-bar, Online Temperature Monitoring system.

ON-STREAM ROBOTIC TANK INSPECTIONS BY ATEX CERTIFIED PETROBOT ROBOTIC TOOLS - AN ALTERNATIVE TO CONVENTIONAL TANK M&I

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Aboveground storage tanks (ASTs) are very critical assets for storing the various type of liquid Hydrocarbon. Assuring the reliability & integrity of these tanks is also very important considering the critical operations of the Oil & Gas / Chemical / petrochemical Industry. Conventional method of inspecting these tanks is manual cleaning followed by human entry which leads to tank shutdown, hazardous sludge generation, higher M&I cost and increased safety risks. To minimize or eliminate above problems, these tanks can be inspected by using online robotic tools which can enter in liquid filled operational storage tanks and can carry out the internal inspection of tank bottom plates. This technology presentation discusses about the requirement of API STD 653 for conventional tank Maintenance & Inspection, alternative to conventional Maintenance & Inspection - online robotic tank inspection methodology, prerequisite for tank inspections, inspection execution and result / finding reporting etc. This presentation will benefit the participant to get the insights of use of on-stream tank inspection robots ATEX Certified PetroBot ITIS Rover / PetroBot MagRover and to inspect these tanks without any shutdown and service life extension acceptable to regulatory authorities.

Keywords : M&I (Maintenance & Inspection), Robotic Inspection, pressure vessel, inline tank inspection, Boiler inspection, Robotic tank inspection, PetroBot MagRover, PetroBot ITIS Rover.

KEYS TO A SUCCESSFUL ON-FIELD APPLICATION OF ICDA FOR 20 CRITICAL NATURAL GAS PIPELINES : A CASE STUDY

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Pipeline integrity management is a crucial process that ensures the safe and reliable operation of pipelines. It involves a comprehensive approach to identifying, assessing, and managing risks associated with the pipeline systems in-place.

This paper presents an extensive case study applying the code-compliant ICDA integrity assessment methodology on twenty (20) natural gas pipelines owned by a pipeline operator, in North-East of India. Summing a cumulative length of 414.43 km, varying from 4” to 22” in diameter, these pipelines, commissioned between 1973 and 2006, faced challenges including varied gas compositions and operational data availability.

The study, initiated in 2022, includes all four (4) steps of the ICDA methodology, and emphasizes on the importance of having a seasoned Subject Matter Expert (SME) as ICDA assessment are highly subjective in nature and are very much dependent on the Internal Corrosion Predictive Modelling (ICPM) deployed as well as the experience of the team handling the results of the ICPM.

Keywords : pipeline integrity management, identifying, assessing, & managing risks, internal corrosion direct assessment (ICDA), internal corrosion predictive modelling (ICPM), Subject Matter Expert (SME).

METHODOLOGY TO FIND CUI (CORROSION UNDER INSULATION) IN INSULATED PIPING USING INFRARED THERMOGRAPHY CAMERA

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Corrosion Under Insulation (CUI) poses a significant risk to the integrity of insulated piping systems in industrial facilities. Traditional methods for detecting CUI often involve invasive inspections or limited access, which can be disruptive and costly.

This study proposes a methodology to identify CUI using infrared thermography, a non-destructive testing technique that leverages thermal imaging to assess the condition of insulated pipelines.

This methodology enhances the efficiency of CUI detection by providing a non-invasive, real-time assessment of insulated pipelines, thereby reducing inspection costs and minimizing operational disruptions. The integration of infrared thermography into routine maintenance schedules can significantly improve the reliability and safety of industrial piping systems.

Keywords : Corrosion under insulation I, Thermography, reliability, Integrity.

CORROSION GROWTH RATE IS NEVER LINEAR : RLA OBTAINED WITHOUT THE APPLICATION OF DIRECT ASSESSMENT (DA) PRINCIPLES IS NON - REPRESENTATIVE!

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Integrity assessment for the first time was performed using the continuously iterative process of ICDA, ECDA and SCCDA respectively to a group of 23+ year old refined product transporting pipelines in the year 2015. The same group of pipelines went through its second cycle of integrity assessment in 2023 (the pipeline assets being 31 years old during the second code-compliant integrity assessment campaign). The 2023 inspection program was based on the Owners' prerogative to assess the pipelines within the 2015 project report calculated re-assessment interval period.

This paper is taking into consideration results from joint dig verifications which are known as Detailed/ Direct Examinations (DEx) within the DA process. These DEx were performed at two (2) different locations belonging to two (2) different 24” pipelines sharing the same RoW. One (1) location for the threat of internal corrosion, the other for the threat of external corrosion. One (1) of these locations was excavated during the 2015 program, wherein internal corrosion was confirmed. The second location on the other 24” pipeline predicted to consist of external indication and was not excavated due to inclement weather.

The reports from 2015 project were re-studied, independent engineering analyses of data for the 2023 program was initiated. Based on results of simulations as well as indirect inspection surveys, the same two (2) locations did get flagged. The authors associated with this project mutually decided to ensure both these locations as flagged in the 2023 program (previously flagged and partially excavated during the 2015 campaign) needs to be excavated to ascertain growth rate (if any).

This paper thus shall discuss the findings of the Direct / Detailed Examination performed on these two (2) pipelines, ascertain corrosion growth rate, determine that corrosion growth rate in real-world conditions is never linear. Utilizing inspection tools only, without understanding the 'science' behind the mechanism, could deviate a practitioner from obtaining a representative growth rate or determining a re-assessment interval prior to a failure manifestation.

Keywords : ECDA, ICDA, SCCDA, corrosion growth rate, damage mechanism.

STRESS CORROSION CRACKING OF AN AISI 321 STAINLESS STEEL SEAMLESS PIPE OF HOT HIGH-PRESSURE SEPARATOR (HHPS) VESSEL IN VGO HDT UNIT EXPOSED TO SALINE ENVIRONMENT

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The Hot High-Pressure Separator (HHPS) vessel in the Vacuum Gas Oil Hydrotreater (VGO HDT) unit is designed to separate the reactor effluent into hot gases and liquids. The VGO HDT unit enhances the quality of raw Vacuum Gas Oil and Heavy Vacuum Gas Oil from the Atmospheric Vacuum Unit, as well as Coker Gas Oil from the Delayed Coking unit, by reducing its sulfur and nitrogen content. The HHPS is equipped with two Level transmitters, nine level gauges, and six level zero transmitters. Over the past few years, multiple cracks and leaks have been detected in the impulse lines and the connections between the level gauges and transmitters to the vessel. Failures in any part of the HHPS vessel can lead to fires, unit outages, and are hazardous due to the potential release of H2S.HHPS failures may arise from various causes, including corrosion, sulfidation, High-Temperature Hydrogen Attack (HTHA), corrosion under insulation etc. These damage mechanisms are often related to operating conditions, external environmental conditions and material susceptibility to specific damage. To identify the root cause of the failure, the affected circuit was isolated and severed at both ends of the leak site. A comprehensive failure investigation was conducted including visual inspection, radiography, Metallography, fractography analysis, operating parameters study, and chemical analysis of pipes and insulation. Laboratory tests, supported by literature reviews, indicate that the tube failures resulted from Chloride Stress Corrosion Cracking (Cl-SCC). External moisture infiltration or water leakage through insulation made contact with the outer surface of pipes and tubes, turning it saline and leading to the formation of surface cracks. Some of these cracks extended through the entire tube thickness, resulting in leaks.

Keywords : HTHA, CLSCC, Sulfidation, Corrosion under insulation.

CORROSION PROTECTION OF MILD STEEL IN ACIDIC ENVIRONMENT USING FATTY ACID-PEG HYBRID INHIBITORS

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Corrosion poses a significant challenge in industrial operations, particularly in the oil and gas industry, where acidic conditions can rapidly degrade metal surfaces, leading to economic losses and equipment malfunctions. Corrosion inhibitors are a highly effective strategy for mitigating metal deterioration. While organic compounds are commonly explored for their corrosion-inhibiting properties, many of these substances are costly and harmful to the environment and living organisms. In contrast, fatty acids derived from plants and polyethylene glycol (PEG) offer sustainable, eco-friendly, and renewable alternatives. Fatty acid and PEG-based corrosion inhibitors have emerged as effective solutions, forming a protective barrier that minimizes metal dissolution and significantly enhances corrosion resistance. The fatty acids provide hydrophobic protection, while PEG creates a stable, uniform layer on the metal surface. This synergistic effect improves overall inhibition efficiency and helps safeguard metal components, ensuring their reliability and reducing the frequency of costly repairs and replacements in demanding acidic environments.

In this paper, we investigate the corrosion inhibition performance of two eco-friendly inhibitors for mild steel in 1M HCl: amphiphilic polyesters derived from ricinoleic acid with polyethylene glycol, specifically RR-A (with PEG-4000) and RR-C (with PEG-2000). The performance of these inhibitors was assessed using electrochemical impedance spectroscopy (EIS) and potentiodynamic polarization (PDP).

Keywords : PEG, Corrosion inhibitors, Amphiphilic ester, Fatty acids.

STATISTICAL EVALUATION OF INLINE INSPECTION TOOL PERFORMANCE : AN ANOVA-BASED APPROACH TO ERROR ANALYSIS ACROSS MULTIPLE PIPELINES

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This study presents an in-depth analysis of Inline Inspection (ILI) tool errors using Analysis of Variance (ANOVA) techniques. The primary objective is to understand the variability and potential sources of error in ILI data across multiple pipelines and to develop strategies for handling these errors to inform better decision-making processes.

ILI tools are critical for assessing pipeline integrity, detecting anomalies such as corrosion, cracks, and other defects. However, the accuracy of these tools can be affected by various factors, leading to potential errors in the data collected. This study utilizes data from several pipelines to perform a comprehensive error analysis.

Using ANOVA techniques, the study evaluates the differences in ILI tool error measurements across different pipelines and operating conditions. ANOVA helps in identifying statistically significant differences in the means of error measurements, allowing for a better understanding of the factors contributing to these discrepancies. The factors considered in the analysis include pipeline material, diameter, wall thickness, operating pressure, and environmental conditions.

The results of the ANOVA analysis reveal significant sources of variability in ILI tool measurements. By quantifying these sources of error, the study provides insights into the reliability and accuracy of ILI data Furthermore, the study discusses the handling of these errors through calibration techniques, data filtering, and integration with other inspection methods to enhance the overall accuracy of pipeline integrity assessments.

The findings of this study have practical implications for pipeline operators, enabling them to make more informed decisions regarding maintenance, repair, and replacement of pipeline segments. By understanding and mitigating the sources of error in ILI data, operators can improve the safety and reliability of pipeline infrastructure.

In conclusion, this study underscores the importance of robust statistical analysis in evaluating ILI tool performance and provides a framework for using ANOVA techniques to enhance the precision of pipeline inspection data. The approach outlined in this paper can be applied to various pipeline systems, contributing to the overall goal of ensuring pipeline integrity and safety.

Keywords : Inline Inspection, Error Analysis, ANOVA Techniques.

CORROSION DESPITE PROTECTION & LIVE LEAK REPAIRS

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Integrity of any facility, considering the critical operations of the Oil & Gas / Chemical / petrochemical Industry, is dynamic due to operational difficulties and challenges that occur despite having taken sufficient measures during engineering or construction or maintenance phases. Stake holders lose considerable operational costs and shutdown costs when defects and leaks occur. To minimize or eliminate losses in asset operational or shut-down costs, the defective assets or leaks can be repaired online without reduction of operating parameters using resins and composites, above ground, underground or under water.

This paper discusses the integrity repair and leak repair techniques, prerequisite for leak or integrity repair, summary of field experiences of over 40 years of existence all over the world for major end users in Oil, Gas, Petrochemicals, Steel and Power sectors. This paper will benefit the industry participant to get the insights of using resins or composites to mitigate the corrosion failures and to extend the service life of their facilities before it leads to disastrous incidents.

Keywords : Underwater Live leak repairs, Online leak sealing, Long term restoration of Assets, Composite Leak and integrity repairs.

ENHANCING CORROSION MANAGEMENT THROUGH INTEGRATION OF IOWS AND RBI : A PROACTIVE APPROACH TO RISK MITIGATION IN THE OIL & GAS INDUSTRY

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IOWs program is valuable for Oil & Gas industry because it helps the operators to identify the corrosion loops, expected damage mechanism and monitoring parameters based on the corrodents present and the factors which can influence the corrosion/degradation rate. Establishing Integrity operating windows for a process unit is a key element for compliance with corrosion monitoring and mitigation program. IOW could be a more effective corrosion management strategy as number of integrity related failures can be effectively mitigated via IOW due to early detection of corrosion/degradation in the system and taking corrective actions in order to prevent any SHE (Safety, Health, Environment) incident/failure.

The forthcoming presentation will expound upon our vision in prioritizing the risk-based inspections based on the surveillance program. In traditional Risk based inspection, risk is assessed based on the past operating history up to the next scheduled inspection. Integrating RBI with IOW offers real time, direct insights into the actual risk and provides early warning to the process & integrity teams about deviations regarding any excursions in the parameters being monitored, enabling prevention of unexpected failure. These advantages transcend financial considerations, encompassing operational facets such as regulatory compliance, optimization of inspections for credits, increased facility uptime, and the systematic quantification and categorization of risks. The study also outlines recommendations characterization for managing and maintaining the assets to bring down the risks at an acceptable level.

Keywords : Integrity Operating Window, Corrosion Monitoring and Mitigation, Corrosion Loops, Risk Based Inspections, Surveillance Program.

RELIABILITY ENHANCEMENT OF BOILER TUBES BY MAINTAINING WATER CHEMISTRY & PREVENTING OVERHEATING

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Reliability of one Indian Refinery CPP Boiler was enhanced by taking suitable measures in water chemistry control with ensuring the proper burner management to avoid any flame impingement. There was a sudden failure of Boiler tubes due to overheating & unexpected upset in water chemistry which needed a detailed root cause analysis (RCA). The RCA was focused on material characterization of failed components, deposit analysis, SEM fractography, EDAX analysis and study of the trends of dissolved O2 (DO) & other water chemistry and operational philosophy. A hard & porous metal oxide deposit due to oxygen corrosion occurs in localized cells that result in pitting. High DO in feed water and subsequently flame impingement led to premature failure of Boilers tubes eventually resulted in Boiler outage and subsequent expensive repairs/replacement of the pressure parts. SEM fractography analysis confirmed micro cracking originated from corrosion pits with ductile failure phase. EDAX analysis confirmed the presence of Sodium & DO with corrosive elements and water impurity. The analysis results indicated that the failure was attributed to combined effect of Dissolved oxygen corrosion and Caustic Corrosion. Flame impingement (Overheating) of Boiler Tubes further aggravated the corrosion process leading to failure.

Keywords : Water Boiler tubes, Feed water, Corrosion, Caustic, Dissolved Oxygen, Pitting, Bulging, SEM, EDAX.

ROLE OF MICROSTRUCTURE AND HEAT TREATMENT IN CORROSION, CRACKING AND MATERIAL INTEGRITY

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During failure analysis of equipment operational failures of an upstream oil & gas industry, it was observed that there is some correlation between microstructure / heat treatment and the failure mechanism which led to premature failures of these components. In this technical paper, a few case studies are discussed regarding the premature failures due to improper heat treatment and microstructure.

In the first case, an onshore well of a Coal Bed Methane field, Progressive Cavity Pump (PCP) was installed and just after 20 days of working, rotor of the PCP pump snapped. After pull-out, it was found that Rotor was parted from top and remaining part of rotor stuck in the stator. The metallographic studies revealed ferrite pearlite microstructure with high pearlite content (62.5%). The presence of cracks propagating through pearlite phase and intergranular spaces are a signature of Hydrogen Induced Cracking. It was due to the presence of significant amount of pearlite phases, which are hard and brittle, as a result, the cracks propagated through them under existing torsional fatigue load and finally the material got fractured in brittle mode.

In second case, it is observed that the Water pump motor of utility water plant of an offshore platform was drawing high current. The water pump was pulled out and dismantled for inspection and found that the pump shaft experienced severe corrosion damage and the material was washed out at several portion along its length. Metallography studies revealed that the specimen has microstructure of austenite-ferrite phase typical of a super duplex stainless steel and exhibited presence of undesirable sigma phases. One of the major reasons of the failure of the pump is primarily due to the presence of array of sigma phase in the microstructure due to improper heat treatment, which in turn made the component very brittle and less corrosion resistant.

In the third case, Well Services Section of an Onshore Asset, during work-over observed that Sucker Rod of one of the onshore oil well field was broken from upset taper head. The Sucker rod was pulled out and it was found that Sucker rod was broken. The metallographic analyses of the failed rod sample revealed martensite with retained austenite microstructure which is not acceptable for this type of material. Stringers in the metal matrix have been observed as stringers are weakest site where a crack can initiate, it lead to premature failure of the sucker rod. The details of tests and suitable remedial measures are discussed in detail in the paper.

Keywords : Rotor, Hydrogen Induced Cracking, Sigma phase, Retained Austenite, Stringers.

COMBATING CORROSION IN HARSH MARINE ENVIRONMENTS : A CASE STUDY ON THE REHABILITATION OF A 70-YEAR-OLD MARINE JETTY STRUCTURE

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Marine structures, such as jetty structures, are vital assets for petroleum refineries, facilitating the supply of seawater for cooling systems and firefighting operations. Over decades of service, continuous exposure to the harsh marine environment, coupled with the presence of aggressive chemicals in saltwater, results in severe structural deterioration. Corrosion becomes a primary concern as it accelerates the degradation of both RCC and steel components, compromising the integrity and operational efficiency of these structures. This paper presents corrosion deteriorations in marine environment and an in-depth study of the retrofitting initiatives undertaken for a 70-year-old Marine RCC and steel jetty structure at BPCL Mumbai, aimed at countering the adverse effects of corrosion and extending the structure's service life. The initiatives focus on improving structural longevity, durability, and resilience in the face of constant exposure to seawater and fluctuating tidal conditions. Key challenges addressed include the impact of chloride ions, sulfates, and other corrosive agents present in saltwater, which exacerbate the deterioration of concrete and steel elements. This deterioration is compounded by wet surfaces, salt deposits, sea breezes, and tidal variations, which accelerate corrosion processes. The logistical constraints of underwater repair work and restricted access during splash zone operations further complicate the rehabilitation process.

This paper provides a detailed evaluation of each repair method, highlighting their effectiveness in slowing corrosion, reinforcing structural strength, and prolonging the lifespan of the marine structure. The case study showcases how strategic, proactive interventions can successfully mitigate the detrimental effects of long-term exposure to chemically aggressive marine environments.

Keywords : Marine Environment Exposure, Retrofitting Techniques, Sacrificial Cathodic Protection, Corrosion and Distress, Structural Longevity and Durability, Rehabilitation, Retrofitting.

IN-LINE INSPECTION OF 10" LPG TRANSFER PIPELINE (NON-PIGGABLE) USING HIGH RESOLUTION ULTRASONIC IN-LINE INSPECTION PIPELINE INTEGRITY GAUGE (ILI PIG)

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As per OISD-STD-130, comprehensive inspection of cross-country pipelines must be done every 5 years. So, In-line Inspection of the 10" LPG Transfer (Non-Piggable) Pipeline has been carried out between 14.09.2024 and 18.09.2024 to detect geometric and metal loss features in the subject pipeline using Pipeline surveyor system (an advanced high resolution ultrasonic wall thickness measurement tool). The subject 10" LPG transfer pipeline spanning a length of 3.7 km, was originally installed in 2004 to connect CPCL LPG Bulk Storage to the Bottling Plant situated at Amullaivoyal in North Chennai. The pipeline starts from the western boundary wall of CPCL and crosses the Manali-Ponneri High Road using the existing pipe way culvert.

The subject 10" LPG transfer pipeline is "non-piggable" since originally commissioned due to its complex geometry and lack of PIG launching/receiving arrangements. So, ultrasonic testing technique has been selected for the intelligent pigging activity of 10" LPG pipeline to assess the condition of the pipeline, especially the underground section of the pipeline, spanning 1.1 kilometers from the Madras Fertilizers Limited exit point to the LPG Bulk Storage & Bottling Plant.

Keywords : In-line inspection, Cross-country pipeline, Non-piggable, Ultrasonic testing.

CORROSION IN PETROCHEMICAL, REFINERIES AND FERTILIZER INDUSTRY

CASE STUDY ON POLYTHIONIC ACID SCC OF SS304L ELBOWS IN PIPELINE

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This paper discusses about a case study on Polythionic acid Stress Corrosion Cracking (PASCC) of multiple SS304L elbows in petrochemical plant in the vent pipelines. It is an inter-granular SCC that can occur in sensitized austenitic stainless steels when sulfide scale formed on the surface during operation is exposed to air and moisture. It normally occurs during shutdowns or start-ups.

Minor hydrocarbon vapour leakage observed from bottom cracked elbow of the vent line going to flare during de-pressurisation of pipeline for shutdown. Failed elbow was tested in metallurgical laboratory and found to be in sensitized condition. Also, it differed in material composition and failed in IGC test.

Based on the investigation it was concluded that the reason for failure was contributed to material defect due to improper manufacturing/inspection causing sensitization of the material and further aggravated by PASCC due to exposure of piping internals to oxygen and other corroding elements. Thermal stresses due to low temperature and stresses due to improper piping supports also were the other contributing factors.

Replacement of all affected / potential elbows, investigation of lapse of inspection from TPIA/OEM, checking feasibility of providing continuous N2 purge to avoid ingress of air/moisture and rectification of improper supports were some of the recommendations/forward path to avoid re-occurrence of this incident.

Keywords : Polythionic acid SCC, IGC, de-pressurisation, sensitized, thermal stresses.

FLANGE LEAK AT INLET JOINT OF THE HYDROGEN REFORMER – A CASE STUDY

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With the implementation of stricter environmental regulations, the significance of hydrogen has grown substantially. Hydrogen (H2) plays a crucial role in various process units such as DHDS, DHDT, VGO-HDT, and Hydrocracker, where it is essential for producing cleaner fuels. Hydrogen (H2) is primarily generated in the Hydrogen unit, with additional hydrogen produced as a byproduct in reforming units such as CRU and CCRU within a petroleum refinery. Hydrogen reformers are essential for producing cleaner fuels, enhancing refinery efficiency, and ensuring the smooth operation of various refining processes. The reliable operation of the Hydrogen unit is crucial for any refinery, with the reformer being the most critical equipment and the heart of the Hydrogen unit. Proper maintenance, in addition to diligent operation, is vital to ensure the reliable and safe functioning of this unit. This paper presents a case study on the failures of the RTJ-type inlet flange joint of a hydrogen reformer, where improper maintenance, stemming from a lack of awareness, caused an interruption in the unit's operation. The flange leaked because it was exposed to higher temperatures than designed for, due to the application of a CF blanket that fully covered it. The failure resulted from several factors, including:

- The application of insulation on a flange joint that should have remained bare.
- Exposure of the A193 grade B16 bolting material to higher temperatures than it was designed to withstand.

The paper concludes with recommendations for preventing such joint failures in Hydrogen Reformers.

Keywords : Environmental norms, DHDT, DHDS, hydrocracker, High temperature exposure, H2, Ring type joint (RTJ), CF blanket, etc.

INVESTIGATIONS OF DE-ZINCIFICATION INDUCED FAILURE IN ALUMINUM BRASS HEAT EXCHANGER IN OIL REFINERY

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Aluminum and admiralty brass are widely used in heat exchangers for their excellent thermal conductivity and are very cost-effective when the environment is not very aggressive. The process fluctuations due to large temperature changes, presence of Cl or low pH levels, can lead to severe corrosion issues, including dezincification, pitting, crevice corrosion, stress corrosion, erosion, and mechanical fatigue. This study examines the premature failure of Aluminum Brass C68700 tubes in an oil refinery's heat exchanger, which failed within six months against a two-year service expectation. The failure investigation revealed that significant metal loss had occurred on the shell side due to dezincification. Zinc leaching, revealed by EDS mapping, resulted in brittle, porous copper, while chloride ions and ammonia gas exacerbated corrosion. Cracking was also observed in the tubes. The refinery decided to upgrade the tubes to UNS S32707 considering its suitability for the application conditions. Literature indicated that this grade was in operation since more than 9 years without any problems in a similar conditions at the time of publication of that paper. This case highlights that in cases when the material selection is borderline, any changes in the process conditions can result in premature failures and production losses.

Keywords : Failure analysis; Corrosion; Aluminum Brass, Dezincification.

LONG TERM INSIDIOUS CORROSION IN A COMBINED FEED EFFLUENT EXCHANGER OF A HYDROCRACKER UNIT

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Combined Feed Effluent Heat Exchangers are critical pieces of static equipment in a Hydrocracking unit and are used to exchange heat between the hot Reactor effluent and the cold feed. A sudden tube leak occurred in a Combined Feed Effluent Exchanger during an emergency startup of a Hydrocracker unit and resulted in the un-availability of the unit for an extended period of time. The exchanger had earlier been inspected and pressure tested during a turnaround in the preceding six months and was found fit for operation. The root cause analysis of the failure revealed miniscule corrosion occurring continuously over the entire operating history due to the presence of H2/H2S ultimately resulting in the tube ruptures due to overload.This paper details the failure, the root cause analysis, impact of NDT techniques and provides mitigation measures including metallurgy upgradation options for increased reliability.

Keywords : Hydrocracker, H2/H2S Corrosion, Reliability, Root Cause Analysis.

CASE STUDY ON FREQUENT FAILURE OF TOP PUMP AROUND (TPA) VS CRUDE HEAT EXCHANGER IN AN OIL REFINERY UNIT

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The Top Pump Around (TPA) vs crude heat exchangers are used to preheat the crude, installed at upstream of the desalter trains. These exchangers have faced repetitive failures since commissioning. Failure in these heat exchangers may lead to significant loss in crude throughput, discoloration of ATF during leakage and significant fall in desalter temperature. Failure may occur due to various reasons arising out of corrosion, erosion, deposition, fatigue due to operational issues and design related problems. This paper deals with fixed tube sheet (AEL) heat exchanger of service TPA vs crude having shell of SA516Gr.70 and tube bundle of SA179 seamless tube metallurgy, which failed many times during operation. To facilitate the root cause of failure, different destructive and non-destructive tests of failed sample were carried out. Methodology for failure investigations like visual inspection, dimensional measurement, analysis of operating parameters, review of design conditions and chemical analysis of deposit samples were carried out. Operating window for this heat exchanger was investigated to assess the recurring failure of tubes. The prime reason of failure in this case was due to acidic corrosion caused by chloride rich deposits in presence of moisture (water) in service.

Keywords : Top Pump Around (TPA), Crude, chloride rich deposits.

CASE STUDY ON FAILURE OF CENTRIFUGALLY CAST HOT COLLECTOR AND REPAIR METHODOLOGY IN HYDROGEN GENERATION UNIT

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The Hydrogen Generation Unit (HGU) is an essential process plant in refineries, playing a key role in adhering to stringent environmental regulations on sulfur content.

At the core of the HGU is the Hydrogen Reformer, which utilizes Steam Methane Reforming to generate hydrogen. The operational reliability of this reformer is critical to the safety, efficiency, and profitability of the refinery. This paper explores the failure of a Centrifugally Cast Hot Collector Outlet Header after nearly two decades of service.

The investigation involved an extensive methodology, including visual inspection, microscopic examination, Scanning electron microscopy. The findings revealed that the failure was caused by High-Temperature Creep Damage. Additionally, this paper also discusses the repair methodology adopted to address the weldability issues to use the old Cast Tee components.

Keywords : Hydrogen Reformer, Hot collector, High temperature creep, Weldability of cast header.

DEAD LEG MANAGEMENT IN RISK BASED INSPECTION OF PROCESS PLANTS

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Refineries, petrochemical and other process plant facilities encounter numerous damage mechanisms threatening the asset integrity. They become even more detrimental when the flow is stagnant (the process parameters are unlike the ones in the normal operating circuits). Dead Legs (DLs) fall in this category.

Risk Based Inspection (RBI) approach, [Risk =, Probability of Failure (PoF) x Consequence of Failure (CoF)] can improve risk management ,reduce shutdowns/inspections and hence, increased plant availability without compromising safety or reliability. RBI implementation takes care of all the static equipment and piping, addressing component wise. It is in this respect; DLs are also addressed.

If undetected, DLs related corrosion is a major potential threat. Despite these risks, they have often received less attention than the mainline pipes. Working personnel express confusion on the DLs during Inspection Data Management System (IDMS) for RBI assignments.

As their management is necessary to minimize the plant failures, in this paper, a detailed account is given like what are they, examples of representation of DLs, how are they classified, where to find them, what are the threats and how to manage them. While working for some time, improved the understanding, which is shared. The management part of DLs is quite involved which is the main theme of this paper. Corresponding inspection aspects and connected NDT are highlighted.

Key words : Dead Legs, Risk Based Inspection, Inspection, Corrosion of piping.

MITIGATING SULPHUR-INDUCED CORROSION IN RCC STRUCTURES : A CASE STUDY OF SULPHUR PIT REHABILITATION

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RCC sulphur pits in Sulphur Recovery Units are designed for storing molten sulphur at approx. 140°C. However, these pits are prone to severe degradation due to aggressive sulphur attacks on the RCC and embedded reinforcement, leading to significant structural deterioration. This recurring global issue necessitated a detailed investigation and the development of an innovative strategy to address corrosion-induced damage and ensure the structure's long-term durability.

Initial inspections revealed extensive water seepage through acid brick joints along the pit's peripheral walls, traced to groundwater infiltration through the RCC. When the RCC was exposed by removing the insulating materials and acid-alkali brick linings, severe sulphur- induced corrosion was found, leading to structural cracks, concrete softening, and deteriorated reinforcement.

A comprehensive condition assessment was conducted using advanced NDT's like UPV, GPR, RHT, Core Sampling, Petrographic Analysis, HCP, etc. The findings indicated widespread reinforcement corrosion and severe concrete deterioration. Based on these results, a robust repair strategy was developed, including sulphur-attack mitigation, crack remediation, corrosion inhibition, structural reinforcement, and final protective measures.

The efforts put by BPCL MR not only restored the structural integrity of Sulphur Pits but also significantly enhanced its resistance to future sulphur attacks and corrosion, thus resolving the perennial issue faced globally. This case study highlights the critical importance of early detection, thorough condition assessment, and the use of specialized materials in extending the service life of RCC structures exposed to harsh chemical environments.

Keywords : Sulphur-Induced Corrosion, RCC Deterioration, NDT, Structural Rehabilitation, Epoxy Grouting, Corrosion Inhibition, Condition Assessment.

DESIGN AND CONSTRUCTION STRATEGIES FOR CORROSION PROTECTION IN MODULARISED CHEMICAL PLANTS

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In Onshore Chemical plant construction, modular fabrication approach is increasingly preferred by end-users. This involves splitting layout into multiple modules, each comprising equipment, piping & ancillaries, for prefabrication at remote yard location. Such modules are then transported by road or ship for site erection. Corrosion in such logistically complex paradigms, is often overlooked, leading to costly site repairs. External atmospheric corrosion can impair mechanical integrity of carbon steel piping & equipment. Insulated items are vulnerable to corrosion under insulation. Protective coatings tailored to benign site conditions may prove inadequate for storage & marine transportation. Unless proper layup procedures post-yard hydrotesting exists, aqueous corrosion and MIC can occur, with SS vulnerable to localized corrosion and chloride SCC. In a recently executed project, these risk factors were analysed in detail with appropriate mitigation. This paper discusses effective implementation of project preservation procedures to manage corrosion risks specific to modular fabrication.

Keywords : Modular fabrication, Corrosion, Protective coatings, Corrosion under insulation.

CORROSION TESTING AND APPLICATIONS CASE STUDIES OF SANICRO 35 : A NEW ALLOY WITH HIGH PERFORMANCE-TO-COST RATIO FOR REFINERIES AND CHEMICAL PROCESS INDUSTRY

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Refineries, petrochemical and chemical process industry face some of the most severe corrosion challenges for materials of construction because of the wide range of temperatures, pressures and process media encountered by the production equipment such as reactors, heat exchangers, pipes, pumps, and hydraulic and instrumentation tubes. Therefore, material innovations play a crucial role in advancing many industrial processes by solving corrosion problems. Sanicro 35 (UNS N08935), a recent material innovation, has very good resistance to pitting and crevice corrosion, Microbiologically Induced Corrosion, Stress Corrosion Cracking, and general corrosion in acids. This paper describes the corrosion testing data for pitting/crevice corrosion, corrosion in seawater, sulphuric acid with chlorides and for conditions encountered in Crude Distillation Unit Overhead Condensers and Reactor Effluent Air Coolers in refineries. Corrosion test results indicate that UNS N08935 performs at par or even better than the more expensive alloys such as Alloy 625 (UNS N06625) and C-276 (N10276). Based on the test results, some case studies of industrial installations are presented where UNS N08935 was an optimum material choice because of its good performance-to-cost ratio.

Keywords : Corrosion; Material Selection; Pitting; Austenitic Steels; Reactor Effluent Air Cooler.

LIFE ASSESSMENT ANALYSIS OF HEATER TUBES IN ATMOSPHERIC & VACUUM DISTILLATION UNIT (AVU) IN A REFINERY AND PETROCHEMICAL PLANT

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5 Cr- 0.5 Mo steels are versatile material and used as a high temperature component in different units of the refinery and power plants. A heater tube from Atmospheric Vaccum Distillation (AVU) unit from a refinery

plant was studied after 18 years of service for remaining life analysis. The tubes were designed at nominal temperature of 510°C and pressure of 25 kg/cm2. The investigation includes visual inspection, dimensional measurements, microstructural examination, mechanical characterization such as room and elevated temperature tensile properties. Microstructural analysis by Optical Microscopy and Electron microscope depicted no significant metallurgical degradation in the form of grain growth, grain boundary precipitation and creep micro voids. Further, life analysis based on API 530 predicted remaining life at design temperature and pressure more than 5 years.

Keywords : Grain growth, Grain boundary precipitation, and API 53.

EXTRACTIVE DISTILLATION (ED) COLUMN REBOILER PREHEATER TUBE FAILURE IN SHELL SULFOLANE UNIT (SSU) OF A PETROLEUM REFINERY : ANALYSIS AND PREVENTION

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The carbon steel tube of an extraction distillation column reboiler preheater failed in service in shell sulfolane unit due to metal loss on the tubes. Tube failures were observed to be predominantly near the Shell inlet & outlet nozzles.

First tube failure was reported in the equipment after 9 years of service life. Detailed analysis was carried out to establish the cause of failure by reviewing the dosing parameters & its frequency, quality of solvent, MOC of the tubes, metallurgical analysis and process parameters.

This paper deals with all the probable damage mechanisms which lead to tube failure and precautionary measures which shall be implemented to avoid recurrence of such failures which has unit shutdown impact.

Keywords : Sulfuric acid corrosion, solvent induce corrosion, sulfolane.

FAILURE OF 1.5" STUB IN THE INTER REACTOR EXCHANGER OUTLET LINE TO FRACTIONATOR FEED FURNACE IN OHCU UNIT DUE TO HIGH TEMPERATURE SULFIDATION

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A small leak was observed from redundant 1.5" Stub in the shell side outlet of inter Reactor exchanger line to Fractionator Feed Furnace in once through Hydrocracker (OHCU) unit. The 1.5" redundant stub was removed and inspected after the line was isolated post the shutdown. Severe wall thickness loss was observed in the stub. However, the flange end of nipple has not detectable thickness loss. A smooth and severely thinned pipe surface was observed underneath the blackish deposit inside the pipe. Severe localised and smooth thinning along with the presence of iron sulphide scales indicated that the stub failed by sulfidation corrosion. The corrosion rate was further aggravated due to high throughput and high Feed sulphur of OHCU unit. Though Carbon steel and low alloy steel piping are being used to achieve satisfactory life in moderate H2/H2S environments up to a temperature of 330-350 deg C, only stainless stell having Chromium above 12% is immune to such corrosion. Moreover, conditions such as higher H2/H2S content, high fluid velocities, turbulence and dead ends aggravate the corrosion and low alloy piping above 260 deg C. It is critical to identify carbon steel and low alloy piping prone to H2/H2s corrosion in dual phase systems above 230 deg C and develop a comprehensive inspection program for critical monitoring of piping especially of small-bore connections.

Keywords : OHCU, Low alloy steel, High Temperature Sulphidation, Couper -Gorman Curves.

FAILURE INVESTIGATION OF TAIL GAS PIPING IN SRB (TAIL GAS TREATING UNIT)

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The tail gases from Sulphur Recovery Unit leaves the Final Condensers at about 132°C are being fed to the Tail Gas Treating Unit to achieve the desired Sulphur recovery efficiency. Further tail gases are routed to the Incinerator through Tail gas header and after proper combustion the flue gases are vented to atmosphere through the stack.

Frequent failure of Tail Gas piping was observed in Tail Gas Treating Unit of Sulfur Recovery Block. Leakages and thickness reduction observed at many locations in the entire loop and thus number of piping spools were replaced in different instances. Detailed Investigation was carried out to find out the root cause for frequent failure of the tail gas loop. The root cause found was corrosion due to the condensation of Sulphur and water vapor present in the tail gases. We took number of initiatives to control the internal corrosion of the Tail gas piping.

Keywords : Tail Gas Piping, Sulphur, Condensation, Corrosion.

ROOT CAUSE ANALYSIS OF FAILURE IN REFRACTORY LINED PIPING OF PETRO FLUIDIZED CATALYTIC CRACKING UNIT (PFCCU)

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Reactor and Regenerator (RR) section is predominantly refractory lined and subjected to abrasion, erosion from the catalyst being used in process. Fresh/regenerated catalyst powder circulates between Reactor where process reaction takes place at 545°C in presence of feed, steam and converts catalyst to spent catalyst and this spent catalyst is regenerated in Regenerator with air at 709°C. Flue gas generated in plenum chamber is sent to a Flue gas cooler for heat recovery through a refractory lined piping via a double disc slide valve (DDSV). Repeated hotspot was observed in this line at downstream of DDSV and steam cooling was provided to cool this line.

This paper deals with the repeated refractory lining damage in this piping, its root cause analysis and corrective actions taken in the refractory lining & pipe supports to avoid reoccurrence for reliable operation.

Keywords : hotspot, refractory damage, steam cooling, thermal growth, refractory lining.

FAILURE INVESTIGATION OF HOT COLLECTOR OF HYDROGEN GENERATION UNIT (HGU) OF A PETROLEUM REFINERY – A CASE STUDY

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An in-service failure of Hot collector header took place in Hydrogen Generation Unit (HGU) after service life of around 20 years. The root cause of failure investigation findings indicates that multiple axial cracks in both outer and inner surface of the header sample. Further, cross sectional section revealed nemorus cracks throughout the thickness. Optical micrographs revealed multiple microcracks, creep voids adjacent to primary carbides and disintegration of primary dendritic boundaries were observed. Further, Creep micro voids were clearly identified in Electron Probe Micro Analyzer (EPMA). Therefore, based on the above analysis material has gone service induced creep damage and replacement of hot collector header is recommended.

Keywords : Hot Collector Header, Creep Micro voids and Electron Probe Micro Analyzer (EPMA).

WARM SEPARATOR FAILURE ANALYSIS AND RECTIFICATION

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In present geopolitical scenario, increasing complexity of refining operations due to non-availability of desired crudes and processing opportunity crude blends, the types of crudes processed by refineries varies frequently. Because of this dynamic nature of crude diets, chloride content was observed in VGOMHC unit feed in both organic and inorganic form. VGOMHC unit was originally designed with no chloride content in unit feed but due to presence of Chloride content in unit feed, there is formation of ammonium chloride in Reactor effluent circuit. This ammonium chloride salts were deposited in exchangers and connected piping at its sublimation temperature based on concentration of ammonia and chloride. This caused corrosion and higher pressure drop in the in the exchangers as well as Reactor effluent circuit. To resolve this issue, Licensor suggested to install intermediate vessels (warm separator and warm flash drum) with wash water provision with the objective to wash and remove ammonium chloride salts.

During Pre-commissioning inspection of Warm Separator, tight linear discontinuities were observed on the inside surface of north dished end and same was confirmed by MPT (Magnetic Particle Technique) inspection and UT. Defect was observed in parent metal even after all inspection and quality checks done at vendor shop. The main challenge was to ensure mechanical integrity and reliability of vessel. Hence detail assessment of vessel carried out and proper repair methodology developed in consultation with renowned detail engineering consultant. This paper summaries the reasons for the discontinuity (tight crack), methodology adopted for assessment and repair, its execution, QA/QC inspection & testing after the repair to ensure mechanical integrity. This paper also covers recommendations to prevent such kind of tight discontinuities at vendor shop and required precautionary quality checks to avoid the recurrence of the problem.

Keywords : Warm flash separator, ammonium chloride, repair methodology, QA/QC inspection & testing, mechanical integrity.

FAILURE OF A HIGHLY STRESSED DISSIMILAR AUSTENITIC STAINLESS STEEL TO NICKEL ALLOY WELD DUE TO LIQUATION CRACKING

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Nickel-based filler metal are commonly used in applications requiring dissimilar welding involving joining of Austenitic Stainless Steels, Nickel based alloys, carbon steels etc. The dissimilar welding produces a region with composition different from the base and filler metals. Near the fusion line in the base metal within this region is a partially melted zone. This zone which is characterized by grain boundary liquation can result in liquation cracking in the austenitic stainless steel.

Austenitic stainless steels (SS) undergo sensitization during exposure at temperature from 500 to 850 °C making them highly susceptible to intergrannular corrosion and stress corrosion cracking.

The study delves into the root cause of a failure encountered in a highly stressed dissimilar weld between Alloy 800HT and SS 304 material welded with Nickel filler operating at around 800 °C due to synergetic effects of liquation cracking and stress corrosion.

Keywords : Allay 800HT, Austenitic Stainless Steel, Nickel alloy, Gas Tungsten Are Welding. Dissimilar Weld, Sensitization.

CORROSION IN TOP SECTION OF MAIN FRACTIONATOR COLUMN OF DELAYED COKER UNIT – A CASE STUDY

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Internal corrosion in top section of main fractionator column of Delayed Coker Unit (DCU) was observed during a planned shut-down. Corrosion in the form of localized thinning and perforation was reported in column shell & trays particularly at Kero zone. Minor corrosion was noticed earlier which has further aggravated to unexpected level within a short period of around one year.

Coker main fractionator columns are one of the refinery's critical equipment, creating usable fractions from heavy residue oils. This fractionator column was commissioned in 1981 with as built shell carbon steel top, low alloy steel (P12) bottom metallurgy and trays of SS410s. At present, column is processing the Reduced Crude Oil (RCO) from bottom of Atmospheric Crude Column, refinery slops and Clarified Oil (CLO) from other units.

Analysis of corrosion product revealed the presence of significant level of chlorides, indicating formation of chloride salts during operation. At the column operating conditions, ammonium chloride salt formation was anticipated which has been established by further investigations. A detailed study was carried out to find the root cause of salt formation leading to severe corrosion. This case study, presents the probable reasons for the corrosion along with the mitigation measures required to eliminate the corrosion problem in main fractionator during operation. As a part of remedial measures, process operation management, corrosion control techniques and metallurgy upgradations are discussed.

Keywords : Delayed Coker Unit, Main Fractionator, Corrosion, Ammonium Chloride, Root Cause, Mitigation Measures

FAILURE OF CATALYTIC CRACKING UNIT INTER STAGE HEATER TUBES DUE TO COKING

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BPCL Mumbai Refinery is having Catalytic Cracking Regeneration Unit (CCR) which was commissioned in the year 2014. The Reaction Unit in the CCR Plant comprises of four (4) reactors where naphtha from Naphtha Hydro treating Unit (NHT) undergoes a catalytic reaction producing aromatics, as well as light hydrocarbons and hydrogen as by products. The primary product from this Unit is Reformates, which are routed to the battery limit for storage. Other products are Hydrogen-rich Gases and Fuel Gas, which are sent to other units from the CCR Plant.

The top side bend of an Arbor coil in the Furnace of CCR Plant failed during operation. Failure occurred after around 2 years of service after replacement of the heater tubes in 2020. Before the failure, 04 nos. heater tubes were observed in hot glowing condition with tube metal temperatures recorded up to 762°C for around 10 hours, whereas the maximum design temperature of tube is 655°C. Later, the temperatures were controlled by shutting off the nearby burners and the metal skin temperature were brought down up to around 670°C. However, the top side bend of one of the coil failed within 30 days since the suspected choking & hot glowing.

The material of construction of the CCR heater tube is ASTM A335 Grade P9 with OD of 101.6mm and 5.74 mm thickness. In order to find out reason of failure, failure analysis was carried out for the failed tube sample. As part of analysis, testing was done for coke sample inside tube also.

This paper deals with the detailed discussion on the CCR heater tube failure due to tube inside coking.

Keywords : Tube metal temperature.

CORROSION IN NUCLEAR INDUSTRY

CORROSION CONTROL IN THE NUCLEAR INDUSTRY

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Corrosion control in the nuclear industry is essential for the safe and reliable operation of nuclear power plants. This paper examines the critical role of material selection, identifies key corrosion mechanisms in nuclear environments, and discusses strategies employed to mitigate these effects. The focus is on the performance of materials such as Zircalloy-2, Zirconium-2.5% Niobium, and Incoloy-800 in Indian Pressurized Heavy Water Reactors (PHWRs). Additionally, the paper provides a historical overview of nuclear power development in India, from its inception under Dr. Homi J. Bhabha to the commissioning of the country's first fast-breeder test reactor at Kalpakkam. The paper also explains the functioning of the FBTR at Kalpakkam, its use of sodium as a coolant, and the methods of corrosion control in Fast Breeder Reactors (FBRs). The imperative of including corrosion control in civil structures, particularly the reactor containment, is also explored. The paper further discusses the classification of materials and items in nuclear plants into safety and non-safety categories, with an emphasis on Items Important to Nuclear Safety (ITNS). Significant corrosion challenges faced by the Indian nuclear industry, historical instances of global corrosion failures, and the advancements made in corrosion-resistant materials are highlighted.

EFFECT OF FILM FORMING AMINES ON CORROSION BEHAVIOR OF SS-321 IN SIMULATED SECONDARY SYSTEM

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SS-321 is the material for steam-generator tubes for VVERs or Russian pressurized water reactors. In secondary system, the corrosion of structural materials is minimized by maintaining alkaline pH using ethanolamine (ETA). Octadecylamine (ODA), a film-forming amine (FFA), is beneficial to augment the corrosion-control strategies. In this regard, SS-321 coupons were exposed to 0-50 ppm of ODA in ETA at 250°C for 7 days in an autoclave, in both liquid and steam phase. Specimens post exposure were characterized by contact angle, Atomic Force Microscopy (AFM), Scanning Electron Microscopy (SEM), and Electrochemical Impedance Spectroscopy (EIS). The surfaces were hydrophobic but no correlation existed as a function of ODA. Inhibition efficiencies (IE) were estimated by EIS. In liquid, no 'enhanced' inhibition was found with ODA addition. However, in steam, corrosion was inhibited for the addition of 6 to 24 ppm of ODA with maximum IE of ~ 90% observed for 18 ppm ODA.

Keywords : SS-321, Steam generator, Octadecylamine, EIS

MICROBIAL CORROSION & INHIBITORS

MITIGATION OF CORROSION USING GREEN INHIBITORS THROUGH MODERN ELECTROCHEMICAL METHODS

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In the context of sustainable development and environmental protection, the field of corrosion science faces the challenge of reducing the environmental impact of corrosion inhibitors traditionally used in industries. This keynote lecture will explore the advancements and potential of green corrosion inhibitors, which are derived from natural, non-toxic, and eco-friendly materials. The discussion will cover the fundamental principles behind the selection and effectiveness of green inhibitors, focusing on their mechanism of action, advantages over conventional inhibitors, and the role of phytochemicals and biopolymers in corrosion protection. Recent research findings, case studies, and real-world applications in industries such as oil and gas, water treatment, and construction will be highlighted. The lecture will also address the challenges in scaling up and commercializing green inhibitors, and future directions in this rapidly evolving field. Emphasizing the critical role of interdisciplinary collaboration, this presentation aims to inspire further research and innovation towards developing sustainable solutions for corrosion control, contributing to the broader goal of environmental stewardship and industrial efficiency.

As the demand for sustainable industrial practices grows, the development of green corrosion inhibitors has become a critical focus in corrosion science. This keynote lecture will delve into the application of modern electrochemical methods for the evaluation and optimization of green corrosion inhibitors. The presentation will explore how techniques such as electrochemical impedance spectroscopy (EIS), potentiodynamic polarization, and electrochemical frequency modulation (EFM), EFMT, analysis are being utilized to investigate the effectiveness, mechanisms, and durability of eco-friendly inhibitors derived from natural and renewable sources. By examining the electrochemical behavior of these green inhibitors in various corrosive environments, the lecture will highlight their performance in real-world applications, such as in the oil and gas, marine, and construction industries. Additionally, the discussion will address the integration of computational electrochemical models to predict inhibitor efficiency and guide the design of next-generation green inhibitors. Through case studies and recent research findings, the lecture will showcase the synergy between modern electrochemical methods and green chemistry in advancing sustainable corrosion control solutions. This presentation aims to provide insights into the future of corrosion protection, emphasizing the role of innovation in achieving both environmental sustainability and industrial resilience.

Keywords : Corrosion, inhibitor, impedance, polarization, EFM, computational chemistry.

CAPSICUM CHINENSE JACQ. FRUIT EXTRACT AS ECO-FRIENDLY CORROSION INHIBITOR FOR MILD STEEL IN 15% HCL SOLUTION

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The indigenous capsicum type found in northeastern India is known as Capsicum chinense Jacq. “Bhut Jolokia” is renowned for having the world's hottest chili. Finding an environmentally acceptable, renewable, and long-lasting anti-corrosive inhibitor is the main objective of this research. On a 15% HCl solution of mild steel, an anticorrosion analysis using 1500 rpm was conducted on Capsicum chinense fruit extract (CCFE). Research on metal corrosion and prevention has long been a popular topic. Inhibitors of corrosion play a major role in protecting metal against corrosion. Capsicum chinense fruit extract (CCFE) was obtained for this study using an extraction technique. An examination was conducted on the mild steel extract's anti-corrosive properties. The aqueous solutions of capsicum extract demonstrate excellent corrosion inhibition in 15% HCl solution, according to weight loss measurements, electrochemical tests, surface morphology, theoretical calculations, and SEM examination. Hence, it exhibits promise as a low-cost, environmentally acceptable mild steel corrosion preventive property of CCFE on mild steel surfaces was discovered.

Keywords : Capsicum chinense Jacq., Bhut jolokia, Corrosion inhibitor, Mild steel.

INFLUENCE OF SENSODYNE MOUTHWASH ON THE CORROSION BEHAVIOUR OF THERMO-ACTIVE ORTHODONTIC WIRE IMMERSED IN ARTIFICIAL SALIVA

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Well-aligned teeth are considered aesthetically pleasing, however, some individuals naturally have irregular teeth alignment. In order to correct this, Dentists utilize Orthodontic wires. Following the application of Orthodontic wires, individuals consume various food items, beverages, and tablets orally. These food items have the potential to damage the orthodontic wires. In addition to this, the wire experiences corrosion when exposed to saliva. The current study assessed the corrosion resistance of Orthodontic wires composed of Thermo-active alloy in artificial saliva with and without the addition of Sensodyne mouthwash, through electrochemical analysis including Polarization study The corrosion characteristics of the Thermo-active alloy were evaluated for the subsequent systems.

- Artificial Saliva.

- Artificial Saliva + Sensodyne mouthwash.

The experiment involved measuring the Linear Polarization Resistance (LPR), and corrosion current values.The research results in the subsequent findings. The order of decreasing Corrosion resistance in Thermo-active Orthodontic wire is as follows.

- Artificial Saliva > Artificial Saliva + Sensodyne mouthwash

It implies that individuals wearing Thermo-active Orthodontic wire should avoid making use of Sensodyne mouthwash.

Keywords *: Corrosion resistance, Orthodontic wire, Thermo-active, Artificial Saliva, Sensodyne mouthwash.*

INVESTIGATION OF BIOMASS-MEDIATED SYNTHESIS OF NANOPARTICLES AS EFFICIENT CORROSION INHIBITORS

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Several methods have been used to create nanoparticles, but green synthesis has gained more importance because it produces no harmful byproducts. Although plant components have been used to develop green synthesis, the latest trend is using extracts from agri-food waste or sustainable green synthesis. Utilizing agri-food waste increases its added value while lowering pollution levels in the environment. Fruits and vegetables, cereal, bagasse from the food business, alcoholic drinks, and oil cake from the oil industry are among the agricultural crops and industries that produce the majority of trash. The primary biomolecules found in agri-food waste extracts include proteins, cellulose, hemicellulose, terpenes, alkaloids, and phenolic substances. NAGA-Garlic Peel was investigated as a mild steel corrosion inhibitor in 1M H2SO4 solution. The evaluation of corrosion inhibition was done using a weight loss study. 88% inhibition efficiency was observed at 7mL of NGPE inhibitor in 1M H2SO4 solution. Langmuir adsorption isotherm yielded a surface coverage value of 0.99113.

Keywords : Nanoparticles, Agri-food waste, NAGA-Garlic Peel, corrosion inhibitor.

ENVIRONMENTALLY BENIGN CORROSION INHIBITORS FOR MILD STEEL IN ACIDIC CONDITIONS

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The adoption of plant-based inhibitors is gaining traction as a sustainable and non-toxic alternative to traditional inorganic inhibitors, reflecting a shift towards eco-friendly approaches to corrosion prevention. The fruit extract of Solanum myriacanthum as green corrosion inhibition of mild steel in sulfuric acid solution was studied using weight loss, electrochemical impedance spectroscopy, linear polarization, and potentiodynamic polarization techniques. The inhibition was found to increase with increasing concentration of the extract. The effect of temperature, immersion time, and acid concentration on the corrosion behavior of mild steel in 0.5 M of H2SO4 with adding the extract was also studied. The corrosion inhibition efficiency was calculated.

Keywords : corrosion, Corrosion inhibitor, Solanum myriacanthum.

MICROBIAL INFLUENCED CORROSION (MIC) FOR A WATER INJECTION PLANT IN SOUR OIL PRODUCTION FIELD

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Various types of biocides were identified for use during commissioning of a water injection plant for the purpose of injection in a sour oilfield in Kuwait, a few years ago. The current biocide regime for the injection system has proven to be effective, as very low microbial growth (MPNs) was observed. High microbial numbers were, however, established for the produced water samples. The overall risk assessment from the

provided MPN and qPCR data suggests that the potential for MIC and biofouling is low at the injector and moderate at the producer. Overall, iron reducers and sulfate reducers (IRB and SRB) are the microorganisms found to be present in relatively high numbers. Regular monitoring is recommended to ensure that any increase in these bacterial numbers is promptly detected. Optimisation of the current biocide treatment is recommended to deal with the MIC risk for the producer and to control the relatively high numbers of detrimental IRS and SRB microbes. From the laboratory work on MPN and qPCR, the data suggests that the potential microbial risk is low at the injector and moderate at the producer. This means the overall MIC and biofouling risk is greatest at the producer.

Keywords : Microbial numbers, iron reducing bacteria, microbial growth, bacteria monitoring.

CORROSION RESISTANCE OF EVER SILVER VESSEL IN BUTTERMILK IN THE ABSENCE AND PRESENCE OF SODIUM CHLORIDE

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Office goers and students take buttermilk in ever silver tiffin carriers. It is interesting to study the corrosion resistance of ever silver in buttermilk in the absence and presence of sodium chloride salt, because invariably sodium chloride is added to buttermilk. Corrosion resistance has been evaluated by electrochemical studies such as polarization study and AC impedance spectra. Linear polarization resistance, corrosion current, charge transfer resistance and double layer capacitance have been evaluated. It is inferred that when 500 ppm of sodium chloride is added to 100 ml of buttermilk, the corrosion resistance of ever silver increases. This implies that people need not hesitate to add sodium chloride to buttermilk preserved in ever silver tiffin carriers. It seems that a protective film is formed on the metal surface. The surface morphology has been analyzed by AFM and SEM.

Keywords : corrosion behaviour, ever silver vessel, polarization study, AC impedance spectra, AFM, SEM.

EFFECT OF METALLURGY ON THIOUREA PERFORMANCE – COMPUTATIONAL INSIGHT

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Corrosion inhibitors are widely used across various industries to enhance metal life. The inhibitors usually tested for a particular metallurgy do not always perform equally on other metallurgies. Steel is the work horse in many industries, but its composition varies with industry as well as time and location due to replacements, maintenance etc. in the same plant or process. This causes difference in inhibitor performance, which we have captured in laboratory experiments with thiourea. Generally, the experimental evaluation of molecules, consume valuable resources such as, time, effort and materials. Here, we have modelled the system computationally, which is inexpensive, fast and also scientifically insightful, to assess thiourea adsorption on iron surfaces representing 2 compositions, with various conformations at top and bridge sites, using density functional theory (DFT). The calculations predict the effectiveness of the inhibitor on two compositions successfully, paving the way for computational assessment of inhibitors on various compositions.

Keywords : Computational modeling, metallurgy effects, inhibitors.

A COMBINATION OF CHEMICAL, MICROBIOLOGICAL AND MORPHOLOGICAL ANALYSES CAN RELIABLY IDENTIFY MIC RELATED FAILURES

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It is estimated that about 40% of corrosion failures in the global Oil and Gas industry can be attributed to MIC (Microbiologically Influenced Corrosion). However, the accurate identification of MIC failures requires the combined and judicious use of chemical and microbiological analyses of corrosion products and fluids as well as morphological characterization of the corrosion damage. The presence of sulfides in the corrosion products and/or fluids indicates the possible presence of SRB (sulfate reducing bacteria) activity in the corrosion process which can then be confirmed by microbiological analysis. MIC attack is localized in nature and is often characterized by unique morphological features. Thus, corrosion damage showing pits within pits or terraces within the pit surface is associated with SRB influenced corrosion. The occurrence of striations on the corroded surface is indicative of the involvement of APB (acid producing bacteria) in the corrosion process.

This paper will highlight what chemical and microbiological analytical techniques are typically used in investigating suspected MIC failures as well as provide photographic examples of MIC morphology.

Keywords : Corrosion failures, Microbiologically Influenced Corrosion (MIC),Corrosion Morphology.

EFFICIENT MANAGEMENT OF INJECTION WATER TREATMENT AND RISK ASSESSMENT

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The ever-growing demand for crude oil has encouraged petroleum producers to employ techniques for enhanced oil recovery (EOR), one of the most prevalent is the cyclic steam injection. Kuwait is a water-stressed country, here the highly saline tertiary treated reverse osmosis (RO) reject is being used to meet the huge water demands for steam generation. It has been realized that even the treated water is not free from contaminants and has solid particles, carbonaceous elements, scale-forming sulfates, and microbes, which are introduced into the oil facilities during the EOR process. A risk assessment of water quality is, therefore, a priority for the efficient management of injection water treatment. The molecular monitoring tools have been the state-of-the-art approaches for the organic loading in the water systems. For molecular monitoring quantitative polymerase chain reaction (qPCR) and next-generation sequencing (NGS) is very promising. Among the NGS, Oxford nanopore sequencing (ONS) is gaining immense popularity for its speed, accuracy and industry-applicable workflow. These innovative tools of monitoring call for application at the industrial level to meet the challenges of asset management. In the present communication, we report the bacterial communities present in two sites from a water injection plant. Water samples from the site were used for DNA isolation and sequenced on a MiniION MK1C instrument. This is one of the early steps in the application of ONS in microbial monitoring. The findings provide an overview of the bacterial communities prevailing in the injection waters.

Keywords : DNA sequencing, Oxford Nanopore, sea-water, effluent, organic loading.

WATER-SOLUBLE Co-MOF ADSORPTION KINETIC STUDIES ON MILD STEEL - X65 CORROSION INHIBITION

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This research investigates into the adsorption kinetics of a water-soluble cobalt-based Metal-Organic Framework (MOF) on Mild steel (X65) surfaces within a CO2-purged 3.5. wt.% NaCl environment, with a primary focus on corrosion inhibition in both static and flow conditions. The investigation employs a combination of experimental techniques, including surface analysis methods such as X-ray photoelectron spectroscopy (XPS) and scanning electron microscopy (SEM), to characterize the evolving interfacial interactions. The static adsorption experiments elucidate the temporal evolution of the cobalt MOF layer on the mild steel surface, providing insights into the molecular-level adsorption kinetics. In dynamic flow experiments, the research simulates realistic conditions to assess the stability and effectiveness of the adsorbed cobalt MOF under continuous exposure. Electrochemical impedance spectroscopy (EIS) and Potentiodynamic polarization techniques are employed to monitor corrosion processes and evaluate the protective performance of the adsorbed layer. The impact of CO2 on the adsorption kinetics and subsequent corrosion inhibition is rigorously examined, shedding light on the synergistic effects of the cobalt MOF and CO2 on the protective film formation.

Keywords : Water Soluble MOF, CO2 Purged Environment, Adsorption kinetics, Corrosion Inhibition.

MICROBIALLY INDUCED CORROSION OF X65 PIPELINE MATERIAL INDUCED BY A FACULTATIVE SULPHATE REDUCING BACTERIA

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Microbially induced corrosion (MIC) poses a significant threat to the oil and gas industry as it provides favorable conditions for the proliferation of corrosion-inducing microorganisms, leading to pitting corrosion in primary containment systems. The study investigates the corrosion properties of marine grade pipeline material API 5LX 65 when exposed to Enterobacter fruendii bacteria. Enterobacter fruendii is a facultative anaerobic bacterium, which can survive and grow under both aerobic and anaerobic conditions. Depending on the availability of oxygen these microorganisms switch their mechanism of metabolism from aerobic respiration to anaerobic respiration or fermentation. In the presence of oxygen, they utilize atmospheric oxygen as the terminal electron acceptor during respiration. While in anaerobic conditions they utilize various substrates like nitrate (NO3-), nitrite (NO2-), Sulfate (SO4-) etc. as the terminal electron acceptor. In this study, it is demonstrated that Enterobacter fruendii has the ability to reduce sulfate under anaerobic conditions. The current study deals with a 14-day immersion test under both abiotic and biotic conditions. Various techniques such as potentiodynamic polarization, scanning electron microscopy and energy dispersive X-ray spectroscopy are used to analyze the corrosion characteristics of X65 carbon steel.

Keywords : Microbially Induced Corrosion, Pitting Corrosion, Enterobacter Fruendii, X65.

SARCANDRA GLABRA LEAVES EXTRACTAS A POTENTIAL GREEN INHIBITOR IN PREVENTION OF CORROSION OF MILD STEEL IN 1 M HCL SOLUTION

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Corrosion inhibition effect of Sarcandra glabra plant extract on mild steel was studied in 1M HCl solution using the weight loss method, potentiodynamic polarization, and electrochemical impedance spectroscopy. The maximum inhibitor efficiency was recorded to be 94.73% at 10 mL with minimum being 64.42% at 2 mL at 298 K. The findings from all studies indicate that the extract of Sarcandra glabra leaves has the potential to inhibit corrosion of mild steel in acidic environments.

Keywords : Sarcandra glabra, corrosion inhibitor, HCl, plant extract.

CORROSION AND ITS MITIGATION IN RENEWABLE ENERGY SECTOR

MOVING AHEAD FROM E10 TO E20 : CHALLENGES AND WAY FORWARD

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Ethanol is a clean and sustainable energy option that holds great promise in addressing the growing demand for alternative fuels. In India, the government's goal to shift from 10% ethanol-blended gasoline (E10) to 20% (E20) by 2025 offers significant benefits, including reduced reliance on non-renewable resources, improved engine efficiency, lower emissions, and cost savings. Given India's strong agricultural base in crops like corn and sugarcane, ethanol production is feasible and can drive economic growth. However, the increased ethanol concentration presents corrosion challenges. Ethanol absorbs moisture easily, which can lead to both general and localized corrosion, as well as phase separation and stress corrosion cracking (SCC). Additionally, ethanol's oxidation into acids in the presence of dissolved oxygen further raises the risk of material degradation. Addressing these issues is crucial for the safe storage, blending, and transportation of ethanol-blended fuels. HPCL Green R&D Centre (HPGRDC) has developed innovative corrosion inhibitors that effectively prevent these problems in E20 blends. These inhibitors, rigorously tested against international standards, maintain gasoline properties while ensuring corrosion resistance and phase stability, enabling safer and more efficient fuel distribution.

Keywords : Ethanol-blended gasoline, Stress corrosion cracking, corrosion inhibitor, E20 blends.

HYDROGEN READY THREAD SEALANTS TO PREVENT CORROSION & LEAKAGES

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Corrosion in threaded fittings within oil and gas plants presents significant operational challenges, particularly in high-pressure environments. The exposure of these fittings to harsh chemicals, moisture, and hydrogen sulfide (H_2S) accelerates corrosion, leading to potential leaks, equipment failures, and safety hazards. Preventing corrosion in threaded fittings is essential to maintaining plant reliability, safety, and cost efficiency. Corrosion weakens threaded fittings, leading to potential leaks. In oil and gas plants, leaks can result in the release of hazardous fluids, gases, or chemicals, posing significant safety and environmental risks. Corroded fittings require frequent maintenance, repair, or replacement, which leads to increased operational downtime and higher maintenance expenses. Corrosion accelerates the deterioration of fittings, reducing their service life and the overall longevity of piping systems, resulting in premature equipment failure. Regular inspections, protective coatings, and corrosion-resistant materials are vital strategies for mitigating these impacts. Additionally, the transition to hydrogen-based applications necessitates the use of hydrogen-compatible sealants to prevent permeation and degradation. Advanced research into elastomer-based sealants and metallic coatings for hydrogen environments offers a promising way forward in ensuring the durability of threaded fittings in the oil and gas sector.

In an era marked by a growing emphasis on sustainability and the pursuit of clean energy alternatives, green hydrogen emerges as a particularly compelling solution. Yet, throughout its entire lifecycle, spanning production to distribution, the imperative to minimize or eradicate leaks looms large, presenting both economic burdens and potential safety hazards. This paper addressing the challenges posed by the minute size of hydrogen molecules, making connections while maintaining a seal becomes a formidable task. Threaded connections are often avoided in hydrogen related equipment. Instead, engineers often resort to costly assembly processes, such as seal welding or the adoption of more expensive connection methods. This study highlights the efficacy of anaerobic thread sealants and thread sealing cord as outstanding solutions (ASTM D6396) for effectively preventing leaks in threaded joints, offering a pivotal contribution to the seamless integration of green hydrogen in our pursuit of sustainable energy solutions.

Finally, this study concludes that for commissioning of future energy ready green Hydrogen hub this proposed method will ensure to build a safer & reliable processing plant.?

Keywords : corrosion, leakage, green Hydrogen, safety, maintenance, oil & gas, sealant, embrittlement, pressure, reliability)

COMPREHENSIVE CORROSION MANAGEMENT IN RENEWABLE ENERGY GENERATION BY OFFSHORE WIND FARMS : FROM REAL-TIME MONITORING TO PREDICTIVE MAINTENANCE

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To meet the growing power demand, it is essential to explore options such as installing offshore wind power plants to harness the abundant wind energy available over the sea, especially in country such as India where power demands is continuously rising. Additionally, offshore wind farms do not require land clearances, making them a more visually appealing and environmentally acceptable mode of energy production compared to traditional onshore wind power plants. The rapid expansion of offshore wind power generation in renewable energy sector has caused many significant challenges in maintaining the structural integrity of wind turbine foundations due to the harsh marine environment. Corrosion, particularly in the monopile foundations, poses a severe threat to the long life and safety of these structures. This paper reviews the literature on the state-of-the-art corrosion monitoring and analytical techniques designed for offshore wind turbine foundations. This paper further discusses the various mechanisms of corrosion that impact both the external and internal components of offshore structures, including the transition from traditional time-based maintenance strategies to more advanced predictive modelling & maintenance approaches. Literature review focusses on techniques that are available for real-time monitoring systems, such as ultrasonic sensors and electrical resistance probes, which provide critical data for assessing the condition of submerged structures and forecasting potential failures. The findings in this paper highlight the importance of implementing a comprehensive, data-driven approach to corrosion management in offshore wind farms, ensuring both the economic viability and operational reliability of these renewable energy assets.

Keywords : Corrosion management, offshore wind turbines, cathodic protection, sacrificial anodes, impressed current cathodic protection (ICCP), splash zone corrosion, predictive maintenance, real-time monitoring, protective coatings, monopile foundations, transition pieces, marine corrosion, corrosion prognostics, maintenance-free service life, wind turbine structures, environmental impact.

CORROSION IN ELECTROCATALYSTS OF FUEL CELLS : MITIGATING BY 2D MATERIALS

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The transition to sustainable and renewable energy sources has become imperative in the rapidly changing world of today. Motivated by the urgent need to battle against climate change and to lower the dependency on fossil fuels, fuel cells, with their high efficiency and low emissions, have emerged as a viable technology for achieving a clean energy conversion. However, the durability and lifetime of these systems are hindered by various degradation mechanisms, notably corrosion of the catalyst support materials. Platinum (Pt) supported on carbon (C) is commonly used to facilitate electrochemical reactions. However, despite their effectiveness, Pt/C catalysts are prone to corrosion under harsh conditions, leading to oxidation of the carbon support, a reduction in active surface area, and a subsequent decline in overall fuel cell performance. The current work tackles this issue by incorporating MXenes as an alternative support material alongside the catalyst. MXenes are a class of 2D layered materials that offer excellent conductivity, mechanical strength, and corrosion resistance. To enhance their active sites and interlayer spacing, FAB is intercalated into the MXene matrix. Thus, MXene with FAB and Pt nanoparticles can further enhance and provide robust protection against oxidation. The electrochemical surface area (ECSA) appears to be three-fold higher than commercial Pt/C catalysts. Utilizing Ti3C2Tx as catalyst support enables the development of more efficient, durable, and cost-effective catalysts for fuel cells.

Key Words : Sustainable, Renewable Energy, Fuel Cells, Corrosion, MXene.

ENVIRONMENTAL CORROSION AND ITS MITIGATION IN BUSBAR CONDUCTORS OF SOLAR POWER PLANTS : A MULTIPHYSICS SIMULATION STUDY

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The increasing demand for power has shifted the focus towards renewable and clean energy sources, with solar power emerging as one of the cleanest forms of energy generation. As the dependence on renewable energy increases, it becomes essential to address silent threats that could undermine the operation of power plants. Among these, environmental corrosion poses a significant concern for solar power plants. This study emphasizes the need for reliable performance of critical components, such as busbar metallic conductors, which are crucial for high-current power distribution. Typically made of copper and aluminum, these conductors are particularly susceptible to atmospheric corrosion, especially in humid and coastal environments where many solar installations are located. Using advanced multiphysics simulation software [9], this research models the complex interactions between environmental factors and the electrochemical behavior of busbar conductors under varying conditions. The simulations specifically account for variables such as relative humidity to predict corrosion impacts and identify critical stress points within busbar assemblies. Additionally, the study reviews literature on the effectiveness of protective coatings and evaluates the impact of design modifications in mitigating corrosion due to environmental conditions. The findings, supported by experimental data, provide valuable insights to optimizing material selection and corrosion protection strategies, ultimately enhancing the durability and efficiency of renewable power infrastructure.

Keywords : Corrosion, Electric potential, Galvanic corrosion, Solar power plants, Busbars, Relative humidity, Earthing systems, Electrolytic layer, High-current distribution, Bonding resistance, Fire hazards, Arcing, Multiphysics simulation, Electrical substations, Current-carrying capacity.

CORROSION CONTROL IN WATER TREATMENT UTILITIES

CREVICE CORROSION IN COOLING WATER PLATE HEAT EXCHANGERS

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In process industries, heat exchanging (one fluid heats or cools another) is one of the major process requirements. This is normally/mainly done in 3 ways exchanging the heat between

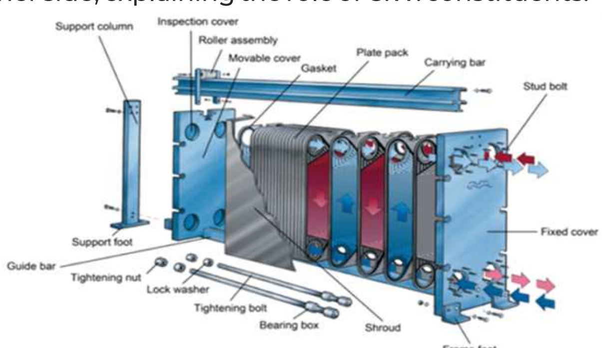
- Two process fluids,
- Process fluid and utilities like Steam/Cooling Water (C.W.)/DM Water/Air/Gas
- Between two utilities.

Many types of heat exchanging configurations are available like Shell and Tube (S&T) type, Plate Heat Exchanger (PHE) type, Spiral type. In this paper, problems related to PHEs are covered.

PHE is an assembly of plates and sealing between them is by the gasket. Different parts of the PHE is shown in the following picture.

PHEs have inherently large crevices between the plate to plate and plate to elastomer gaskets.

This paper deals with how stainless steel PHEs get corroded with special reference to Crevice attack. A case study is presented herewith for three SS type 316L PHEs having C.W. on one side and steam or D.M. Water on the other side, explaining the role of C.W. constituents.



Keywords : Corrosion of Plate Heat Exchangers, C.W. corrosion, Corrosion of Stainless steels in C.W. Crevice Corrosion.

CORROSION IN PIPELINE DUCTILE IRON PIPE A LIFELINE FOR SUSTAINABLE WATER MANAGEMENT

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Water is essential for life, and access to clean, potable water is a fundamental human need. Without it, survival on Earth is impossible. Unfortunately, over 1 billion people worldwide lack access to safe drinking water, and over 2 million people, mostly children, die annually from waterborne diseases. Ensuring the delivery of high-quality water in the right quantity, at the right place, and at the right time is crucial for human health. Ductile iron (DI) pipes provide a long service life of up to 100 years, making them an ideal choice of material for water pipelines infrastructure. These DI pipes offer several advantages, including superior resistance to breakage from impact, excellent tensile and yield strength, high ductility, traditional corrosion resistance, and easy installation through socket-spigot or push-on joint systems, ensuring leak-proof connections.

Ductile (DI) iron pipes are designed with internal protection systems, including cement mortar lining, to maintain the potability of drinking water. Externally, they are protected with a primary coating of metallic zinc or Zinc-Aluminium alloy to prevent galvanic corrosion of the metallic pipe surfaces. Additionally, a finishing coat of bituminous coating or synthetic epoxy paint is applied over the metallic layer to ensure further protect against external soil erosion and corrosion. Specialty coatings such as Polyurethane (PU) are also available to provide enhanced protection against environmental degradation.

Keywords : Ductile iron pipes, Corrosion resistance, Water management, Sustainable infrastructure, Pipeline protection.

CORROSION CONTROL WATER TREATMENT WITH THE HELP OF A RING

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Effectiveness of the Ring in Mitigating Corrosion in Industrial Water Systems: A Sustainable Approach To Corrosion Control This study examined the effectiveness of the Ring, made from specially treated aluminum, in mitigating corrosion, scaling, fouling, algae, and bacteria in industrial water systems. By transmitting active oscillations to the water, the ring enhances the solubility of substances, gradually removing existing deposits and preventing new ones from forming.

In a case study in Malaysia, a 4" ring was installed in the feed line of a steam boiler. Prior to the installation, water quality issues required heavy chemical treatment to combat corrosion and scaling. Following ring installation, chemical dosages were reduced by 15-55%, resulting in significant cost savings. Corrosion and limescale buildup in the boiler were visibly reduced, and annual cleaning became easier due to the soft texture of the remaining deposits. These results suggest that the ring offers an eco-friendly, cost-effective alternative to traditional chemical treatments for water systems.

Keywords : Ring, Corrosion & limescale buildup, Cost-effective, Eco-friendly, Chemical treatments.

CASE STUDY ON ROOF TUBE FAILURE IN BOILER (CPP)

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This paper provides an in-depth analysis of the recurring failures of combustion chamber roof tubes in the CPP boiler at CPCL. The investigation focused on identifying the root causes and damage mechanisms behind the failure.

The analysis involved visual inspections, macro and microstructural evaluations, Energy Dispersive Spectroscopy, a thorough review of operating data and utility systems, and chemical analyses of both the failed tube and the process fluid. Additionally, the investigation highlighted that higher copper content in the return condensate, particularly from the surface condenser played a significant role in initiating corrosion.

The study concluded that the roof tube failures were caused by a combination of overheating and corrosion which is caused by the presence of contaminants. The findings provide valuable insights into failure analysis in the oil and gas industry, contributing to our understanding of damage mechanisms affecting fixed equipment and facilitating preventive measures to enhance equipment reliability and safety.

Keywords : Overheating, Surface condenser, Acidic corrosion, Copper.

COATINGS LININGS & THERMAL INSULATION

SUPERHYDROPHOBIC COATING: BENEFITS, CHALLENGES AND INDUSTRIAL APPLICABILITY

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Superhydrophobic coatings have gained some interests in the oil and gas industry in the last decade based on their unique properties. Despite various attractive claims made by the manufacturer of such coatings, there are very limited case histories available in open literature on applications of such products in any oil and gas asset. While numerous publications are found presenting the research and developmental stages of such coatings, not many commercial products suitable for oil and gas field applications, especially in the upstream assets, are available in the market. Inhibitive cost and unclear benefits over the conventional coating products are the two main reasons of having only few oil and gas assets using such products in the recent past. This paper presents the potential benefits and the limitations of such coatings as well as the findings of a lab study evaluating the properties of one of such coating products claimed to be superhydrophobic.

Keywords : Superhydrophobic coating, cyclic ageing test, Offshore top-side.

NEW GENERATION ACTIVATED ZINC RICH EPOXY PRIMER AS AN ALTERNATIVE TO THE TRADITIONAL INORGANIC ZINC SILICATES

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It is very commonly stated in the field of corrosion protection that Zinc Silicates offer superior corrosion protection than conventional zinc rich epoxies. We very often observe that even now specifications call for Inorganic Zinc Silicate primer as a galvanic protection in a 3-coat protective coating system especially for new construction. Several utilities continue to use the same specification in their maintenance as well, resulting in unnecessary project delays due to long overcoat intervals caused by slow curing especially in low humidity conditions. In addition, zinc silicates commonly give rise to application problems such as mud cracking, alligatoring, blistering of top coats, etc.

When compared to Zinc Silicates the most common reason attributed for the lower performance of conventional epoxy zinc rich coatings is that the zinc in the epoxy gets encapsulated with epoxy binder which is an insulator and the primer behaves like a barrier coating sacrificing the all-important properties of zinc metal.The is no electrical conductivity between Zinc particles and only about 20 – 30 microns of the primer layer near the steel surfaces is active and utilized in the corrosion protection mechanism.

This paper aims to compare the productivity, ease of application, overcoat interval, and anti-corrosive properties of the activated zinc-rich epoxy primers against inorganic zinc-rich primers. Details of the test results from different corrosion tests such as ISO 12944-6, Salt Spray Test according to ISO 9227, NACE Cracking Test TM0304 will be discussed and compared with inorganic zinc-rich primers.

Key words : Zinc Silicates, Activated Zinc, Corrosion Protection, Sacrificial Coatings.

INSULATION - THE COATING APPROACH

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Advancements at industrial processes demands the challenging solutions to address the complex problems... thermal insulations is one of those important challenges in current era of industrial development in India. The limitations of the currently used conventional thermal insulation technologies have provoked the researchers to develop the sustainable and efficient alternates.

The current presentation focuses advanced thermal insulation coating systems which are easy to install, having sustainability advantages over the prevalent alternates and high in efficiency. These coatings have high durability and are available as water borne system with lower VOCs and toxicity. Being coatings the application is easy over the complex geometries like valves, joints etc. ensuring the monolithic covering over entire surface, this helps achieve the full proof insulation with best performance.

The advancements in material science provides great opportunity and flexibility to choose the best efficiency composition, thus addresses the unsolved issues like water condensation, hot / cold burns, corrosion under insulation etc for safe and improved working environment at industries.

Key words : Anti-condensation, Thermal insulation, Coatings, sustainability, energy saving.

EVALUATION OF THE INFLUENCE OF THE SURFACE PREPARATION OF THE BASE METAL BEFORE COATING ON THE UNDER-FILM CORROSION

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Steel structures such as overhead transmission towers are generally hot-dip galvanized or coated. After construction, hot-dip galvanized overhead transmission towers are coated with an corrosion-proof coating before the hot-dip galvanizing corrodes and disappears in the atmospheric environment. Before applying the corrosion-proof coating, surface preparation (preparation or cleaning) is performed to remove corrosion products, sea salt, and other contaminants on the surface of the member. If the coating is applied without sufficient surface preparation, under-film corrosion may occur at an early stage.

Since 1994, TEPCO have been using fluorocarbon polymer-based paint with excellent weather resistance as the top coating, but their long-term performance capability has not been clarified. Coating specimens were made from hot-dip galvanized steel plates that had applied a surface preparation on the actual member and polished steel plates. Accelerated degradation tests were conducted on the specimens using a metal halide lamp as a light source, and cross-sectional observations were conducted. This paper reports the results of an evaluation of the long-term performance of paint system on different base metals, as well as the results of an evaluation of the difference in the increasing tendency of under-film corrosion due to surface preparation.

Keywords : Overhead transmission towers, corrosion-proof coating, under-film corrosion.

TROUBLESHOOTING OF CORROSION IN ACID SERVICE ION EXCHANGE VESSELS USING SPECIALIZED CHEMICAL COATINGS

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This research describes about the problems faced in “Maintenance of acid and alkali service Ion exchange vessels with reference to water demineralization plant, also known as a DM plant. The DM plant chain mainly comprising of Strong Acid cation exchanger, Degasser Tower, Strong Base Anion exchanger, Mixed bed unit which are normally rubber lined. These exchangers/vessels were frequently getting damaged due to damages in rubber lining and resultant accelerated corrosion. The cost of repair and maintenance and unit interruptions are high in long term which is not desirable. This paper compares the usage of chemical coating vis a vis rubber lining in the DM plant ion exchangers and the results obtained in terms of reliability of plant and maintenance cost in long run.

Keywords : Strong Acid cation/anion exchanger, Rubber lining, chemical coating.

INTERNAL PIPE COATING WITH INNOVATION IN APPLICATION METHODS

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Corrosion in case of pipeline has been universal challenges, which has been constantly worked upon by various Corrosion Engineers to mitigate this Challenge.

In any industry not only oil & gas industry but also other Core industries like Steel, Power, Cement plants, all have huge network of Pipelines for the transportation of various fluids like water, oil, gas, chemicals.

Internal pipe line coating has been widely done in all major Pipes of larger diameter ie above 700 mm with relative ease, however a pipe diameter reduces to below 500 mm, It becomes critical, which needs to be effectively addressed to protect valuable assets.

In this paper we shall be addressing the technical aspects involved in the coating of small/ large diameter pipes using innovative application technique so that we are not only completing the project fast at the same time providing excellent service in addition to takingof environment.

This paper also provides cost-effective, long-lasting solution so that internal pipe corrosion in Small/ large diameter pipes so that financial losses are prevented.

Keywords : About four key words or phrases separated by commas, with only the first index term capitalized, should be included.

WATER BORNE COATING TECHNOLOGY FOR PROTECTIVE COATING APPLICATION

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Steel is crucial to the protective coating industry but is prone to corrosion, posing risks to structures and living beings. Waterborne protective coatings, using advanced technology, offer effective corrosion protection while being more environmentally friendly than traditional solvent-based coatings. These systems comply with ISO 12944-2018 standards and meet the growing demand for eco-friendly solutions in industrial applications. The waterborne coating system, consisting of an epoxy primer, epoxy MIO intermediate, and polyurethane topcoat, provides long-term protection in harsh environments, with excellent corrosion resistance, adhesion, flexibility, and QUV resistance.

This paper explores the system's development, application, and potential use across industries like PEB structures, oil & gas, and infrastructure projects.

Keywords : Water borne, Corrosion, Steel substrate, Sustainability.

MARINE CORROSION

SELECTION OF CORROSION & CRACKING RESISTANT METALLURGY FOR DOWNHOLE EQUIPMENT AND WELL FLUID PIPELINE OF OFFSHORE OIL & GAS FIELD

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In a challenging oil and gas field located in the western offshore region of India, four wells were planned for drilling, with their production to be transported via a new pipeline from a recently commissioned wellhead platform. This study focused on determining the appropriate metallurgy for downhole equipment—specifically casing, tubing, and liner—as well as the new pipeline. The goal was to select materials resistant to corrosion and cracking, ensuring a design life of 15 years while remaining economically viable.

At bottom hole conditions, the partial pressures of carbon dioxide (CO2) and Hydrogen Sulfide (H2S) were measured at 130 psi and 50 psi, respectively, while for the pipeline, these pressures were 50 psi and 19 psi. The CO2 corrosion severity is elevated, given that the partial pressure of CO2 exceeds 30 psi. According to NACE MR0175, the downhole environment falls under Sour Severity Zone -3, whereas the pipeline environment falls under Sour Severity Zone -2. The observed corrosion rate was 42.6 mpy for downhole conditions, which is high and 20 mpy for pipeline conditions, which is also elevated. Additionally, the pipeline flow pattern was found to be segregated, leading to a water-wet environment susceptible to under deposit corrosion and microbial induced corrosion (MIC).

Based on the findings of corrosion severity, temperature and H2S partial pressure, Alloy 28 or Alloy 926 were recommended which are Corrosion Resistant Alloys (CRA) for casing and liner, while carbon steel material with grade API 5CT L-80 Type 1 (high ppf) was recommended for Tubing. For pipeline, API 5L X60 Carbon Steel complying to NACE MR0175 was recommended along with suitable corrosion mitigation strategies. The paper provides detailed insights into the selected materials and proposed mitigation measures.

Keywords : Cracking, Casing, Liner, Corrosion Resistant Alloy.

FPSO / FIXED OFFSHORE PLATFORM PIPE SUPPORT CORROSION - CAUSES AND MITIGATION IN DESIGN

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FPSO (Floating, Production, Storage & Offloading) Units and Fixed Offshore Platform piping are subject to severe corrosion in a marine environment. One of the primary causes of FPSO / Fixed Platform piping failure is corrosion under pipe supports. The corrosion mechanisms encountered in various types of offshore pipe supports are explained. Considerations in the design engineering stage (Hollow sections, Special coating for springs & viscous dampers, etc.) to avoid and mitigate such pipe support corrosion are addressed. Also, the design requirements from the latest engineering standards that were specifically developed to mitigate the corrosion under pipe supports are highlighted. Apart from mitigating corrosion, the best practices in the pipe support design that allow easy maintenance and inspection of the pipe at the support point are discussed. These mitigations have been applied to multiple Offshore projects and proved successful in extending the design life of piping support components.

Keywords : Pipe support corrosion, FPSO / Fixed platform.

STUDIES TO MEASURE THE IMPACT OF ATMOSPHERIC AND INDUSTRIAL CORROSION IN INDIAN COASTAL PENINSULA OVER STRUCTURAL STEEL IN INDUSTRIAL PLANT SERVICE

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The entire coastal belt of the Indian peninsula is extremely corrosive belt India is encircled by water bodies on three sides and land on the other. Subsequently, it is a Peninsula. Indian landmass is encircled by Arabian ocean on the west, Bay of Bengal on the east and Indian sea on the south. Steel and other ferrous metal along the coastline is susceptible to corrosion, which is mainly initiated by chloride ions present in the sea salts. The fact that engineering goods survival in coastal region is challenging an often suffer a leakage, breakage, unplanned shutdown until unless a proactive mechanism of protective coating layer covers them to provide them safeguard against atmospheric and industrial corrosive elements. A back-to-back two studies on analysis and measurement of rate of corrosion first by National Metrological Laboratory (NML) Jamshedpur from 1963-68 covering 11 cities and latest by Central Electrochemical Research Institute, Karaikudi covers 40 cities from 1994-2011 has also put the cell on fact that metal corrode faster in coastline compared to other region of the country.

Being corrosion auditor I received special privilege from industry to organized real time corrosion impact studies in their plant and let them know the corrosion damage by analyzing in details the reason of corrosion, impact of it over structural steel under plant services, type and grade of corrosion, severity index of facility, measurement of different corrosive elements like soluble salt test, hardness of metal, ultrasonic test, corrosion cell pit depth and microscopic morphography and studies of coating efficiency in dealing with harsh marine and industrial corrosive element together. My course of studies covers corrosion causes, impact and destructions of structural steel under service of industrial plant and mitigation with scientific technological application of high-performance protective coating in east coast, west coast and south coast with sample size of one industrial facility in each region. My studies will help plant maintenance manager, coating manufacturer and coating specifier to take an inappropriate decision in formulating protective coating project within industrial facility located across coastal region for structural stability and sustainability.

Keywords : peninsula, chloride, ions, morphography, corrosive, ultrasonic, protective, coastal.

COMPLEX APPROACH TO THE ELECTROCHEMICAL PROTECTION AND MARINE GROWTH PREVENTION OF THE SHIP HULL

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Due to corrosion damage the large number of ship's and water engineering structures is destroyed. Biofouling of the internal surfaces of pipelines leads to dangerous failures of critical ship systems. To prevent the negative impact of seawater to marine objects, it should be considered a complex method which is presents :

1. Special anti-corrosion and antifouling coatings.
2. Protectors.
3. Impressed current cathodic protection.
4. Corrosion Protection of the propeller-rudder group.
5. Protection of the ship seawater equipment against marine growth.

Experience in equipping ships of different classes and navigation areas with such systems, where the demerits of some protection methods are compensated by merits of others, shows that only such integrated approach can solve the problem of the vessel's body keeping in action and supporting of the ship systems operability and avoiding economic and material losses as well.

This paper focuses on the combined use of all above means for ships. There are a little technical details, just clarifying and demonstrating factors showing the insistent necessity combine implementation of several anticorrosion and antifouling methods that to get full protection of the ship hull in seawater.

Keywords : Electrochemical corrosion, antifouling, cathodic protection, coatings.

PITTING CORROSION RESISTANCE IN OFFSHORE WATER INJECTION WELL ENVIRONMENT : L80'S EDGE OVER 13CR MATERIAL

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Water is being injected in many offshore fields as a method to improve oil production by maintaining reservoir pressure in depleting oil fields. From two such WI wells, corroded L-80 Type-I and L-80 Type-13 Cr tubing were analyzed.

The failed tubing samples were subjected to different tests, viz. chemical composition, hardness, metallography and fractography where all the material properties were found to be in-line with the specified standards for both the tubing. The inhibition studies revealed sufficiently good inhibition efficiency at 10ppm dosage of Water Corrosion Inhibitor (WCI). Scanning Electron Microscopy (SEM) analysis revealed the presence of Chloride networks and a mixture of corrosion product and scales in the internal surface of L80 Type I tubing and pitting corrosion on the corroded edge of L80 13Cr) tubing near the threaded region which can be attributed to interaction of metal surface with chloride ions present in the injection water. Based on extensive data analysis, laboratory experiments and Literature Survey, comparative studies have been done to identify the suitable material.

Keywords : Enhanced Oil Recovery (EOR), Water Injection (WI), Water Corrosion Inhibitor (WCI).

ENHANCING DURABILITY AND SUSTAINABILITY OF MARINE STRUCTURES USING FRP-REINFORCED SEAWATER SEA-SAND CONCRETE: A REVIEW

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By 2024, it is expected that there will be more people on the planet than 8.2 billion, which would increase the need for infrastructure development. As a result, there are now more people using cement, especially in nations like India, which is concerning for the environment. As a result, in areas where freshwater resources are few, saltwater sea-sand concrete (SWSSC) has become a viable option for building. The durability and safety of structures are jeopardized using traditional steel reinforcement in SWSSC, which increases the danger of corrosion in maritime conditions. Because of their improved mechanical qualities and resistance to corrosion, fiber-reinforced polymer (FRP) bars—more especially, glass fiber-reinforced polymer, or GFRP—have the potential to be a practical substitute for steel in SWSSC. The bond strength, tensile strength, and flexural strength of FRP bars in SWSSC in maritime conditions are highlighted in the study. According to experimental findings, FRP-reinforced SWSSC outperforms steel-reinforced counterparts in terms of structural longevity, increased load-bearing capability, and significantly lower maintenance costs. Furthermore, following extended exposure to saltwater, FRP bars maintain 85–90% of their initial tensile and flexural capabilities. By lowering dependency on freshwater and river sand, the use of FRP bars in SWSSC not only tackles corrosion difficulties but also encourages sustainable construction. The potential of fiber-reinforced SWSSC as a robust, long-lasting, and ecologically friendly solution for maritime and coastal infrastructure is highlighted in this work, setting the stage for further study and useful implementations in the building sector.

Keywords : FRP Bars; GFRP Bars; SWSSC; Corrosion.

PARTICLE SIZE-DEPENDENT CORROSION BEHAVIOR OF GREEN GRAPHENE FOR USE IN COATING OF CARBON STEEL UNDER SAFE SEQUESTRATION PRINCIPLE

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In this work, green graphene (GG) was synthesized from residual mix agricultural biomass using physical, chemical and thermal treatment (pyrolysis) processes and prepared in various sizes of GG (two dimensional, 37 μm, 45 μm, 53 μm, and 100 μm) via mechanical and liquid phase exfoliation technique. Then GG samples were incorporated into commercial epoxy (EP) separately for making the GG/EP composite coatings for carbon steel protection in marine environment (3.5% NaCl). The corrosion resistance of GG/EP composite coatings was observed using potentiodynamic polarization (PDP) and results found that the 37 μm- GG/EP composite coating displayed higher corrosion inhibition efficiency (99%) compared to uncoated carbon steel sample. The mechanical property and water contact angle of the optimized coating showed improvement. Biomass-derived green corrosion-inhibiting coating can be a good replacement for traditional toxic chemicals generally used in paints and coatings industries.

Keywords : Green graphene synthesis, protection of carbon steel, anticorrosive coating, corrosion mechanism)

CORROSION BEHAVIOR OF STEELS USED IN MARINE APPLICATIONS

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This study investigates the corrosion resistance of various steel alloys critical for marine applications through complete immersion and electrochemical techniques. The steels tested—X-70, sDSS2507, DSS2205, N50, and SS304—were exposed to artificial seawater (ASW) and a sodium chloride + sodium thiosulphate (NaCl + STS) solution. Scanning electron microscopy (SEM) was utilized for corroded surface analysis. A clear hierarchy of corrosion rates was established: X-70 exhibited the highest vulnerability, while SDSS2507 demonstrated exceptional resistance. Electrochemical potential (Ecorr) measurements corroborate these findings, highlighting sDSS2507 as the most resistant alloy. Immersion test results align with electrochemical data, showing that sDSS2507, DSS2205, and N50 consistently outperform X-70 and SS304 in corrosion resistance. This study underscores the significance of corrosion and electrochemical tests in selecting materials for marine environments, providing valuable insights into maintaining the structural integrity of maritime components.

Keywords : Steels; Immersion corrosion; Electrochemical corrosion; Marine application.

INVESTIGATIONS ON THE EFFECT OF CHROMIC OXIDE FLUX POWDER ON THE CORROSION CHARACTERISTICS OF SUPER DUPLEX STAINLESS STEEL WELDS

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The current research paper investigates the effect of chromic oxide flux (Cr_2O_3) powder on the corrosion characteristics of UNS S32760 Super Duplex Stainless Steel (SDSS) welds. For the analysis, two cases were considered, viz., autogenous Tungsten Inert Gas (TIG) weld and Flux Bound TIG weld using chromic oxide flux. The corrosion resistance and corrosion rates of the base metal and the welds were analysed using Electrochemical Impedance Spectroscopy (EIS) and Tafel Curve Analysis respectively. The primary objective was to analyse the effect of the Cr_2O_3 flux in Flux bound TIG welding for marine applications and compare it with autogenous TIG weld made without the addition of any filler materials. It was observed that for the Flux Bound TIG weld using chromic oxide powder, the corrosion resistance was increased by 49% relative to the conventional autogenous TIG weld. These findings suggest that incorporating chromic oxide flux powders in TIG welding can enhance the durability and reliability of SDSS welds, making them highly suitable for applications in the maritime industry. This advancement could lead to better performance and extended service life of the SDSS welded structures in corrosive environments.

Keywords : Autogenous conventional TIG welding, Flux Bound TIG welding, Electrochemical Impedance Spectroscopy, Tafel Curve Analysis.z

CORROSION IN DEFENCE SECTOR

ADVOGUARD 3370 PHE : A HIGH-PERFORMANCE EPOXY PHENOLIC COATING FOR TANK LINING IN NAVAL PLATFORMS AND OTHER AREAS

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The development of advanced coatings for corrosion protection is critical for naval applications, where fuel and ballast tanks are constantly exposed to aggressive marine environments. This study aimed to address the challenge of ensuring long-term corrosion resistance in such conditions by formulating a epoxy phenolic coating, Advoguard 3370 PHE. The coating was synthesized by modifying phenolic novolac resin to enhance crosslinking density, and it was tested on mild steel panels with a dry film thickness of 275-300 microns. A total of 10 specimens were subjected to various standard tests, including chemical resistance (ASTM G20-10), salt spray (ASTM B117), and humidity (IS:101), over durations up to 36 months. The results demonstrated exceptional performance, with the coating passing 4000 hours in 30% H2SO4 and maintaining adhesion even after exposure to harsh chemicals, with minimal reduction from 680 PSI to 320 PSI in the most severe case. These findings suggest that the Advoguard 3370 PHE coating offers robust protection against corrosion in maritime environments, potentially extending the service life of naval infrastructure. This work adds to the body of knowledge by showcasing an effective solution for corrosion mitigation in chemically aggressive and marine settings, particularly for naval applications requiring durable tank linings.

Keywords : Epoxy phenolic coating, Corrosion protection, Naval applications, Chemical resistance.

GRAPHENE AND FUNCTIONALIZED CHITOSAN COATINGS TO PREVENT THE BIOFILM-ASSOCIATED CORROSION ON MEDICAL IMPLANTS

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Corrosion-associated bacterial infections on medical implants through biofilm are a serious problem. Therefore, suppressing corrosion (or biofilm) on medical implants is challenging. Herein, a synergistic efficient surface coating was developed to inhibit the biofilm formation on the glass surface (model implant) by combining the antimicrobial property of functionalized chitosan (TMC) and with 2D materials (2DMs) graphene oxide (GO) and black phosphorous (BP) using LbL assembly. The anti-biofilm properties of coatings were confirmed against both Gram-negative (E. coli) and Gram- positive (B. subtilis using crystal violet (CV) and live/dead assays. Around 20 samples were tested for the anti-biofilm (corrosion) studies with and without 2DMs/TMC coatings. The electron microscopy analyses revealed that the bacteria were affected by membrane perturbation, thereby preventing biofilm formation. Our results demonstrate that TMC/2DMs coatings could prevent implant corrosion-associated- biofilm formation.

Keywords : Corrosion, Biofilms, Implants, Infections, graphene, Chitosan.

ALUMINIUM COATED HOLLOW CERAMIC SPHERES BASED HEAT BARRIER COATINGS FOR THERMAL MANAGEMENT OF NAVAL PLATFORMS

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Heat barrier coatings (HBCs) are advanced materials that are applied to surfaces which are exposed to high temperatures to provide insulation and protect the underlying substrate from the extreme heat transfer. Hollow glass/ceramic spheres have long been used as insulating materials in coatings. In the present study, spheres were coated with aluminum using polysiloxane binders. The coated spheres were then added to epoxy resin at different concentrations, ranging from 5% to 20%, to form a heat barrier coating. Free films of these coatings were analyzed using Differential Scanning Calorimetry (DSC). Tensile strength tests were also performed on the free films to assess the mechanical properties of the coatings. The coatings were tested according to ASTM D4803 to study heat build-up. It was found that at a 15% concentration, a good trade-off between mechanical properties and performance was achieved.

Keywords : Aluminium, Polysiloxanes, Heat barrier coating, Hollow ceramic spheres and Heat built up.

LOGARITHMIC FREQUENCY MODULATED THERMAL WAVE IMAGING FOR CORROSION UNDER INSULATION IN NAVAL APPLICATIONS

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Corrosion under insulation evolved as a significant challenge due to its unavoidable, hidden and undetected severity of the damage growing invisibly under the protective coat in various defence applications. The need for non-invasive, non-contact testing methods that can precisely assess the subsurface corrosion without harming in-service applications is critical for early detection and prevention of catastrophic failures. Being a safe, non-invasive and non-destructive approach for detecting anomalies depending on the temperature map over the surface, thermal wave imaging can be employed to assess corrosion in various Naval applications. This study explores a novel logarithmic frequency-modulated thermal imaging-based subsurface evaluation for evaluating different types of corrosions and moisture trapped below the coat to facilitate early detection of failures in various naval applications. This novel detection methodology employing chirp-Z transform-based phase analysis facilitates highly depth-resolved detection. It helps assess corrosion severity and morphology by precisely estimating substrate wall thinning. Experiments carried over coating on a mild steel substrate ensure that the proposed methodology clearly presents an edge over contemporary thermal wave imaging approaches verified quantitatively using various measures.

Keywords : Corrosion undercoat, Thermography, Chirp Z transform, Phase analysis, Depth resolution.

THE CANNONS OF DINDIGUL FORT REPRESENT AN EXTRAORDINARY ACHIEVEMENT IN INDIAN METALLURGICAL CRAFTSMANSHIP-FREE FROM CORROSION

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Dindigul Fort is located approximately 400 kilometers from Chennai in the state of Tamil Nadu, India. The fort's geographical coordinates are 10.35° N latitude and 77.95° E longitude. Rising to an elevation of nine hundred feet, the structure is primarily built from granite. Atop this elevation, several brick edifices, likely erected during the British colonial period, can be found. The fort is strategically positioned and features a circular freestanding bastion that historically accommodated multiple cannons. The introduction of artillery and cannons to the site dates back to the 17th century, and remarkably, these cannons have not succumbed to corrosion. A detailed analysis of a rust sample taken from one of the cannons at Dindigul Rock Fort was performed using scanning electron microscopy (SEM), dynamic light scattering (DLS), and Fourier-transform infrared (FTIR) spectroscopy. This analysis revealed the presence of various elements, including carbon, oxygen, silicon, phosphorus, sulfur, calcium, and iron, as well as the detection of nanoparticles.The FTIR spectrum was used to confirm the existence of FeOOH, FeOOH, and Fe3O4.

Keywords : Cannons of Dindigul Fort, composition, SEM, FTIR , corrosion.

Advanced Nano Ceramic Coatings for Dual Protection : Combating Corrosion Under Insulation and Improving Thermal Efficiency in Marine Environments

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Corrosion Under Insulation (CUI) poses a critical threat to the structural integrity and operational readiness of naval vessels, leading to heightened maintenance costs and unexpected failures. Conventional insulation materials often exacerbate CUI due to their susceptibility to moisture retention and limited corrosion prevention capabilities. This study investigates the mechanisms and thermodynamics of CUI, identifies the most vulnerable areas on naval vessels, and examines the role of thermal fatigue in accelerating corrosion. Nano ceramic thermal insulation coatings are introduced as a novel solution, offering superior moisture resistance, enhanced thermal stability, and compatibility with existing mitigation methods such as cathodic protection. Through thermodynamic calculations, electrochemical testing, and comparative analysis, we show that nano ceramic coatings reduce corrosion rates by up to 87% while improving structural resilience. Integrating these advanced coatings with current protection systems provides a comprehensive approach to CUI mitigation, thereby enhancing safety, operational efficiency, and mission readiness of naval vessels.

Keywords : Corrosion Under Insulation, Nano Ceramic Thermal Insulation Coating, Naval Vessels, Operational Readiness, Corrosion Mitigation, Thermal Fatigue, Cathodic Protection.

COATINGS FOR AUTONOMOUS DAMAGE REPAIR AND DETECTION

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Generally during service life of coatings Micro cracks are formed and corrosive agents like water and oxygen ingress through the crack and initiate the corrosion and ultimately results in complete delamination of coating film and leads to catastrophic failure of the structures. If the micro cracks can be repaired immediately as soon as they are formed, the further damage can be controlled and service life of the structures can be enhanced.

In this study, Coatings prepared with microcapsules containing healing agents and indicators. Paint applied on MS substrate by brush and dry film thickness was maintained 80 ± 10µ microns. The coating performance was tested after drying. It is found that coatings are giving indication of the cracks/damages instantaneously and also healing the damage to provide temporary protection to the substrate. While crack formation the capsules break open and releases the healing agent to fill the crack and film formation takes place at ambient temperature conditions through oxidative drying. Studies were carried out with varying concentration of microcapsules from 1 % to 4%. Studies shows that coating with 2.5% capsule loading is showing optimum performance of crack healing and damage indication.

STUDY ON EFFECTS OF CAMPHOR SOOT AND ZNO NANO FILLERS IN SELF-STRATIFYING COATING INFLUENCING HYDROPHOBIC FOUL RELEASE PROPERTY

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This study explores the development of a self-stratifying single-coat application system using incompatible polymer blends of epoxy and silicone, designed to impart dual functionalities anticorrosion and hydrophobic foul release. The coating system integrates an epoxy-based anticorrosive bottom layer with a silicone-based hydrophobic top layer, achieving stratification during curing. Silicone resins were reinforced with camphor soot (CS-1, CS-2, CS-3) and nano ZnO (Z-1, Z-2, Z-3) using Nonidate-P40 surfactant through high-speed dispersion and sonication. These pigmented silicones were combined with respective cross-linkers, catalysts, and then mixed with epoxy resin and hardener in a 50:50 ratio before application on mild steel test specimens. The self-stratifying behavior of the coating was confirmed using FE- SEM, FTIR spectroscopy. Corrosion resistance via Electrochemical Impedance Spectroscopy (EIS) and antifouling performance using a pseudo-barnacle test was evaluated.

Keywords : Stratifying coating, silicone, biofouling, PDMS, low surface energy, nanofillers.

USE OF COMPUTER VISION FOR CORROSION DETECTION

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This paper delves into the utilization of computer vision methodologies for the detection of corrosion on steel surfaces. By amalgamating computer vision algorithms with corrosion detection techniques, the study aims to present a robust framework for identifying corrosive activities. The paper discusses the development and evaluation of two distinct models tailored for above-water and underwater corrosion images. Furthermore, it elucidates the evolution of these models through various iterations aimed at enhancing performance metrics such as mean Average Precision (mAP). Insights into the limitations of existing methodologies and potential avenues for future research are also provided.

Keywords : Computer Vision, Mean Average precision.

EFFECT OF CATHODIC PROTECTION ON CRACK TIP DRIVING FORCES AND INFLUENCE OF FATIGUE CRACK GROWTH IN HSLA STEELS

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Different High Strength Low Alloy (HSLA) steels are widely used in ship building industry due to their combination of strength, fracture toughness and excellent weldability. It has often been seen that the rate of growth of a fatigue crack within HSLA steels is particularly sensitive to the value of the stress intensity factor range (ΔK) and maximum stress intensity factor (KMax). As long as ΔK is not higher than a threshold known as ΔKTh, no extension of the existing crack takes place. As soon as one reaches this value and increases ΔK further, the linear crack growth rate according to Paris-Erdogan law – stage II crack growth, takes over. In seawater environment, the maximum stress intensity factor KMax interferes with the effects of crack closure mechanisms and therefore crack tip spends longer periods of the loading cycle in the sea water environment. Therefore, faster growth rates are noticed even for same ΔK due to reduced crack closure and higher crack tip stresses. By giving proper corrosion protection methodologies like Cathodic Protection (CP), it is possible to mitigate Fatigue Crack Growth Rate (FCGR).

FCGR studies of DMR249A steel which is used in warship construction in Air, 3.5% NaCl, and 3.5% NaCl with CP of -850 mV against Ag/AgCl as RE at stress ratio (R) of 0.1 were studied. FCGR experiments conducted in air exhibited an equal confluence of both the driving parameters (namely, ΔK and KMax), the experiments conducted in 3.5% NaCl exhibited an increase in FCGR as the regime is governed by KMax. However, FCGR experiments conducted with CP (-850 mV) demonstrated results akin to FCGR experiments conducted in air. Fractographic micrographs at similar ΔK of three specimens confirm the failure morphologies. While tests conducted in air and 3.5% NaCl with CP shown the formation of dimples and subsequent coalescence, tests conducted in 3.5% NaCl without CP exhibited quasi-cleavages and ensuing failure.

Keywords : Stress intensity factor range (ΔK), Maximum stress intensity factor (KMax), Paris-Erdogan curves, Cathodic Protection, Fractography.

GREEN OPTIMIZATION OF SELF-STRATIFYING COATINGS WITH PANI-ZNO NANOCOMPOSITE FOR EFFECTIVE ANTIFOULING AND ANTICORROSION APPLICATIONS

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Considering the excellent biocompatibility, antibacterial, and anticorrosive properties of conductive polyaniline (PANI), and zinc oxide (ZnO), PANI-ZnO nanocomposites (1-10 wt%) were synthesized by in situ polymerization and used as a reinforcing filler (1 wt%) in novel self-stratifying coatings. The FESEM micrographs revealed presence of PANI nanobridges, XRD and FESEM of ZnO showed a pure wurtzite phase with a narrow size distribution of 20-40 nm and spherical morphology. The shift in FTIR bands and DRUV spectra indicated the formation of PANI-ZnO nanocomposites. The mechanical properties of the self-stratifying coating formulation such as flexibility, cross-hatch adhesion, pull-off adhesion, enhancement in the contact angle were improved by inclusion of PANI-ZnO nanocomposites filler. Specifically, 5 wt% PANI-ZnO nanocomposite filler showed superior antifouling and anticorrosion performance in the coating by artificial seawater (ASW) immersion test and pseudo barnacle test as well as excellent mechano-chemical properties.

Keywords : Polyaniline nanocomposites, Self-stratified coatings, Antifouling, Anticorrosion.

EPOXY-SILOXANE INCORPORATED FLEXIBLE ANTI-CORROSIVE PROTECTIVE COATINGS

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Anticorrosive, flexible Coatings are elastic protective compounds that are applied to surfaces, particularly metals, to stop corrosion. In sectors where metals are subjected to extreme conditions like dampness, chemicals, and mechanical stress, such as the maritime, automotive, construction, infrastructure, and oil and gas industries, these coatings are essential. These coatings' flexibility enables them to tolerate thermal expansion or contraction, vibrations, and structural movements without breaking or losing their protective qualities. Epoxy-modified siloxane coatings have gained significant attention in the coating industry because of their outstanding performance and environmental advantages. In this study, various coating formulations were prepared by incorporating epoxy siloxane resin, and curing agents, and a comparison has been made with conventional epoxy resin. Significant improvements in impact strength and heat stability were demonstrated by the epoxy-siloxane-containing coatings along with enhanced anticorrosive properties. The prepared coatings also demonstrated flexible stability with strong surface adherence. This research created a new avenue for epoxy siloxane resin coatings and their use in the building, automotive, and aerospace sectors.

Keywords : Epoxy siloxane resin, anticorrosive, flexible coatings, marine coatings.

NANOCOMPOSITE EMBEDDED POLYMER FOR MITIGATING MARINE CORROSION

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Corrosion and fouling on various surfaces in saline water are inevitable processes significantly affecting the performance of submerged surfaces, the service time and also associated with potential risk of catastrophic failure. In defense sectors, various protective strategies have been developed, however, paramount importance is given for developing eco-friendly coatings. Among various protective measures, biocidal coatings have exhibited better performance, however, the leaching of biocides is a major concern owing to their severe and complex impact on non-targeted species, prompting the International Maritime Organization to mandate the research focus on other alternatives. Strategies using polymer nanocomposite can be promising by ensuring no leaching. Therefore, we have developed anticorrosive pigments based on graphene oxide modified with conducting polyaniline after incorporating in epoxy coatings. In an alternate strategy, the focus was on increasing the interfacial bonding between magnetic iron oxides with matrix polymer which substantially increased their potential towards anticorrosive performance. Herein, a comparative performance of both composites is attempted for mitigating corrosion with minimal environmental impact.

Keywords : Graphene nanocomposites, Magnetic nanoparticles, anticorrosive performance.

CORROSION MONITORING AND TESTING

QUANTIFICATION OF MIC-CAUSING MICROBES USING RT-PCR AND NETWORK-BASED ANALYSIS OF MIC POTENTIAL

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Microbiologically influenced corrosion (MIC) is inherently more complex to predict, detect, and measure because, for instance, the presence of biofilm and/or bacterial products is not sufficient to indicate active microbiological corrosion. The major challenge for current MIC models is to correlate factors that influence corrosion (i.e., physical, chemical, biological, and molecular variables) with the potential of having MIC. The present work discusses the testing of microbial presence using an RT-PCR (Real time-PCR) based technique and correlates the results with other factors to determine the potential for MIC.

Most advanced labs in India, where pig muck or tank water bottom samples are tested, follow culture-based techniques to determine the presence of specific microbes. However, these techniques are not effective as the quantification level is less than 10%. IOCL-R&D has developed an I-qPCR detect kit based on the Real-time PCR (RT-PCR) technique, where the amplification of the target gene is detected based on fluorescence. In the presence of the target gene in the sample, DNA amplification increases the fluorescence level in the tube, which is detected by the RT-PCR instrument. The Ct value is then converted to DNA copies using a standard curve, and the presence of microbes is calculated in CFU/ml. RT-PCR is considered the advanced technique available to detect and understand the bacterial load. Once the respective microbial presence is quantified, the next challenge is to determine whether the microbes have the potential to induce corrosion. Different models have been adopted across various industries internationally to understand the potential MIC threat. However, based on literature studies, a network-based approach considering different influencing factors has proved to be a practical approach. Hence, a similar type of network-based approach (based on ranking) has been adopted here, which takes into consideration major factors affecting the potential for MIC such as operating parameters, microbial presence in pig muck (mostly SRB, IOB & APB), feed data, and tank bottom water data to analyze and predict MIC potential.

Keywords : Microbial Induced Corrosion, Real-time PCR, pipelines, Corrosion.

LEVERAGING DIGITAL SOLUTIONS TO OPTIMISE ASSET INTEGRITY MANAGEMENT

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In today's volatile geopolitical landscape, refineries face increased challenges in Asset Integrity Management (AIM) due to the processing of "opportunity crudes" crudes that are less consistent in composition and can introduce/ pose new risks to asset integrity. Advanced digital solutions are becoming crucial in addressing these challenges & are being applied as :

- Predictive Analytics: Effective monitoring of Integrity Operating Windows (IOW).
- Real-Time Data Acquisition: Monitoring real time thickness of critical piping circuits by installing non-intrusive thickness / corrosion monitoring sensors.

Predictive Analytics :

Predictive analysis by monitoring leading indicators e.g. effective monitoring of IOW in process plants of refinery helps in detecting early signs of corrosion, potential damages, failures or other potential issues. Timely addressing the corrosion / integrity related issues prevents minor problems from escalating into major failures.

Real-Time Data Acquisition :

Corrosion in critical piping circuits and its monitoring is a challenge that the industry faces as the units are expected to have increased run length. Processing of variety of crude makes it difficult to keep a track of the healthiness of the equipment and associated piping circuits as the corrosion and associated damages do not behave in a defined pattern. Online wireless thickness monitoring tool gives the plant inspector the true picture of the corrosion happening in the piping circuits.

By leveraging these advanced digital solutions, we have enhanced Asset Integrity Management practices, which effectively manage the risks associated with opportunity crudes, and ensure safe and efficient operations despite the uncertainties of the current geopolitical climate.

Keywords : Digital Solutions, Corrosion monitoring, Asset Integrity Management.

CRUDE COLUMN OVERHEAD PIPING CORROSION - NEVER ENDING BATTLE

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Ever since the inception of refineries, crude overhead corrosion has always been one of the most talked about subject for corrosion engineers. Carbon steel remains the most economical choice for metallurgy and corrosion engineers across the world have been experimenting to predict and control overall consequences. Initial efforts based on Lab sample monitoring and more intensive assessments were never enough. Digital transformation in industry increased the expectation from corrosion engineers to predict corrosion and also report corrosion as it occurs in operations, on-line. The paper discusses journey of crude Overhead corrosion and challenges in today's perspective of digital transformation.

Keywords : Corrosion Management Program, Integrity Operating Window, reliability improvement, Inspection Plan, digital transformation, Ionic models, Safe to Operate.

EVALUATING PREFERENTIAL WELD CORROSION IN NI WELDS : A LABORATORY APPROACH TO QUALIFY WELDS

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The susceptibility of welds to corrosion, particularly preferential weld corrosion (PWC), poses significant challenges in maintaining the integrity of welded structures in corrosive environments. This study focuses on evaluating the PWC behavior in welds containing Nickel (Ni> 1%) through a series of newly developed controlled laboratory experiments. The experimental approach includes the fabrication of weld samples with varying Ni content, followed by exposure to simulated field conditions.

Electrochemical techniques, such as Linear polarization Resistance (LPR) for measuring the corrosion rate and zero-resistance ammeter (ZRA) for assessing the Galvanic current were employed. Additionally, surface analysis using optical microscopy & surface profilometry provided insights into the corroded surface morphology and elemental composition of the corroded welds.

Results indicate that Ni content plays a crucial role in the PWC resistance of welds. Welds with higher Ni exhibited significantly higher corrosion rates & formation of locally corroded areas around weld & the heat affected zone (HAZ) in corrosive environments.

The findings from this study underscore the importance of composition of weld in reducing the threat of PWC, particularly nickel content. This is essential in ensuring longevity and reliability of welded structures. These insights can guide the development of more durable welds for applications in highly corrosive environments experienced in the oil and gas industry.

Keywords : Preferential Weld Corrosion (PWC), Ni Weld, Welding.

ADVANCEMENT IN HYDROCARBON DEW POINT MEASUREMENT IN NATURAL GAS INDUSTRIES : EVALUATING THE RTD PT100 AGAINST TRADITIONAL METHODS

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Accurate measurement of the hydrocarbon dew point (HCDP) is crucial for efficient natural gas processing, quality assurance, and regulatory compliance. Traditional methods such as chilled mirror technology, capacitance-based sensors, gas chromatography with Equation of State (EOS) models, and manual techniques have been employed but exhibit significant limitations, including sensitivity to sample matrix effects, calibration difficulties, and complex operational requirements. This paper introduces the RTD PT100 (Resistance Temperature Detector) as a superior alternative for HCDP measurement. The RTD PT100 provides precise temperature readings with minimal calibration and effectively addresses issues related to adsorption and desorption in the sample matrix. It also offers enhanced integration with advanced thermodynamic models like the Peng-Robinson EOS, enabling accurate determination of key thermodynamic terms including cri-condentherm, cricondenbar, bubble point, and the HCDP curve. The RTD PT100's ability to provide real-time data and facilitate immediate corrective actions represents a significant advancement over existing methods. This paper reviews recent literature on traditional methods and highlights the RTD PT100's advantages in terms of accuracy, reliability, and operational efficiency. Economically viable, it saves costs associated with maintenance contracts and environmental impact by avoiding cold venting and flaring, thus ensuring resource protection and safe operations.

Keywords : Equation of State (EOS), Cri-condentherm, Cri-condenbar, Bubble point, Resistance Temperature Detector, Hydrocarbon dew point (HCDP) , RTD.

CASE STUDY ON AC INTERFERENCE RISK ASSESSMENT, MITIGATION STRATEGY AND MONITORING

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Over time, India's rapidly developing infrastructure, especially in the Power Sector, has made AC interference a bigger worry due to its increasing significance and corrosion on nearby metallic structures and pipes. Finding the interference source and current discharge point in order to create a mitigation strategy is difficult when it comes to AC corrosion.

This case study investigates the risk assessment, mitigation, and monitoring solutions for alternating current (AC) interference on a buried petroleum product pipeline that runs parallel to high-voltage transmission lines. The emphasis is on identifying potential hazards, implementing effective mitigation measures, and developing a strong monitoring system to assure the pipeline's safety and integrity. The paper cites a procedure and guidelines for use during initial risk assessment, AC Interference & mitigation strategy on underground CP protected pipeline caused by proximity to AC power supply systems. The paper also highlights the parameters for profiling activity and other important factors to be considered for Pre mitigation field survey and use of these data for better AC interference survey results and validation.

The case study examines a specific petroleum pipeline segment, using field surveys and electromagnetic modelling to determine AC interference levels. Detailed measurements revealed high induced AC voltages, needing prompt intervention to avoid potential risks and protect pipeline integrity. The risk assessment results were used to build and implement a multifaceted mitigation strategy. The results demonstrated a significant reduction in AC-induced voltages and associated risks, ensuring compliance with industry safety standards. This case study emphasises the significance of an integrated approach that combines risk assessment, targeted mitigation, and ongoing monitoring for effective AC interference management. The methodologies and insights gained from this study offer valuable guidance for addressing AC interference in similar petroleum pipeline projects.

Keywords : AC Interference, Cathodic Protection, AC Current Density, Pipeline Integrity, Pipe to soil Potential, Electromagnetic Induction, Mitigation Strategy.

ADVANCE EARTH RESISTANCE MONITORING IN CATHODICALLY PROTECTED PIPELINES : NECESSITY OF EARTH RESISTANCE MONITORING, SOLUTIONS FOR LONG-TERM MEASUREMENT AND ELECTRODE CORROSION

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Maintaining the longevity and safety of cathodically protected pipelines depends on effective earth resistance monitoring, which is crucial for the proper operation of grounding systems. Metal electrodes, which play a key role in these systems, are susceptible to corrosion, potentially compromising the integrity and performance of the cathodic protection (CP) system. This study examines the corrosion resistance of metal electrodes exposed to a simulated corrosive environment using a salt spray test, conducted in accordance with ISO 9227:2022 standards. Over a 72-hour period, the results showed that while initial signs of corrosion were observed, the affected area was minimal, and the electrodes' electrical resistance remained unchanged. These findings demonstrate the electrodes' short-term resilience but also emphasize the importance of prolonged monitoring to fully assess long-term corrosion effects. The study highlights the need for improving electrode durability to ensure stable earth resistance and the ongoing effectiveness and safety of cathodically protected pipeline systems.

Keywords : Earth Resistance Monitoring, Cathodic Protection, Pipeline Integrity, Electrode Corrosion, Long-Term Measurement, DEHNrecord SD EPMS.

ENHANCEMENT OF CORROSION RESISTANCE OF MILD STEEL WITH ZINC-RICH AND HYDROPHOBIC BI-LAYER COATING

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In this study, we developed a bilayer coating with a zinc-rich base coat and an h-BN incorporated silane-siloxane hydrophobic top coat. The h-BN top coat enhances the surface wettability, underwater stability, corrosion resistance properties and thermal stability while the zinc-rich base coat provides galvanic protection. Atomic force microscopy (AFM) and water contact angle (WCA) analysis were utilized to evaluate the surface of the coating. The corrosion resistance of the coating was studied using electrochemical impedance spectroscopy (EIS). This work provides a simple and scalable method to prepare zinc-rich and hydrophobic coating for corrosion protection of mild steel.

Keywords : corrosion, bi-layer, Zinc-rich, mild steel, EIS and salt spray.

SELF-HEALING BI-LAYER COATING INCORPORATED WITH CORROSION INHIBITOR LOADED POLYUREA CAPSULES AND SILICA NANOCONTAINERS FOR ACTIVE CORROSION PROTECTION OF MILD STEEL

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Self-healing coatings are known to smartly respond to impairment caused by corrosive ions and moisture on the metals without manual intervention. Unlike normal organic coatings, they automatically recover the barrier function and are found to be attractive anti-corrosion coatings. In this work, poly urea (PU) microcapsules loaded with two corrosion inhibitors such as flax oil and silane were synthesized by interfacial polymerization method. Also benzotriazole (BTA) loaded silica nanocontainers were prepared via one step surfactant micelles. The morphology of the microcapsules and nanocontainers with and without the loading agents was evaluated using SEM. The encapsulation of the corrosion inhibitors into PU microcapsules and silica nanocontainers was confirmed using FTIR, UV-Vis spectroscopic and thermal analysis. Bilayer coating was formulated with epoxy as primer and polyurethane as a topcoat, both incorporated with self-healing agents. The self-healing coating was prepared by the addition of pigments into the coating matrix and then painted on the mild substrate. Optical microscopy was used to evaluate the self-healing effect of the coating. The neutral salt spray tests confirmed the superior anti-corrosion performance of the bilayer coating.

Keywords : corrosion, bi-layer, microcapsules, mild steel, EIS and salt spray.

WATER UPTAKE BY ORGANIC COATINGS AND ROLE OF HYDROPHOBICITY

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The initial stage of coating failure is the ingress of water through organic coatings during which oxygen and corrosive species are transported to the metal-coating interface. Depending on the characteristics of the coating, a variety of changes may occur when water enters the coating. Since water is the main reason for corrosion, superhydrophobic coatings have achieved great attention in the field of corrosion and protective coatings. In this work, attempts were made to establish a correlation between hydrophobicity and water uptake of organic coatings. Two coatings were fabricated over mild steel and two different binders were used. Two bare coatings namely, PDMS coating and epoxy coating were made to compare the water uptake of hydrophobic and hydrophilic coating respectively. Water absorption of these coatings was estimated by electrochemical impedance spectroscopy (using Brasher and Kingsbury equation) and also found that there exists a reverse correlation between hydrophobicity and water uptake.

Keywords : Water uptake, Hydrophobic surface, Electrochemical impedance spectroscopy, Mild steel.

DEVELOPMENT OF A HYDROPHOBIC CORROSION SENSING SOL-GEL COATING USING ENCAPSULATED NANOCONTAINERS FOR Mg AZ31 B

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In this work phenolphthalein and 2-mercaptobenzothiazole, encapsulated silica nanocontainers were utilized to develop a corrosion-sensing, hydrophobic and self-cleaning sol-gel coating. During corrosion, the pH was increased, causing the phenolphthalein to change from benzenoid to quinonoid form, thereby indicating corrosion with a pink color in the coating. The phenolphthalein and 2-mercaptobenzothiazole encapsulated silica nanocontainers were synthesized by the oil-in-water emulsion method and the nanocontainers were characterized using scanning electron microscope (SEM), Brunauer-Emmett-Teller (BET) analysis and X-ray photoelectron spectroscopy (XPS). The surface morphology of the coating was observed using a scanning electron microscope (SEM). The corrosion resistance and corrosion sensing of the developed sol-gel coating were studied using electrochemical impedance spectroscopy (EIS) and neutral salt spray (NSS). 2-mercaptobenzothiazole and phenolphthalein were responsible for corrosion inhibition and sensing respectively.

Keywords : Corrosion sensing; hydrophobicity; nanocontainers; magnesium.

APPLICATION OF CLOUD-COMPUTING FOR DESIGNING OF INTEGRITY MANAGEMENT SYSTEM WITH RISK ANALYSIS IN CITY GAS DISTRIBUTION SYSTEM

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City Gas Distribution Systems Face Numerous Challenges Such as Aging Infrastructure, Varying Threats Patterns, Environmental Risks, And Operational Hazards. These Challenges Require Robust Systems to Ensure Seamless Operation, Data Integration and Historical Data Access & Its Analysis to Prioritize the Threats to The Network to Minimize the Future Risks. Cloud-Based Application for Asset Integrity Management with Risk Analysis for City Gas Distribution System Offers A Cutting-Edge Approach to Improving the Safety, Reliability, And Reducing the Threat to Critical Infrastructure. The Architecture of This Cloud-Based Asset Integrity Management Platforms Offers Analysis of Operational & Process Data to Enhance Operation and Decision-Making Capabilities, And Also Offers Deep Insights for Major Threat and Risks to The Networks and Its Action Plan to Minimize/Mitigate the Same. This Application Generates One Click Integrity Assessment Report with Risk Assessment, Threats Trends with Historical Data, Threat Prioritization, Digital Risk Register, Incident Report Mechanism. This Application Is Designed as Per the PNGRB IMS Regulations and PHMSA Regulations Including Various National and International Industry Practices.

Keywords : Threat analysis in CGD. Threat categorization, Risk Assessment, Integrity management system.

MATERIALS AND COMPOSITES

A COMPLETE SOLUTION AGAINST SEIZING OF FLANGE JOINTS THROUGH NOBLE ANTI-SEIZING COMPOUND

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Industries have lot of process equipment and piping that have flange and other critical bolted joints. Many of such joints are prone to corrosion and seizing over prolonged service. A seized joint is potentially dangerous and can result not only into significant damage to equipment & piping but also sometimes its complete loss during various M&I activities. To prevent seizure and corrosion of various flange and bolted joints of process equipment & piping at refineries, power plants, cement industries, chemical industries; an Anti-seizing compound (ASZC) is used as a thread paste. The anti-seizing compounds allows the joints to be opened easily even after extended periods of service at high temperatures and can potentially improve gasket performance and retard dissimilar metal corrosion.

IOCL R&D centre also took up the challenge and has recently developed a novel anti-seizing compound for mitigation of problems of seizing of flange and other bolted joints. The paper discusses the brief overview of the development including the various components of product, the products performance in the laboratory as well as filed trials.

Keywords : Seizing, ASZC, Paste, Flange & Nut/Bolt and Industries.

INTEGRITY ASSESSMENT OF CLEANING PIG BRUSHES IN SOUR CONDITIONS

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Integrity of pipelines transporting gas/fuel/oil is of utmost importance as a Loss of Primary Containment (LOPC) event results in economic losses, and environmental issues. Many such integrity issues are attributed to reduced corrosion inhibitor effectiveness owing to accumulation of corrosion products over the period of years, leading to under deposit corrosion (UDC) issues. Therefore, these pipelines are periodically cleaned using cleaning pigs to remove the sludge/corrosion products. However, these cleaning brushes are commonly made of plastics and lack operational efficiency. Usage of metallic cleaning brushes over plastic brushes have gained momentum as they can deliver better cleaning efficiency due to their higher hardness, specifically reaching into small pits. This work details an attempt to understand the integrity of metallic cleaning brushes used in sour service conditions as failure of such brushes not only will reduce the efficiency of cleaning but also can trigger expensive retrieval action of broken pieces. Carbon Steel (ASTM A228), Stainless Steel (SS) 302 (UNS30200) and 304 (UNS30400) materials were tested using U-bend specimens in a low condensed water composition of 3500 mg/l (Cl^-) with a TDS of 5785 mg/l at pCO_2 (3.2 bar) and pH_2S(1.7 bar) at 75 oC and 25 oC for several exposure conditions (4h,8h,24h and 48h). The materials evaluated are cold rolled with a hardness of 50-52 HRC. Carbon steel samples failed in 4h exposure due to sulfide stress cracking (SSC) whilst the stainless-steel samples did not fail during the exposure test. Microscopic examination of stainless-steel samples post exposure in 25 oC test condition revealed that several pits and cracks were initiated in samples exposed to 8h test duration potentially due to sulfide stress corrosion cracking (SSCC). The number of pits and the crack length increased with increased exposure duration. However, no pits were found in the 4-hour duration sample. At higher temperatures (75 oC), the SS samples showed deeper pits with higher mass loss and cracks originated from them. These exposure tests assisted in defining an integrity operating window and paved way for selection of cleaning pig brush materials for sour conditions.

Keywords : Stress corrosion cracking, Integrity, pig brushes, Sour grade material.

EVALUATING THE CORROSION PERFORMANCE OF Aa2024 ALUMINUM ALLOY WITH SN AND CE ADDITIONS UNDER DIFFERENT SALTWATER ENVIRONMENTS

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In the recent years, Aluminium (Al) alloys have increasingly replaced ferrous alloys like steels in many applications including construction of airplanes, spacecrafts, ships, heat exchangers, etc. owing to their low weight, easy machinability, excellent castability, and recyclability. Among the commercial Al alloys, the 2024 Al-alloy of the 2XXX series are used mainly in aerospace industries have Cu content of about 3.9 to 4.8 wt.%. AA2024 has high strength and hardness due to Cu addition to the matrix, but AA2024 suffers from poor saltwater corrosion resistance due to the presence of Al-Cu intermetallic which precipitates/re-deposits Cu in the matrix, which aid in micro- galvanic corrosion to occur. Therefore, it becomes necessary to develop new alloys of 2024 having improved corrosion resistance than the base alloy. Adding rare earth elements (REs) to Al alloys improves mechanical and corrosion properties by forming stable intermetallic phases that hinder grain boundary sliding and dislocation movement. Cerium (Ce) is one of the most commonly used rare earth elements (REs) in alloying, while due to the limited solubility of Ce in the Al matrix (max. 0.05 wt.%), Ce forms a variety of intermetallic compounds with Al. Nevertheless, the impact of Ce addition on corrosion response of Al alloys, specifically 2XXX series, has not received much scientific attention. Hence, the present investigation evaluates the saltwater corrosion behavior of AA2024 and AA2024-Ce aluminum alloys fabricated by gravity casting route. The developed alloys were subjected to microstructural characterization and corrosion studies (immersion and electrochemical) in 3.5 wt.% NaCl and simulated seawater conditions followed by post-corrosion characterization. The addition of Ce reduced the grain size and formed new intermetallic compounds with Al and Cu. The addition of Sn and Ce to the AA2024 alloy increased the corrosion resistance of the base alloy and decreased the dissolution rate of α-Al matrix in the AA2024 alloy.

Keywords : Aluminium alloys, Gravity casting, Corrosion behavior, Potentiodynamic polarization, Anodic dissolution.

TAILORED CERIUM PHOSPHATE/SILICA HYBRID EPOXY FOR ENHANCED CORROSION PROTECTIVE COATING

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Current work focused on resolving a viable and sustainable alternative to the hazardous chrome-based pigments commonly used in organic anticorrosive coatings. We investigated the effectiveness of cerium and phosphate precursors modified conventional silica through a simple synthetic route. The synthesised pigment was further surface-modified with aminopropyl trimethoxy silane to improve its interaction with the epoxy binder. The resulting silane functionalised hybrid pigment-reinforced epoxy coat has a resistance of 9.91×109 Ω cm2, two and five orders of magnitude higher than silica-epoxy and bare epoxy coatings, respectively. Also, it shows a hydrophobic contact angle of 100°, which further enhances the barrier properties. Continuous Electrochemical impedance spectroscopy (EIS) was used to examine coating performance with and without artificial defects. The results showed improved performance compared to commercial chrome-based pigment and an active protection mechanism. Our study presents a reliable, inexpensive, and healable approach using conventional silica particles to prevent steel corrosion in saline media.

Keywords : Anticorrosive coating, EIS, hydrophobicity, self-healing, silica, cerium phosphate.

INFLUENCE ON AL2O3 PARTICLES, CARRIER GASES ON THE MICROSTRUCTURES AND CORROSION PROPERTIES OF COLD SPRAYED COMPOSITE COATINGS

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In recent years, cold-spray coatings have emerged as a key innovation for developing protective surfaces by depositing metal-based composite powders, which offer enhanced material properties and corrosion resistance. The carrier gases used while coating of a substrate influence the attributes of the surface. Therefore, this study investigates the effect of carrier gases, nitrogen, and compressed air on the properties of cold gas dynamic spray (CGDS) deposited Ni-Al2O3 composites on AZ91 magnesium alloy substrates. The experiments were conducted at spraying parameters like gas temperature 650 0C, gas pressure 0.6 MPa and 0.8 MPa, short- off distance 13 mm, spray angle 900, and carrier gas i.e. compressed air and nitrogen to compare the changes in the coating deposition efficiency (DE). Electrochemical tests were carried out in 3.5 wt.% NaCl aqueous solution to investigate the effects of Al2O3 on the corrosion performance of the Ni-Al2O3 CGDS coatings. The FESEM, XRD, surface roughness, porosity, and microhardness results obtained from coated samples showed that the Ni-Al2O3 composite coatings deposited in the presence of nitrogen carrier gas possessed a fully dense microstructural coating, attributed to the hammering effect of dense Al2O3 particles. Moreover, these coatings showed lower porosity, enhanced microhardness, and reduced surface roughness compared to those deposited in compressed air carrier gas. Corrosion studies revealed that the Ni-Al2O3 CGDS coatings deposited with nitrogen carrier gas offered cathodic shielding protection and the best corrosion protection for the AZ91 magnesium alloy substrate.

Keywords : Ni-Al_2O_3 coating, Cold spray, Nitrogen, Compressed air, Magnesium, Corrosion protection.

WATER BASED ZERO VOC COATING TECHNOLOGY FOR CORROSION MITIGATION IN AGGRESSIVE ENVIRONMENT

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Global paint consumption is to the tune of USD 206 Bln with CAGR is over 9.2 %. Emissions from the paint is impacting environment and human health adversely. It is urgent need now that the paint industry looks beyond performance and focus on development of Green and sustainable coating formulations.

The present invention was aimed at developing formulation of water based green coating technology with high performance properties. The efforts were also made to make the coating system operational friendly to avoid human error during application of coating ensuring desired performance.

To achieve all desired performance properties, copolymer molecule was synthesized by synergizing properties of multiple monomers using water as a solvent. No other hazardous elements like coalescent agent, plasticizes etc were used which could impact environment adversely. The polymerization process was designed to achieve branched structure of polymer molecule by grafting polymer chains of multiple monomers in a specific manner.

The panels were coated with spray technique to achieve Dry film thickness of 100 microns by applying two coats without primer. The coated panels were cured and conditioned for 72 hours and mechanical tests like adhesion, flexibility, scratch hardness and impact were tested while chemical resistance was tested by exposing coated panels to salt spray, acid, alkali and aromatic hydrocarbons.

The present work offered solution to the concerns of sustainability and high-performance properties. The developed coating formulation is water based with no smell, no emissions and most importantly offers ZERO VOC feature. At the same time, it offers high resistance to corrosion, UV Radiations, abrasion resistance and resistance to aging and weathering necessary to protect substrates in the most aggressive conditions.

Keywords : Water Based, Zero VOC, Sustainable, High Performance.

ON-LINE PIPE BOTTOM CORROSION PROTECTION BY COMPOSITE WEAR PADS IN PETROLEUM, PETROCHEMICAL & FERTILIZER INDUSTRIES

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In process industries such as petroleum, petrochemical, and fertilizer sectors, large pipeline networks are essential for transporting fluids for processing. These pipelines, often positioned above ground, rest on metallic or concrete supports. During the monsoon, moisture accumulation at the intersection between the pipe bottom and its support is common, leading to pitting corrosion at the 6 o'clock position. Pitting can reduce wall thickness and hoop strength, eventually causing fluid leakage—a critical concern for operators. Thus, maintaining pipelines to an acceptable standard is paramount.

Current solutions include:

1. Metal sleeve/Corrosion Pad/Wear pad welding during pipeline commissioning.
2. Epoxy putty to bond metallic wear pads during plant maintenance.

Both solutions have limitations, prompting operators to seek innovative technologies to prevent pitting corrosion and extend the pipeline's service life without compromising its integrity.

Loctite has developed a composite wear pad that offers effective protection against pitting corrosion and wear at the pipe bottom during plant operations. The benefits include:

1. Elimination of metal-to-metal contact,
2. Prevention of crevice corrosion,
3. Strengthening of weakened pipe sections,
4. In-situ, on-line, and cold application,
5. Non-flammable material,
6. Enhance the service life of pipelines

Keywords : Composite Wear Pad, Metal-free, Pitting Corrosion Protection, Strengthening, Cold Repair.

ROLE OF MODIFIED AND UNMODIFIED MIXED FILLERS IN CORROSION PROTECTION OF NANO COMPOSITE COATINGS

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This study examines the role of surface modified and unmodified mixed-alumina nanoparticles of different sizes (100 nm and 300 nm) on the corrosion resistance of nano composite polymer coatings. Different sized filler ratios of P100+2P300 and 2P100+P300 are compared with single filler concentrations.

Characterization studies of fillers was performed using Scanning electron Microscopy (SEM) and Fourier transform Infrared Spectroscopy (FT-IR). Electrochemical impedance spectroscopy (EIS) was employed to study the corrosion resistance and Filler distributions were analyzed using Energy-Dispersive Spectroscopy (EDS). Water absorption test was performed to show the barrier performance diffusion of corrosive medium into the coated samples. Results indicated that the 2P100+P300 coatings showed significantly high corrosion resistance ($|Z|_{0.01}$ approaching 109Ω·cm²) after 480 hours of exposure than compared to other coated samples. Conversely, the P100+2P300 ratio showed decreased performance. These findings highlight the important role of filler morphology in determining the anti-corrosion properties of coatings.

Keywords : Nanocomposite coatings, Multi size fillers, anti-corrosion coatings, barrier property.

INNOVATIVE COATING SOLUTIONS FOR TINPLATE IN FOOD PACKAGING APPLICATIONS WITH SUPERIOR CORROSION RESISTANCE AND ADHESION STRENGTH

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In food packaging, tinplate materials require enhanced durability and mechanical properties to ensure product safety and longevity. This study addressed these needs by developing an advanced nanocomposite coating for tinplate, consisting of an epoxy matrix infused with reduced graphene oxide (rGO), Polycysteine (PC), and copper titanate ($CuTiO_3$) nanoparticles. The $CuTiO_3$ nanoparticles, functionalized with Polycysteine and anchored to rGO, were synthesized and incorporated into epoxy resin. The surface morphology and thermal stability of the synthesized nanocomposites were analyzed by SEM/EDX and TGA. The specimens were tested to assess the coatings corrosion resistance and mechanical properties. Electrochemical Impedance Spectroscopy (EIS) demonstrated that the nanocomposite coated tinplate exhibited superior corrosion resistance compared to conventional epoxy coatings. The Polycysteine component further provided antimicrobial efficacy, reducing microbial contamination risks and extending the lifespan of packaged goods. This work enhances the potential application of epoxy/rGO/PC/$CuTiO_3$ nanocomposite as a comprehensive solution for food packaging, protection against moisture and gas transmission, and sustained antimicrobial performance.

Keywords : Tinplate; Polycysteine; reduced Graphene oxide; CuTiO3; Biodegradable polymer; Nanocomposite coating; Antimicrobial.

BENZOTRIAZOLE-ENCAPSULATED POLYANILINE-ENWRAPPED POLY(UREA-FORMALDEHYDE) MICROCAPSULES-BASED COATINGS : A NOVEL APPROACH FOR SELF-HEALING AND REMARKABLY HIGH CORROSION INHIBITION PERFORMANCE

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Metal substrates are protected by replenishing coatings, which minimizes corrosion in chemical and petrochemical industries, refineries, maritime environments, automobiles, aerospace, defense, and railways sectors. The polymeric matrices enriched with different additives, fillers, and pigments are used for anticorrosive coating. In the last three decades, several technological developments have been made to enhance the anticorrosive properties of coatings and minimize the environmental footprints. Several two-dimensional nanostructured materials and their nanocomposites have recently been addressed as excellent corrosion-inhibiting fillers. However, their high cost, poor compatibility with the coating matrix, and processability at the industrial scale have been major setbacks for several applications. The present work demonstrates the design and synthesis of benzotriazole-encapsulated polyaniline-enwrapped poly(urea-formaldehyde) microcapsules (UF-BTA-PANI). The benzotriazole, a nitrogen-rich corrosion inhibitor, was encapsulated during the in-situ polymerization of urea-formaldehyde into microcapsules at a high agitation rate (8000 rpm). It was followed by the interfacial growth of polyaniline (PANI) on the surface of UF-BTA microcapsules. The UF-BTA-PANI microcapsules were thoroughly dispersed in the epoxy matrix to prepare the uniform coating (85-90 μm) on mild steel. The electrochemical (TAFEL and EIS) and salt spray tests showed remarkably high corrosion-inhibition performance of UF-BTA-PANI-based epoxy coating in an aggressive corrosive media (3.5% NaCl aqueous solution). The PANI on the surface of UF-BTA imparts electrochemical corrosion reactions to capture the electrons released during the anodic oxidation of iron and forms the protective layer for inhibiting corrosion. In the secondary layer of protection, after the failure of PANI, the microcapsules released the benzotriazole to extend the superior anticorrosive performance and protect the underneath mild steel by forming a thin film. The UF-BTA-PANI microcapsules-based epoxy coating showed significantly low current density (0.325 A.cm-2) and enhanced the protection efficiency of epoxy coating by 96.7%. Moreover, the UF-BTA-PANI-based epoxy coating didn't corrode even after 15 days of exposure to salty fog (3.5%), signifying the excellent self-healing performance of UF-BTA-PANI microcapsules for corrosion mitigation applications.

Keywords : Urea-formaldehyde microcapsule, self-healing coatings, corrosion control, mild steel, EIS.

CORROSION IN CONCRETE AND INFRASTRUCTURE

FIELD STUDIES ON ATMOSPHERIC CORROSION OF STEEL IN SOUTH-EASTERN REGION OF TAMILNADU

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Chloride induced corrosion of steel is one of the primary reasons for premature degradation of civil infrastructures. Corrosion of steel is dependent on several environmental factors, and hence vary from region to region. Civil infrastructures located in the peninsular India (with a coastline of ~6100km) is clearly vulnerable to chloride induced corrosion damage. In this paper, field experiments conducted to determine the atmospheric corrosion rate of steel in a coastal environment (near Rameshwaram in Tamilnadu) are presented. TMT, chromium steel and stainless steel specimens were considered. The study showed that the first-year corrosion rate may not always lead to conservative corrosion rate prediction under extended exposure as per ISO 9224. Corrosion mapping is therefore a vital engineering assignment to be taken up at the earliest to prevent future economic loss.

Keywords : Steel, Reinforcement, Corrosion, Concrete, Field study.

REVITALIZING WASTE: NEXT GENERATION SACRIFICIAL ANODES FROM ACTIVATED PIG IRON (API)

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Activated pig iron (API) is obtained as a by-product during steel making process by charging LD slag (by-product of BOF steel making process) into blast furnace using Tata Steel's patented technology. API has limited usage due to presence of active material as compared to traditional pig iron. Leveraging high reactivity of active material than Iron, a Activated Iron based sacrificial anode was explored as a cathodic protection method for steel structures. Sacrificial Anode Cathodic Protection is an established technique for preventing corrosion of metal in soil, seawater and concrete media. SACP works on the mechanism of naturally occurring electrochemical cell generated between itself (more reactive anode) & the metal to be protected (cathode). SACP has been used for corrosion protection of submerged structures, such as oil drilling platforms, offshore pressure vessels, ship hulls, and coastal bridges where rate of corrosion is high. Corrosion protection of steel in concrete structures has also become pivotal due to increased attacks through carbonation & chloride ingression in concrete. Zn, Mg & Al based products have been the standard offerings in the sacrificial anode market. API was tested in lab along with extensive field trials as a 'Sacrificial anode' to evaluate its efficiency to protect steel from corrosion in a given electrolyte media (e.g. sea water, cement concrete and soil). It was found that API shows very good result as a cathodic protection method in cement concrete. This paved way for producing an innovative value-added green product from effective waste utilisation as a galvanic protection method of concrete structures.

API has shown promising results to be used as potential material for sacrificial anode. The sacrificial nature of the blast furnace metal-based anodes is attributed to the API content, entrapped inclusions, and the formation of soluble ferrous compound. The present work focuses on the development of sacrificial anodes based on activated pig iron.

Keywords : Cathodic Protection; Activated blast furnace metal; sacrificial anode.

FINE-RECYCLED CONCRETE AGGREGATE BASED COMPOSITE COATINGS TO ENHANCE THE CORROSION AND BIOCORROSION RESISTANCE OF CONCRETE REINFORCING STEEL BAR

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Corrosion of concrete reinforcing steel bar (rebar) remains as a serious issue that significantly affect the sustainability of concrete infrastructures. Herein, we report the development of fine-recycled concrete aggregate (f-RCA) based composite coatings to effectively combat the biocorrosion under marine environmental conditions. The composite coating is developed through brush coating technique from a suspension prepared by using f-RCA and activated fly ash in 3:1 ratio, containing small proportions of poly vinyl alcohol (PVA) and cement. The biocorrosion resistance of the bare and surface modified rebars is evaluated in different bacterial suspensions (E. coli, B. subtilis, and seawater consortium). To effectively reduce the microbial reaction and thereby to enhance the biocorrosion protection, the composite coating is further modified by the integration of 0.3 wt.% reduced graphene oxide-zinc oxide (rGO/ZnO) particles. A plausible mechanism for the enhanced corrosion protection of the composite coated rebar in comparison with the bare rebar is discussed with the support of detailed characterization results.

Keywords : Concrete, rebar, composite coating, microbially influenced corrosion.

CORROSION PERFORMANCE EVALUATION OF MILD STEEL AND EPOXY-COATED STEEL REINFORCING BARS IN CEMENTITIOUS AND CHLORIDE-CONTAMINATED ENVIRONMENTS

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Corrosion of reinforcing steel in concrete is a critical concern for the durability and longevity of reinforced concrete structures. This study presents a comprehensive experimental evaluation of the corrosion performance of two types of steel reinforcing bars: Mild Steel and Epoxy-Coated Steel. Reinforcing bars with a 12 mm diameter and 50 mm length were used to conduct the experiments. The corrosion behavior of these bars was investigated in two different electrolytic environments: one containing a cement extract solution and the other a cement extract solution with corrosion inhibitors. Both solutions were tested with addition of 3.5% NaCl, simulating chloride-contaminated environments. to determine their effectiveness in reducing corrosion rates. Advanced electrochemical techniques, including linear Polarization Resistance (LPR), Electrochemical Impedance Spectroscopy (EIS), and Tafel plot analysis, were employed to accurately quantify the corrosion rates. The results of the study showed that the presence of corrosion inhibitors in the electrolyte significantly reduced the corrosion rate for all types of steel.

Keywords : Mild steel and Epoxy-Coated Reinforcing bars, corrosion inhibitor for concrete, electrochemical corrosion studies, corrosion rate.

THE PITTING CORROSION INHIBITION ABILITY OF ALKANOLAMINE (HEPZ) FOR STEEL CORROSION IN SIMULATED CONCRETE PORE SOLUTION ENVIRONMENT

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With the aim of reducing global warming, a new method using alkanolamines to simultaneously promote CO2 fixation for concrete structures with an ability to protect the rebars was developed. In this study, a detailed investigation of influence of Cl- on the corrosion of rebars was carried out by EIS, linear polarization, cyclic polarization and potentiostatic polarization. The results showed that Cl- induces pitting corrosion at more negative potential in simulated concrete pore solution (CPS). 1-(2-Hydroxyethyl)piperazine (HEPZ) inhibits the pitting corrosion significantly in CPS. The experimental results indicate that HEPZ acts as a promising candidate for CO2 capturing and corrosion inhibitor in CPS. It offers new insights for the potential utilization ensuring longevity and safety of vital civil infrastructures.

Keywords : CO2 capture, corrosion inhibitor, alkanolamine, HEPZ.

EVOLUTION OF ELECTROCHEMICAL BEHAVIOR OF FBE-TMT REBARS IN CHLORIDE ENVIRONMENT: A LONG-TERM COMPARATIVE STUDY

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In the context of modern infrastructure, particularly within India's diverse and challenging environmental conditions, the demand for robust and sustainable construction materials is crucial. Fusion Bonded Epoxy (FBE) coated TMT rebar's present an advanced technological solution by integrating the high mechanical strength and ductility of TMT rebar's with the superior corrosion resistance properties provided by FBE coatings. The engineering advantages of these rebar includes enhanced durability and longevity with reduced maintenance costs, improved infrastructural integrity in aggressive environments and can be laid in unstable soils and seismic areas. The present study investigates the potential impact of various steel rebars on the lifecycle of infrastructure projects. Experimental investigations were conducted on various steel rebars, like Bare TMT, CRS, and FBE-TMT rebars, immersed in cement extract solutions with varying Cl- concentrations (0% & 1%) over a 12-month period. Techniques such as OCP, EIS, and LPR were utilized to evaluate corrosion behavior. The study revealed FBE- TMT exhibited a most stable OCP range of -354 to -600mV in 1% chloride conditions among all rebars. Additionally, RCT values for FBE-TMT rebars demonstrated a 40-fold improvement compared to Bare TMT rebars over a 9-month exposure period. Furthermore, FBE rebars exhibited RP values around 4100 Ω cm^2, highlighting the superior corrosion performance by the epoxy coating in chloride-rich environments.

Keywords: Chloride induced corrosion, FBE-TMT rebar, Open circuit potential, Polarization resistance, Charge transfer resistance, Corrosion rate, Durability

PROACTIVE ASSESSMENT OF RC STRUCTURES WITH HALF-CELL POTENTIAL MAPPING AND GRADIENT ANALYSIS FOR PREDICTING CORROSION

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Distress in reinforced concrete (RC) structures can arise from various factors, necessitating comprehensive evaluations to determine effective remedial measures. This study discusses the method for assessing corrosion in RC structures using Half-Cell Potential (HCP) mapping and a newly developed Potential Gradient Analysis. The latter, a 2D representation of potential differences, identifies areas at risk of developing macrocell corrosion. A case study of a distressed RC structure demonstrates the methodology, highlighting the effectiveness of HCP mapping and Potential Gradient Analysis in distinguishing corrosion hotspots. These techniques enable proactive intervention strategies, offering a comprehensive approach to enhancing the durability and service life of RC structures.

Keywords : HCP map, delta plot, potential gradient, condition assessment, reinforced concrete.

CORROSION ISSUES IN BIOMATERIALS

CHALLENGES IN MATERIAL SELECTION FOR BIO-ATF PLANT

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Ever growing world energy demands, depletion of reserves and environmental concerns added impetus for development of eco-friendly, renewable and sustainable fuel options. This has resulted into emergence of biofuels from sustainable bio- resources.

Fuels of bio-origin, such as bio-alcohols, biodiesel, biogas, green diesel and Bio- Aviation Turbine Fuel (Bio-ATF) are potential alternatives. Among these, vegetable oil- based biofuel options i.e. biodiesel, green diesel and bio-ATF have become more attractive in recent times because of their ease of production from available vegetable oil feedstock options.

Hydroprocessing routes are used to convert vegetable oil as a feedstock to green diesel and Bio-Aviation Turbine Fuel (Bio-ATF). A bio-ATF plant is a facility that produces bio-aviation turbine fuel (bio-ATF), a renewable energy source for aircraft.

Bio ATF is a high-performance transmission fluid used in passenger cars, trucks, construction and mining equipment and more. Biofuels can reduce the environmental impact of fossil fuels by reducing greenhouse gas emissions, depleting exhaustible resources and reducing dependence on foreign suppliers.

The present review is on the challenges faced while selecting the metallurgy for Bio- ATF plant. This paper comprehensively elaborates on the corrosion issues and damage mechanisms that are anticipated and ways to select the appropriate and optimum metallurgy along with different corrosion control measures so that safe operation of Bio-ATF plant can be guaranteed.

Keywords : Bio fuels, Bio-ATF, Hydroprocessing, corrosion issues, damage mechanisms.

CAN PEOPLE CLIPPED WITH Ni- Cr ORTHODONTIC WIRE TAKE VODKA ORALLY ?

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Regularly arranged teeth are beautiful. But for some people God has provided irregular teeth arrangement. To regulate the teeth arrangement, Dentists make use of Orthodontic wires. After clipping with Orthodontic wires, people take orally many food items, beverage and tablets. These food items may corrode the Orthodontic wires. Apart from this the wire undergoes corrosion in the presence of Saliva. In the present work the corrosion resistance of Orthodontic wire made of Ni- Cr alloy in artificial saliva with and without a hard drink Vodka has been evaluated, by AC impedance of Spectra.

The corrosion behavior of Ni- Cr alloy was measured for the following system :

- Artificial Saliva.
- Artificial Saliva + Vodka.

- Artificial Saliva + Vodka + Water

During the experiment the charge transfer resistance (Rt), Impedance Value and Double Layer Capacitance were measured. This study leads to the following Conclusion.

The Corrosion resistance of Ni- Cr Orthodontic wire increases in the following order:

Artificial Saliva + Vodka + Water > Artificial Saliva + Vodka > Artificial Saliva.

It implies that people clipped with Orthodontic wire Ni-Cr need not hesitate to take Vodka drink orally with or without dilution.

Keywords : Corrosion resistance, Orthodontic wire, Ni- Cr, Artificial Saliva, Vodka

INFLUENCE OF ORACOOL MOUTHWASH ON THE CORROSION BEHAVIOR OF NI - CR ORTHODONTIC WIRE IMMERSED IN ARTIFICIAL SALIVA

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Properly aligned teeth are visually appealing. Nevertheless, certain individuals possess naturally misaligned teeth. To address this issue, orthodontists employ orthodontic wires. After the wires are installed, individuals ingest a range of food items, drinks, and medications, which can lead to the deterioration of the orthodontic wires. Furthermore, the wire undergoes corrosion upon contact with saliva. This research investigates the corrosion resistance of orthodontic wire made from Ni-Cr alloy in artificial saliva, examining both scenarios with and without the addition of Oracool mouthwash. The evaluation was performed using an electrochemical technique known as AC impedance spectroscopy. The corrosion properties of the Ni-Cr alloy were assessed for the subsequent systems.

- Artificial Saliva.
- Artificial Saliva + Oracool mouthwash.

The study encompassed the assessment of Charge Transfer Resistance (Rt), Impedance Value, and Double Layer Capacitance. This analysis yielded the following results.

The Corrosion resistance of Ni- Cr Orthodontic wire decreases in the following order.

Artificial Saliva + Oracool mouthwash > Artificial Saliva.

This indicates that individuals equipped with Ni-Cr orthodontic wire can be assured in their use of Oracool mouthwash.

Keywords : Corrosion resistance, Orthodontic wire, Ni- Cr, Artificial Saliva.

THE ABILITY OF 21 K GOLD TO RESIST CORROSION WHEN EXPOSED TO SIMULATED SWEAT THAT INCLUDES SODIUM CHLORIDE AND GLUCOSE EVALUATED BY POLARIZATION STUDY

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The corrosion resistance of 21 K gold was evaluated in simulated sweat that contained sodium chloride and glucose, utilizing polarization studies. The results indicate that individuals wearing 21 K gold jewelry or watches do not need to be concerned about high levels of chloride ions or glucose present in their sweat. Even when subjected to elevated concentrations of these substances, 21 K gold demonstrates considerable corrosion resistance in simulated sweat. This assertion is further supported by the increase in the linear polarization resistance (LPR) value and the decrease in the corrosion current value observed under these conditions.

Keywords : Corrosion resistance, Gold 21 K, simulated sweat, Sodium chloride, Glucose, Polarisation study.

TUNING THE MICROSTRUCTURAL CHARACTERISTICS AND CORROSION PROPERTIES OF TITANIA NANOTUBES BY VARYING FLUORIDE ION CONCENTRATION

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Titania nanotubes have gathered noteworthy interest due to their excellent mechanical and corrosion resistance properties. They show potential applications in fields such as orthopaedic implants, biomedical devices and drug delivery. Since titanium is inherently bioinert, it does not interact with living tissue. Consequently, specific surface modifications have been applied to convert the surface into a bioactive state, enabling the material to interact with living tissue and promote the osseointegration process. This work systematically varies fluoride ion concentrations during the anodization process, leading to alterations in the nanotube morphology, including tube diameter and surface area. The surface morphology has been examined by scanning electron microscopy (SEM). The electrochemical studies have been performed by Potentiodynamic polarization studies to monitor the corrosion resistance behavior of the samples. The obtained results elucidate the microstructural changes induced by varying fluoride ion concentration. Among the various fluoride ion concentrations employed, the 0.5M fluoride sample showed better tube morphology and corrosion resistance implicating positive response for orthopedic application.

Keywords : Titania nanotubes, corrosion, bioactive, fluoride concentration.

DUAL-STEP ANODIZED TITANIA NANOTUBE ARRAYS FOR SUPERIOR CORROSION RESISTANCE IN BIOMATERIAL APPLICATIONS

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In recent years, titanium has become the predominant biomaterial for dental and orthopedic implants. The natural ability for osseointegration results from the titanium-based implants and their corresponding bioactivity mechanisms. The titania nanotube arrays (TNTA) enable the establishment of a functional and structural link between the host bone tissue and titanium implant. This relationship is now effectively achieved through the osseointegration process, which is facilitated by the enhanced biocompatibility of the titanium implant. Titania nanotube arrays also reduce the release of metal ions from the implant surface, which promotes the corrosion resistance behavior when compared with bare titanium. This paper presents a comparative analysis of the fabrication of titania nanotube arrays using two-step anodization in an organic electrolyte, with varying applied potential during the second step of anodization. The

characterization techniques included Attenuated Total Reflectance Fourier Transform-infrared spectroscopy (ATR FT-IR), X-ray diffraction (XRD), High Resolution Scanning Electron microscope (HR-SEM) and wettability measurements. The results of electrochemical studies, such as the potentiodynamic polarization of titanium nanotubes, show enhanced corrosion resistance behavior in simulated body fluids.

Keywords : Two step anodization, Titania nanotube arrays, Water contact angle, Potentiodynamic polarization.

CUSTOM-ENGINEERED BIOACTIVE GLASS COATING ON TITANIUM IMPLANTS FOR ENHANCED BIOACTIVITY AND DURABILITY

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Titanium and its alloys are widely used in bone repair and restoration due to their exceptional mechanical strength and biocompatibility. However, their inherent bio-inertness limits their ability to effectively integrate with bone tissue. To overcome this limitation, a coating of europium-doped bioglass was applied to the surface of the titanium to enhance its biological activity. Bioglass, an alloplastic material, comprises a silica matrix doped with calcium and phosphorus. These dopants promote bone regeneration and expedite integration with the body. The europium-doped bioglass coating was uniformly applied to the surface of the titanium. The presence and semi-crystalline nature of the coating were confirmed through IR spectroscopy and X-ray diffraction (XRD) analysis. Potentiodynamic polarization and electrochemical impedance spectroscopy indicated a reduced degradation rate of the coated titanium, demonstrating improved durability. Furthermore, in-vitro biomineralization studies confirmed the bioactivity of the coating, while cell adhesion assays demonstrated that the coating effectively supported cellular attachment to the titanium surface.

Keywords : Europium, Bioglass, Titanium.

BIOACTIVITY AND CORROSION RESISTANCE OF ZIRCONIA NAOTUBES IN STIMULATED BODY FLUID SOLUTION

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Zirconia (ZrO2) has been widely used as biomaterial, catalysts and as coating for corrosion protection of various materials. For biomaterials, surface modification of implant material is essential for better bioactivity and osseointegration. For decades, the electrochemical anodization of aluminum (Al), titanium (Ti), zirconium (Zr) and other metals has been widely valued. The formation of one-dimensional (1D) nanostructures like nanorods and nanotubes has attracted a lot of interest as those structures can be potentially implemented in wide range of novel materials. This is due to the large surface to volume ratio of the nanotubular structure, which evidently could increase the surface for cell-cell interaction to occur. The formation of the nanotubular structure can be done by direct anodization of zirconium in fluoride-containing electrolyte.

Keywords : Zirconium; Zirconium nanotubes (ZNT's), Organic and inorganic electrolyte; Ammonium fluoride

POSTER PRESENTATION

FORMULATION OF SCHIFF BASE WITH ALKYL HALIDE AS A CORROSION INHIBITOR FOR OIL AND GAS INDUSTRIES

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Corrosion poses a significant challenge in industrial environments, particularly within oilfields, where acidic conditions can rapidly degrade metal surfaces, leading to costly equipment damage and failures. To combat this, effective corrosion inhibitors are crucial for protecting metal surfaces and prolonging material lifespan under these harsh conditions. Surfactant-based inhibitors, created by combining a Schiff base with an alkyl halide like bromo-decane, are recognized for their effectiveness in acidizing processes and acidic oilfield environments. These inhibitors feature a polar "head" and a non-polar "tail." The polar head binds to the metal surface through physical and chemical interactions, creating an insoluble protective layer, while the non-polar tail hinders contact between the metal and corrosive ions, enhancing the inhibitor's protective performance. Additionally, increasing the molecular size of the compound can improve inhibition by providing greater surface coverage on the metal.

In our research, we have focused on developing a thiosemicarbazide-based Schiff base combined with bromo-decane to mitigate the corrosion of mild steel in a 1 M HCl solution. The anti-corrosion effectiveness of these synthesized inhibitors was assessed using gravimetric methods, electrochemical impedance spectroscopy (EIS), and potentiodynamic polarization (PDP) measurements. Furthermore, field emission scanning electron microscopy (FE-SEM) was employed to examine the metal surface structure after exposure to the corrosive medium, both with and without the synthesized inhibitors.

Keywords : Corrosion inhibitor, surfactant, mild steel, EIS, gravimetric analysis.

PHOTOCATHODIC CORROSION PROTECTION OF PHOTOVOLTAIC PANELS USING TIO_2/CUO HETEROSTRUCTURE

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Corrosion of steel in various environments presents a significant challenge, requiring effective mitigation strategies. This study addresses the limitations of TiO_2 based photocatalysis such azs its wide band gap, low light utilization efficiency, and rapid charge recombination by incorporating CuO to enhance performance. TiO_2/CuO heterostructures, with varying CuO weight percentages, were prepared using the sol-gel method and coated onto 304SS alloy, followed by sintering at 450°C. Characterization through SEM confirmed the uniformity and microstructure of the coatings. AFM analysis displayed a porous surface with pore sizes ranging from nanometers to sub-micrometers. Electrochemical tests in a 3.5% NaCl solution, conducted both in the dark and under illumination, demonstrated that the TiO_2/CuO (0.005%) heterostructure extends photocatalytic activity into the visible light spectrum and significantly enhances photocurrent density. These findings highlight the potential of TiO_2/CuO heterostructures to improve charge carrier separation, offering a sustainable coating solution for photocathodic corrosion protection in renewable energy applications.

Keywords : Photo cathodic corrosion protection, Stainless steel, Titanium dioxide, Copper oxide.

TIO2/C3N4 HETEROSTRUCTURES FOR SUSTAINABLE PHOTOCATHODIC PROTECTION OF AA2024 ALLOY IN SOLAR ENERGY SYSTEMS

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In this study, TiO_2 with various weight percentages of C_3N_4 heterostructure was successfully prepared and coated on AA2024 alloy using the sol-gel method. X-ray diffraction (XRD) confirmed the tetragonal structure of anatase TiO_2 and the in-plane structure of tri-s-triazine units, while the interaction between TiO_2 and C_3N_4 showed a red shift in the Raman spectrum and bond length changes in FTIR spectroscopy, indicating the formation of the TiO2/C3N4 heterostructure. Topographical analysis revealed a uniform porous coating with pore sizes ranging from nanometers to sub-micrometers. Electrochemical tests in 3.5% NaCl, conducted in dark and light, demonstrated that the TiO2/C3N4 heterostructure enhances electron transfer, reduces recombination, and provides effective corrosion protection. The AA2024 alloy coated with TiO2/C3N4 (0.01g) using two consecutive spin coatings exhibited superior photocathodic corrosion protection under illumination, extending the lifespan of solar panel frames, supporting the sustainability goals in the renewable energy sector.

Keywords : Photocathodic corrosion protection, C_3N_4, TiO_2, AA2024, sustainable solar energy application.

DEVELOPMENT, STABILITY ASPECTS OF ENCAPSULANTS BASED ON THERMOPLASTIC POLYURETHANES FOR PEROVSKITE SOLAR CELLS

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Hybrid organic-inorganic metal halide perovskite solar cell (PSC) technology is experiencing rapid growth due to their simple solution chemistry, high power conversion efficiency (PCE) and potential for low-cost mass production. Nevertheless, the primary obstacle preventing the upscaling and widespread outdoor deployment of PSC technology is the poor long-term device stability which stems from the inherent instability of perovskite materials in the presence of oxygen and moisture. To address this issue, in this work, we have synthesised a series of thermoplastic polyurethanes (TPU) through a rational design by utilising polyols having different molecular weights and diverse isocyantes (aromatic and aliphatic). Thorough characterisation of these TPUs (ASTM and ISO standards) along with structure-property relationship studies were carried out for the first time and were then used as encapsulation material for PSC. The prepared TPUs are robust, adhered well with the glass substrate and the use of low temperature during encapsulation process avoided the degradation of perovskite absorber and other organic layers in the device stack. The encapsulated devices retained more than 93% of their initial power conversion efficiency (PCE) for over 1000 hours after exposure to harsh environmental condition such as high relative humidity (80±5% RH). Furthermore, the encapsulated perovskite absorbers showed remarkable stability when soaked in water. This article demonstrates the potential of thermoplastic polyurethane as a suitable and easily scalable encapsulant for PSCs and pave the way towards extending the lifetime and commercialisation of PSCs.

Keywords : perovskite solar cells, thermoplastic polyurethanes, encapsulation, stability, moisture barrier.

ENHANCING THE CORROSION RESISTANCE OF STEEL REBAR IN CONCRETE WITH CORROSION-RESISTANT MINERAL ADDITIVES

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Corrosion of steel rebar embedded in concrete is a significant issue that affects the durability and longevity of reinforced concrete structures. This study investigates the effectiveness of incorporating corrosion-resistant mineral additives into concrete to enhance the protection of steel rebar. Various mineral additives, known for their corrosion-inhibiting properties, were evaluated for their impact on the concrete's ability to protect embedded steel from corrosion. The experimental program involved preparing concrete mixes with commercially available mineral additives, followed by an assessment of their corrosion resistance through accelerated testing methods. The results indicate that the inclusion of specific mineral additives significantly improves the concrete's resistance to corrosive environments, as evidenced by reduced corrosion rates and enhanced structural performance. These findings suggest that using corrosion-resistant mineral additives in concrete can be a viable strategy for extending the service life of reinforced concrete structures, offering practical benefits for construction and infrastructure applications. This research provides valuable insights into effective strategies for mitigating corrosion and improving the durability of concrete infrastructure.

Keywords : Corrosion, steel, additive, concrete.

EFFECT OF MECHANICAL MILLING ON AQUEOUS CORROSION OF THERMAL SPRAYED CONICRALY ON INCONEL 718 SUBSTRATE

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Mechanical milling for nanocrystallization is one of the processes to improve various physical and chemical properties of the materials. In the present study, nanocrystalline CoNiCrAlY powder has been synthesized by mechanical milling and has been subjected to coating on INCONEL 718 substrate by high velocity oxyfuel (HVOF) and Air plasma spraying (APS) techniques. Followed by coating, a detailed evaluation of corrosion behavior of the coated surface has been carried out in a 3.5 wt.% NaCl solution by potentiodynamic polarization study and electrochemical impedance spectroscopy. Commercially available CoNiCrAlY powder was milled for 10 and 25 hours using stearic acid as a process control agent (PCA) in a tungsten carbide (WC) ball and vial at a speed of 300 RPM. A 150 µm thick coating of both as-received and milled powders was sprayed onto Inconel 718 using the High-Velocity Oxy-Fuel (HVOF) and Air Plasma Spray (APS) technique. The microstructure of the coating consists of □ (Co, Ni, Cr), □'(Co, Ni)3Al and □ (Co, Ni)Al phases. A significant improvement in corrosion resistance was observed in 25 h milled CoNiCrAlY as compared to as-received one due to uniform distribution of □ phase along the matrix. The study established a relationship between corrosion resistance, crystallite size, and microstructure, highlighting how these factors influence the overall performance of coatings. A comparison of the coating HVOF coating shows superior corrosion resistance than plasma spraying. It also compared the benefits of mechanical milling in improving the properties of coatings applied using High-Velocity Oxy-Fuel (HVOF) and Air Plasma Spray (APS) techniques.

Keywords : HVOF Spray, Air Plasma Spray, CoNiCrAlY, Aqueous corrosion, Ball milling.

INFLUENCE OF MULTIFUNCTIONALIZED OXIDE AND SULPHIDE OF MANGANESE NANOPARTICLES INCORPORATED GRAPHENE OXIDE ON THE CORROSION RESISTANCE AND MECHANICAL PERFORMANCE OF EPOXY COATINGS IN HARSH ENVIRONMENT

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This study investigates the incorporation of multifunctionalized manganese oxide (MnO_2) and manganese disulphide (MnS2) nanoparticles into graphene oxide (GO) to enhance the corrosion resistance and mechanical properties of epoxy coatings. The epoxy coatings were systematically reinforced with varying concentrations of MnO_2-MnS2/GO nanocomposites and applied to metal substrates exposed to harsh environmental conditions, including high salinity and humidity. The morphological characteristics of the nanocomposites were examined using scanning electron microscopy (SEM)a and thermal stability was analysed by thermogravimetric analysis (TGA). Electrochemical impedance spectroscopy (EIS) and potentiodynamic polarization tests were conducted to assess the corrosion resistance of the coated samples. Results demonstrated that the MnO_2-MnS2/GO nanocomposites significantly improved the barrier properties of the epoxy coatings, leading to enhanced corrosion protection. The synergistic effects of MnO_2 and MnS2 nanoparticles with GO contributed to the formation of a dense and uniform coating structure, effectively mitigating corrosion and mechanical degradation. This study highlights the potential of MnO_2-MnS2/GO nanocomposites as effective multifunctional fillers for advanced protective coatings, offering promising applications in industries requiring high-performance corrosion-resistant materials.

Keywords : Nanocomposite; MnS2/MnO2 nanoparticles; Anticorrosion; Mechanical properties.

EFFECT OF INCORPORATION OF EPOXY/SILANES/NANO ALUMINA COMPOSITE COATINGS FOR THE PROTECTION OF MILD STEEL IN REINFORCED CONCRETE STRUCTURES

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Corrosion is a major problem to ensuring the structural integrity and durability of reinforced concrete especially for on-shore and off-shore structures. The silane functionalized Nanoalumina particles were incorporated in Epoxy to produce Epoxy/silanes/Nano alumina composites. This study investigates sustainable reinforced concrete which comprises of cement, fine aggregates which is mixed with Epoxy/silanes/Nano alumina nanocomposites. In this study, the feasibility of Epoxy/silanes/Nano alumina composites into the mild steel rod were done to improve the corrosion resistance and durability of the concrete. The surfaces of nano alumina were altered with 3-aminopropyltrimethoxysilane (APTMS) and analyzed by X-ray diffraction (XRD) studies. The corrosion resistance of newly synthesized Epoxy/silanes/Nano alumina composite reinforced mild steel was evaluated by electrochemical impedance spectroscopy (EIS), potentiodynamic polarization (PDP) studies, and scanning electrochemical microscopy (SECM) kept under the natural seawater for several days. The Epoxy/silanes/Nano alumina composite coatings showed a huge resistance against corrosion with a charge transfer resistance of over the bench mark value, which were more than that of the epoxy coating after 90 days immersion in seawater. The coating with nano alumina modified by APTMS showed no significant penetration by corrosive ions during 90 days immersion due to the strong chemical bonding between amino/epoxide/ethyl groups on nano alumina and the sulfur of epoxy. Decreased current was detected at the scratch of investigated nanocomposite coatings by SECM analysis. The affinity between epoxy and silanes/ nano alumina composites is enhanced due to their interfacial interactions, which improves the dispersion of silane functionalized nano alumina in epoxy to produce uniform coatings. Scanning electron microscopy/energy dispersive X-ray analysis (SEM/EDX) and XRD technique of synthesized nanocomposite coatings confirmed the presence of corrosion products which block the dissolution of mild steel. Investigated coatings had good mechanical properties based on the experimental studies. This nanocomposite coating material offers an effective way to reduce early oxidation in steel structures, making it a useful tool in construction projects intended to ensure the prolonged lifespan of mild steel.

Keywords : Corrosion, mild steel, Epoxy, Epoxy/silanes/Nano alumina, APTMS, Nano composites, PDP, EIS, SECM, SEM/EDX, XRD, sustainable reinforced concrete, coatings.

NANOCOMPOSITE MODIFIED ANTICORROSIVE COATINGS

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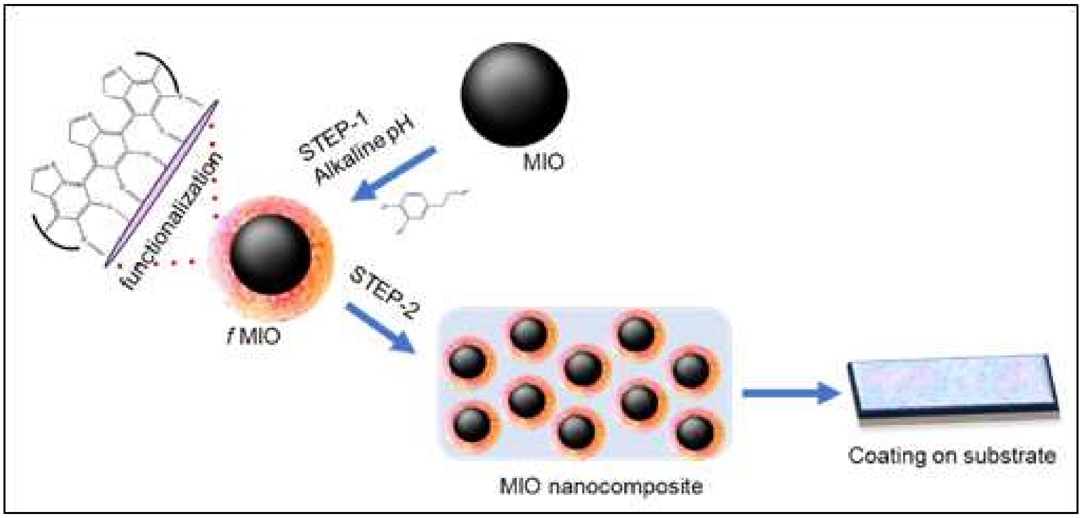
GRAPHICAL ABSTRACT



Eas steel, concrete, wood, and light metals. These coating possess good adhesion, good insulation, high chemical resistance, gopoxy protective coatings are often used on various substrates such mechanical performance depending on the modification according to the application. Herein, an attempt has been made to develop an eco-friendly anticorrosion pigment based on magnetic iron oxide nanoparticles as modifying agent for epoxy coatings (fMIO nanocomposite coating). MIO were synthesized by co-precipitation method and further functionalized with self-oxidizing polydopamine coating to enhance their interfacial bonding within the polymeric matrix. The optimization of the functionalization process involved by varying concentration, pH, time etc. As-synthesized as well as functionalized fMIO nanocomposite were confirmed by various characterizations and showed enhanced performance.

Keywords : Anti-corrosion, Nanocomposite, Epoxy, Functionalized MIO.

MECHANICAL, TRIBOLOGY AND CORROSION PROPERTIES OF CERAMIC COATED MG ALLOY THROUGH THERMAL SPRAY COATING METHODS

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Thermal spray technology has employed in this present investigation on cast Mg alloy. It is an versatile technique that is used in many different fields to improve the endurance of materials and modify their surfaces. Hard ceramic coating is employed on cast Mg alloy which is reducing wear and friction, strengthening resistance to oxidation at high temperatures, and improving resistance to corrosion. The study investigates the latest developments in thermal sprayed coatings and how well they enhance wear resistance and decrease friction. This study explores the effects of nano particle addition during coating process thus refines the microstructure, alter the composition, and improving the mechanical properties. The coatings behaviour in tribological aspects mainly depends on a variety of unique features, including mechanical properties, porosity, microstructure. The conclusion from the work is tribological properties of these coatings was significantly improved by heat treatment and refining procedures.

Keywords : cast Mg alloy; mechanical properties; porosity; microstructure; ceramic coating.

REVOLUTIONARY SUPERHYDROPHOBIC CONCRETE INTEGRATING REDUCED GRAPHENE OXIDE AND SILANISED NANO-ZIRCONIA FOR ENHANCED DURABILITY AND SELF-CLEANING CAPABILITIES

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This study presents a novel superhydrophobic concrete composite by integrating reduced graphene oxide (RGO) and silanised nanozirconia (S-ZrO_2) to achieve superior anti-corrosion, self-cleaning, and durability properties. The synergy between RGO and S-ZrO_2 imparts remarkable hydrophobicity and mechanical strength to the concrete matrix, addressing critical challenges in infrastructure sustainability. Comprehensive characterisation through water contact angle measurements, scanning electron microscopy (SEM), and durability tests demonstrates the effectiveness of this innovative approach. The cement hydration products and morphology were analysed after the addition of hydrophobic SF. The contact angle of the integral hydrophobic cement mortar surface arrived 154.5–155.7□. The SC has a lower corrosion current density (Icorr = 1.878 × 10− 6 A□cm−2). The results indicate that our superhydrophobic concrete exhibits exceptional resistance to water penetration and surface contamination, significantly prolonging the lifespan of concrete structures in harsh environmental conditions. This advancement opens new pathways for sustainable construction materials, promising reduced maintenance costs and enhanced performance of concrete infrastructures.

Keywords : Superhydrophobic concrete; Reduced graphene oxide; Silanised nanozirconia; Durability; Self-cleaning; sustainable.

ENHANCING MILD STEEL CORROSION RESISTANCE IN THE ACIDIC MEDIUM THROUGH SCHIFF BASE COMBINED WITH INORGANIC COMPOUNDS

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Combining organic and inorganic molecules can create highly effective corrosion inhibitors (CIs). Organic molecules typically form an insoluble protective layer on the metal surface through physical and chemical adsorption, utilizing lone pairs and π electrons. Adding inorganic molecules to the inhibitor formulation can further boost anti-corrosion performance, enhancing the protective effects on the metal. The present research is focused on developing N1, N2-dibenzylideneethane-1,2-diamine (CI1) and N^1, N^2-Bis(4-(dimethylamino) benzylidene)ethane-1,2-diamine) (CI2) schiff base along with potassium iodide (KI) and assessing their corrosion protection effectiveness on mild steel (MS) in an acidic solution. Corrosion inhibition studies on MS were performed in a 1 M hydrochloric acid solution using electrochemical impedance spectroscopy (EIS) and potentiodynamic polarization (PDP) techniques. Furthermore, the corrosion inhibition performance of the inhibitors combined with KI was evaluated using scanning electron microscopy (SEM) after a 4 h sample immersion in 1M HCl. The maximum efficiency achieved with CI1 was 95.89%, while CI2 reached 92.02% in 1M HCl. Upon the addition of KI, the efficiencies of CI1 and CI2 increased to 97.26% and 95.07%, respectively, as determined by electrochemical analysis.

Keywords : Corrosion inhibitors, carbon steel, EIS, potentiodynamic polarization.

CORROSION BEHAVIOR OF STRONTIUM INCORPORATED TITANIA NANOTUBE ARRAYS FOR ORTHOPEDIC APPLICATIONS

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Titanium metal is used in the field of biomaterials due to its high corrosion resistance and biocompatibility. Strontium is widely used in the field of biomedical applications due to its superior biological properties of inhibiting bone resorption and promoting osteogenesis. Sr2+ ions are an absolute activator of calcium-sensitive receptor and its efficacy is close to that of Ca2+ ions. This is because the ionic properties of Sr2+ and Ca2+ are quite comparable. Strontium incorporated biomaterials significantly enhanced the osteogenic differentiation and biocompatibility. The interaction of Sr2+ ions in the bone tissue is similar to that of Ca2+ ions. Sr2+ ions are incorporated on the surface of titania nanotube arrays by electrophoretic deposition method, sintered the coated samples at the temperature of 400 for 2 hrs. The morphology of the coated metal was characterized by Scanning Electron Microscopy with Energy Dispersive Analysis to confirm the deposition of strontium on the titanium metal surface. The functional group was analyzed by Fourier Transform Infrared Spectroscopy and the phase angle of coated sample was analyzed by.The Electrochemical corrosion behavior of the coated sample was studied by potentiodynamic polarization method and electrochemical impedance spectroscopy.

Keywords : Titania Nanotube arrays, Strontium, Corrosion Resistance, Biocompatibility.

INFLUENCE OF VOLTAGE AND FLUORIDE CONCENTRATION ON THE FORMATION OF ZIRCONIUM NANOTUBES AND THEIR ELECTROCHEMICAL BEHAVIOUR FOR BIOMEDICAL APPLICATIONS

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The development of biocompatible nanostructured surfaces on zirconium-based implants has garnered significant attention due to their potential to enhance osseointegration and reduce bacterial adhesion. Zirconium's favourable mechanical, physical and biological properties make it a promising material for biomedical applications, but its bio-inert nature prevents direct bonding with bone. In order to enhance osseointegration and corrosion resistance, the surface of zirconium has been modified through electrochemical anodization to enhance its osseointegration and corrosion resistance. In this study, we investigated and optimised the formation of zirconia nanostructures (ZNS) via anodization using a fluoride-containing electrolyte. Key anodization parameters such as voltage, time, electrolyte concentration, and temperature, were optimized. The effects of voltage and fluoride ion concentration on the formation of the ZNS surface were systematically studied. The surface characteristics of ZNS were analysed using Attenuated Total Reflection Infrared Spectroscopy (ATR-IR) and Field Emission Scanning Electron Microscopy (FE-SEM). Their electrochemical behaviour was analysed by potentiodynamic polarisation and electrochemical impedance technique. In vitro immersion studies were conducted by immersing the substrates in Hanks' solution for 7 days to evaluate their ability to form hydroxyapatite. Our results showed improved surface properties and demonstrated the critical role of electrochemical behaviour and surface-to-volume ratio in enhancing zirconium's potential for orthopaedic applications. This work contributes to the understanding of surface modification techniques to improve the bioactivity of zirconium-based implants.

Keywords : Zirconium nanotubes; orthopedic; corrosion; implants; Surface modification.

ZIRCONIUM WITH HYALURONIC ACID COATING AZ31 MG ALLOY : ELECTROCHEMICAL CHARACTERISTICS AND IN-VITRO BIOACTIVITY FOR BIOMEDICAL APPLICATIONS

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The application of magnesium (Mg) alloy implants is currently increasing in biomedical applications such as cardiovascular stents and orthopedics because of its outstanding biocompatibility, lightweight nature, high strength-to-weight ratio, ease of fabrication, and biodegradability. However, the main problem with them is that they corrode easily in physiological conditions. The present work improves corrosion resistance and biocompatibility on AZ31 Mg alloy by applying a hybrid zirconia and hyaluronic acid coating. Findings show that the structure of the nano-spherical agglomeration was produced. The corrosion studies of zirconia coating have enhanced the corrosion resistance of the base material. The H2 evolution studies were examined by body fluid solution, which shows the hybrid coating has reduced the degradation rate of the base material. Hence, with improved biological activity and corrosion resistance, the biocompatible coating was developed and is being utilized in implant applications.

Keywords : Zirconium, AZ31 Mg alloy, Corrosion resistance.

DESIGNING OF ANTI-CORROSION SURFACE WITH PCL COMPOSITE COATING ON Lys-TNTs FOR BONE IMPLANT

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Effective technique employed to accelerate the bone regeneration from post–surgeries are more focus area in research community. The faster and complete healing from post-surgeries is main strategy to overcome problems like infection, inflammation, implant loosening and encapsulation of fibrous tissue. The surface modification of long implant titanium through various methods results in improved bio-compatibility, increase the osseintegration process in higher rate. This work investigates the L-lysine(lys) was introduced on Titania nanotubes (TNTs) for better osteoblast cell function along with enhance apatite formation for strong interaction between bone and implant material, and polycarprolactone/zinc oxide nanoparticle was deposited on the lysine coated TNTs to avoid the complication of bacterial infection and inflammation response from post-surgery. The novel hybrid composite coting was optimized using electrophoretic technique at various voltage. The morphology of coated sample was analyzed in Scanning Electron Microscope (SEM) and chemical composition of coating was identified through EDS/EDX spectrum of SEM. The corrosion behavior of the coated materials and bare Titanium were evaluated using electrochemical impedance spectroscopy in Hank's solution. The result of corrosion studies which is evaluated in hank's solution medium confirmed the composite coated TNT exhibit better solution resistance in low frequency region and supports the better osseintergation between bone and implant.

Keywords : Composite coating, Titania nanostructure, Potentiodynamic polarization, Localized corrosion behavior, Electrochemical Impedance Spectroscopy.

A NOVEL MULTIFUNCTIONAL MXENE/NANOALUMINA HYBRID FOR EPOXY RESIN WITH SIMULTANEOUSLY IMPROVED ANTICORROSION AND MECHANICAL PROPERTIES

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Mxene flakes show the great potential in corrosion protection area owing to their lamellar structure and remarkable mechanical features. However, these flakes are highly susceptible to oxidation, which results in their structure degradation and restrict their application in anti-corrosion field. However, the preparation of anticorrosive MXene polymer nanocomposites has been hindered due to the MXene poor interfacial compatibility with the polymer matrix. To solve this problem, nano-alumina was deposited on the surface of MXene by treating with a silane coupling agent. The modified-MXene (m-MXene) was proved TGA (Thermalgravimetric analysis) and SEM (scanning electron microscopic), The effects of modified-MXene (m-MXene) on the epoxy performance were studied by comparing the performances of epoxy and m-MXene/epoxy. The related results showed that m-MXene could significantly enhance the anticorrosion performance of epoxy. The modified-MXene (m-MXene) inclusion into the epoxy coating and their corrosion performance in 3.5 wt.% NaCl solution was evaluated through electrochemical techniques including open circuit potential (OCP) and electrochemical impedance spectroscopy (EIS) along with salt spray. Results indicated that m-MXene/epoxy presented superior anti-corrosion capability with the coating resistance of 1.73E12 Ω.cm2 after 45 days' immersion in chloride environment, which were 7 orders of magnitude higher than that of the pure epoxy coating. Scanning electron microscope (SEM) and salt spray images demonstrated that the epoxy coating loaded with m-MXene nanosheet could provide robust corrosion protection for mild steel.

Keywords : 2D materials, MXene, Nanoalumina, anticorrosion, polymer composites, coatings, mechanical properties.

ENHANCEMENT OF CORROSION RESISTANCE IN LOW-CARBON STEEL USING SILICON CARBIDE (SIC) NANOPARTICLES-INFUSED CALCIUM ALUMINATE CEMENT COATINGS

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Ensuring the durability and structural integrity of steel structures presents a significant challenge, particularly in harsh environmental conditions. This study investigates the potential of incorporating silicon carbide (SiC) nanoparticles into calcium aluminate cement (CAC) coatings to enhance the corrosion resistance of low-carbon steel (LCS). CAC is a promising alternative to conventional organic coatings due to its excellent corrosion resistance and environmental sustainability. SiC nanoparticles are added to CAC coatings to improve their protective qualities and extend the lifespan of steel components. The characterization of the CAC/SiC coatings was performed using scanning electron microscopy (SEM), energy-dispersive X-ray spectroscopy (EDS), and X-ray diffraction (XRD). The corrosion resistance of these coatings was evaluated through Tafel polarization and electrochemical impedance spectroscopy (EIS) in a 3.5% NaCl solution. The results revealed that CAC coatings containing SiC nanoparticles, especially at higher concentrations, demonstrated superior corrosion resistance. EIS measurements showed notable improvements in coating resistance and charge transfer resistance, indicating robust corrosion protection. Accelerated corrosion tests confirmed that SiC effectively prevents coating delamination, and the adhesion strength of the CAC/SiC coating underscored its durability. Minimal weight loss and adhesion degradation were observed after 28 days in a corrosive NaCl environment, demonstrating the long-term durability of the CAC/SiC coatings. These findings suggest that SiC-enhanced CAC coatings provide an effective solution for improving the corrosion resistance of LCS, thereby extending the service life of steel structures.

Keywords : Calcium aluminate cement, Low-carbon steel, Corrosion resistance, SiC nanoparticles, Cementitious coatings, SEM, XRD, EDS, Durability.

CORCON
CONFERENCE SUPPORTERS

ELECTROTHERM® (India) Limited (Steel Division)

Brief History of Electrotherm (India) Limited

Electrotherm (India) Limited, ISO 9001:2015, ISO 14001:2015, ISO 45001:2018 & ISO 50001:2018 certified and public limited company, was founded in 1983 to cater the needs of all segments of steel industries, foundries and heat treatment industries. Electrotherm deals with business segments such as steel & pipe, steel plant equipments, transformer manufacturing, battery operated electrical vehicles, renewable energy, transmission line tower and education.

Today, Electrotherm is a multidivisional global company which has supplied more than 6000 equipments related to steel plant across 71 countries around the world in just 39 years. Engineering & Technology division of Electrotherm is a customer centric sector delivering total solutions of steel plant from conceptualization to commissioning. It is particularly renowned for providing end-to-end solutions for steel melting shops from raw materials like iron ore to long / flat product.

Electrotherm has full-fledged Research & Development Centre at its Corporate Office & Works located at Ahmedabad with the state-of-the-art manufacturing set-up.

Electrotherm Steel Division has the State-of-the-art fully integrated steel plant commenced in 2005 at Samakhiyali, Kutch (Gujarat). Electrotherm Steel Division makes different products such as TMT Bar, Epoxy Coated TMT Bar, Cut & Bend TMT Bar, Round Bar and Ductile Iron Pipe. The integrated facilities having Sponge Iron Plant, Steel Melting Shop, Ladle Refining Process (a unique & patented ELdFOS™ metallurgical process), Rolling Mill, Epoxy Coating Plant, Cutting & Bending Facility, Blast Furnace & Sinter Plant, Ductile Iron Pipe Plant and utilities (CPP & Gas Plant).

FBE coating is widely used to protect concrete TMT bars from corrosive environment used in construction. The epoxy coated bars last longer due to the protective film and thereby contribute to the quality of construction. Electrotherm sponsored CSIR-CECRI, Tamilnadu a project for the comparison of corrosion rate of Epoxy coated TMT, Bare TMT and CRS TMT bar. Epoxy coated ET TMT bar has 12 times higher life compared to Bare TMT and CRS TMT.

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Oil and Natural Gas Corporation Ltd. (ONGC) stands as the preeminent National Oil Company in India, exerting its influence across a wide spectrum of energy sectors, including Exploration & Production, Refining, Liquefied Natural Gas (LNG), Power, Petrochemicals, and Emerging Energy Sources. As an Energy Maharatna, ONGC occupies a pivotal role by contributing over 70% of India's domestic crude oil and natural gas production, thereby ensuring the nation's energy security.

Boasting the distinction of exploring eight out of India's nine producing basins, ONGC dominates the oil and gas exploration and production arena, covering a remarkable 83% of established reserves. Its presence in the refining sector is equally substantial, with subsidiaries like Hindustan Petroleum Corporation Limited (HPCL) and Mangalore Refinery and Petrochemicals Limited (MRPL), collectively forming the third-largest refining conglomerate in India.

ONGC's global footprint extends through its wholly-owned overseas subsidiary, ONGC Videsh Limited (OVL), currently operating in 32 oil and gas projects across 15 countries. The company's excellence has earned it recognition on global lists, including Fortune Global 500, Platt's Top 250 Global Energy Company Rankings, and Forbes Global 2000.

Beyond its corporate achievements, ONGC takes pride in its distinction as a leading employer in India, acknowledged by the Great Place to Work. It remains dedicated to corporate social responsibility (CSR), actively enhancing economic, environmental, and social performance, while championing efficient resource utilization and green energy initiatives.

Committed to a sustainable future, ONGC leverages advanced technology and global best practices to harness unconventional energy sources like Coal Bed Methane (CBM), Underground Coal Gasification (UCG), Shale Gas, Gas Hydrates, and renewable energies such as wind and solar. These initiatives have resulted in a substantial reduction in emissions, with a goal to achieve Net-Zero emissions by 2038.

ONGC's unwavering commitment to exploration and development is evident in its impressive reserve replacement ratio and extensive drilling activities. The company's dedication to innovation is underscored by the numerous patents and copyrights granted during FY'23.

ONGC's relentless pursuit of energy excellence continues to shape India's energy landscape, firmly establishing it as a symbol of progress, sustainability, and corporate leadership.


ओएनजीसी
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Shaping Next
NET
ZERO
by 2038
Scope-1 and Scope-2
We are ENERGY Now and Next

PLATINUM

About Alleima Group

Alleima is a leading manufacturer of high value- added products in advanced stainless steels and special alloys as well as products for industrial heating. Our origins date back to 1862 and the foundation of the company Sandvikens Jernverk by Göran Fredrik Göransson, a pioneer in using the Bessemer method for steel production on an industrial scale.

Based on long-term customer partnerships, we advance processes and applications in the most demanding industries through unique materials that are lightweight, durable, corrosion-resistant, and able to withstand extremely high temperatures and pressures.

With more than 900 active alloy recipes, our offering comprises products for several customer segments, mainly seamless tubes for the energy, chemical, and aerospace industry, precision strip steel for white goods compressors, air conditioners, and knife applications. It also includes ultra-fine wires for medical and microelectronic devices, industrial electric heating technology, and coated strip steel for fuel cell technology for cars and trucks and hydrogen production.

Sustainability is present in all aspects of our operations and is an integral part of our commercial strategy. Our product offering enables the transition to renewable energy sources, electrification of industries, innovation in the medical sector and much more. We also actively seek to reduce and eliminate harm to people and the environment via our operations. Today, the amount of recycled material in Alleima products is above 80 percent.

Our fully integrated value chain, from R&D to end-product, ensures industry-leading technology, quality, sustainability, and circularity. Alleima, with headquarter in Sandviken, Sweden, and revenues of SEK 13.8 billion in 2021, has more than 5,500 employees and customers in approximately 90 countries. Learn more at www.alleima.com.

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With close and long-standing customer partnerships, we advance processes and applications in some of the most demanding industries imaginable. Our passion for materials technology, metallurgy, and industrial processes helps customers become more efficient, more profitable, more sustainable, and safer.

Brief information on our divisions

Tube : Tube develops and manufactures seamless tubes and other long products in advanced stainless steels and special alloys used primarily in the customer segments Industrial, Chemical and petrochemical, Oil and gas, Mining and construction, Power generation and Transportation. The offering also includes products and solutions for the growing Renewable energy segment.

Kanthal : Kanthal is a provider of products and services in the area of industrial heating technology and resistance materials and provides materials for electric heating, temperature sensing and heat resistant applications. Kanthal also offers ultra-fine wire in stainless steel and precious metals for use in medical and electronic appliances.

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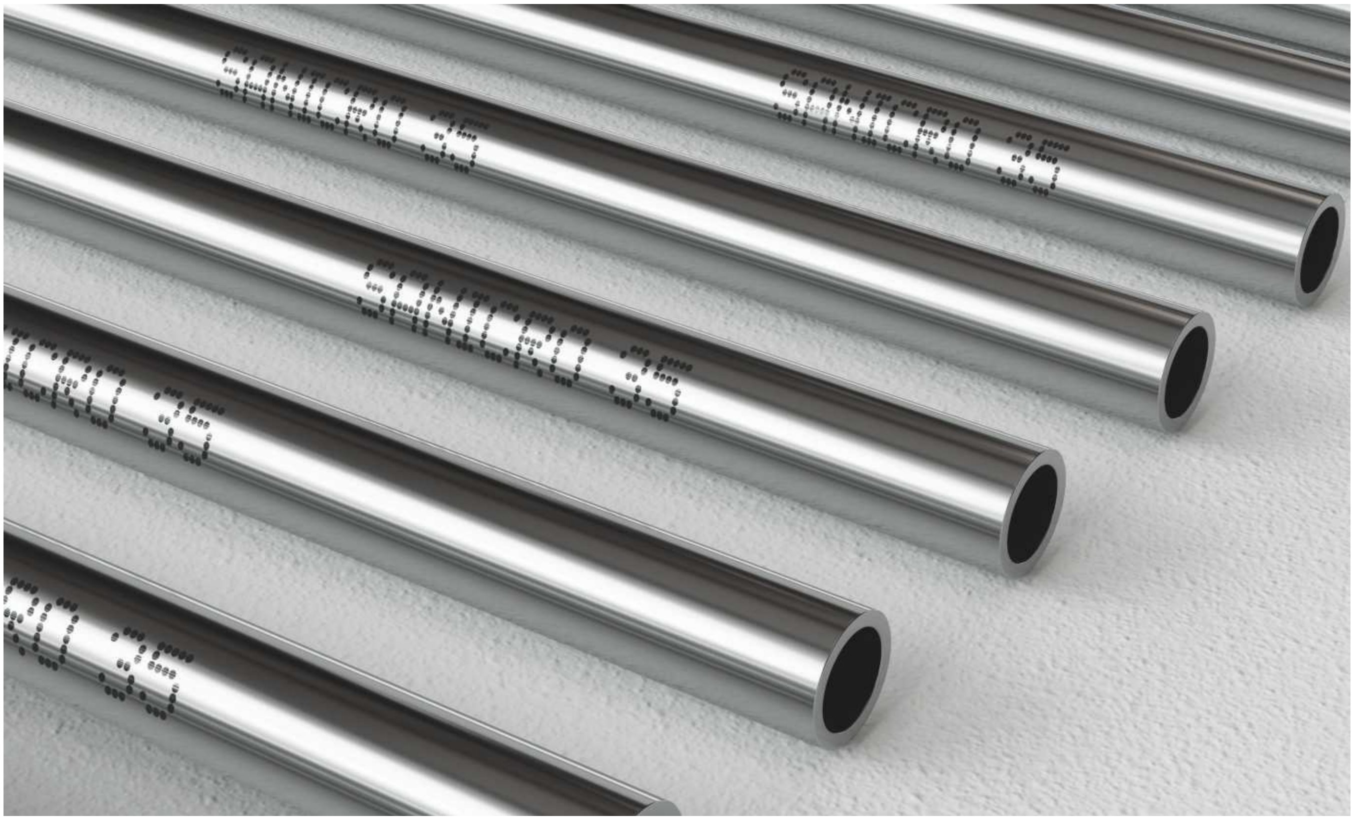
Bridging the gaps



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For further enquiries, please email our Technical Marketing Specialist Rohit Ojha, rohit.ojha@alleima.com

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The group has developed into a highly resourced, responsive global company with strategically positioned offices and facilities in India, Abu Dhabi, Dubai, Saudi Arabia, Kuwait, Qatar, Oman, Nigeria, Algeria, Tunisia, UK, Canada and Belgium.

The organization specialized in Electrochemistry and Sustainable Energy Solutions have been developed into a multi-disciplinary organization handling detailed survey, audit, design, engineering and manufacturing from concept-to-commissioning solutions for asset integrity management. The companies are managed by highly qualified and certified personnel holding extensive experience.

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Today, CPCL stands tall among the public-sector refining companies in India, with one of the most complex refineries of its kind in the country, producing an array of value-added petroleum products. It also pioneered key initiatives in several areas such as process optimisation, technology absorption, energy conservation, waste land reclamation and environment management.

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Dorf Ketal is outperforming long established competitors, to gain market share in some of the most technically challenging and mission critical applications in Refinery and Petrochemical operations. We are doing this with new chemistry and service ideas that are more responsive to customers' needs and pragmatic to apply.

Our portfolio of technologies is world class. Our success in bringing them to market is dominant in India, Brazil, and SE Asia, and we continue to grow in other regions. Dorf Ketal began as a company focused on developing innovative new chemistries to solve challenging problems in crude oil refining and the petrochemical industry. New chemistry to outperform established competitors continues to be a core growth strategy for Dorf Ketal.

Dorf Ketal innovation is a commitment to solve challenging customer problems with new chemistry and application technology, not incremental improvements to old chemistry. We invest in extensive research to identify new chemistries and we embrace failure in our laboratories to assure success in our customer's plants. Product development includes sophisticated proprietary simulations that allow us to predict results across a range of feedstocks under operational stresses that exceed “real-world” conditions. The result is more intellectual property than any of our competitors and a growing list of customers achieving measureable economic advantages for their stakeholders.

The research development teams at Dorf Ketal deliver innovative process chemicals with applications in refining, petrochemical and polymer production, plus unique chemistries for fuel treatment, lubricant additives, organo-metallic catalysts and crosslinkers.

Our scientists and engineers move ideas from the lab quickly into demanding simulation testing and then customer field evaluation. These new product successes are taken to the pilot plant for scale-up studies and then moved into our manufacturing operations for reliable production.

When customers partner with Dorf Ketal, they experience a company that is:

- Experienced in inventing new chemistries to solve difficult challenges
- Agile and responsive to their needs
- Dedicated to delivering results they can measure

Today, Dorf Ketal is one of the world's largest suppliers of process chemicals and additives for refineries, petrochemicals, fuels, plastics, lubricants and oil stimulation industries. Its process chemicals business treats over one-third of the oil refined by the 20 largest refineries in the world. It's Speciality Catalyst business is the largest manufacturer and marketer of organometallic catalysts in the world.

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A brisk walk through the corridors of Dorf Ketal's rich and meaningful history makes an inspiring odyssey that reinstates its core commitment - to emerge as a Global Specialty Company, powered by technology, innovation and customer centricity, offering exemplary levels of service.

Equipped with a world-class portfolio of technologies, Dorf Ketal has set its footprint across the globe, catering to clients in countries like India, Middle East, Brazil, Southeast Asia, Europe and North America. It has also overcome global competition to emerge as a quality supplier of performance additives for gasoline and diesel applications to overseas refiners.

OLEFINS

Dorf Ketal consistently puts to use an innovation and service-driven approach to deliver performance, efficiency and reliability to Ethylene, Styrene and Butadiene processes. Its product offerings in this segment comprise Furnace Sulfiding Agents, Compressor Anti-foulants, Red Oil Inhibitors and NOx-free Polymer Inhibitors.

3 DECADES OF GROWTH

- 1992 – Dorf Ketal Founded
- 1997 – Manufacturing and R&D Established
- 2000 – ISO 9001 Certification
- 2001 – Acquisition of UOP Refinery Additives Business
- 2002 – Dorf Ketal Brazil LTDA formed
- 2003 – Aquires UOP Plastic Additives Business
- 2005 – Offices Opened in Singapore
- 2007 – Exxon Mobil acquisition.
- 2008 – DKC LLC RCMS Certification - ACC
- 2009 – Acquires INTEC Polymer Organo Metallic Titanates; Acquires DUPONT'S TYZOR™
- 2011 – Acquires JOHNSON MATTHEY VERTEC™ IP; New Plant at Mundra Organo Titanates
- 2014 – Dorf Ketal Chemicals (Shanghai) LTD formed; New R&D Labs Dorf Ketal Brazil
- 2016 – Acquires Filtra Chemicals; Acquires Flowchem USA
- 2018 – 3rd Mfg Plant in Mundra Commissioned
- 2019 – New Plant at Dahej Commercial startup
- 2022 – Acquires Khyati Chemicals
- 2023 – Acquires CLARIANT North American Land Oil Business; Acquires Fluid Energy

OIL FIELDS

From Emulsion Breakers, Corrosion Inhibitors, Water Clarifiers and H_2S Scavengers, Dorf Ketal caters to the needs of its customers with cutting edge chemical solutions and services that essentially address the production challenges of oil and gas, while also offering flow assurance, an extended equipment life cycle, cost savings and production optimisation.

REFINING

Be it Multifunctional Emulsion Breakers, Next-generation Anti-foulants, Low Phosphorus High Temperature Corrosion Inhibitors or Patented Reactive Adjunct Chemistry. Dorf Ketal has been involved in creating exceptional Crude Oil Refining Process solutions, backed by its innovative expertise of conducting desalting through distillation, upgraders and hydro-treaters.

FUEL ADDITIVES

When it comes to fuel treatment solutions, Dorf Ketal endeavours to upgrade fuel quality and meet industry requirements by offering innovative chemistry and service solutions.

Refineries – With a keen understanding of the dynamics of refineries, Dorf Ketal helps its clients improve operating margins and also increase product marketability.

Oil Terminals – Dorf Ketal's team of skilled and proficient field engineers help its clients in choosing the right additives to optimise their blend, while also meeting the most stringent market requirements.

Cargo Treatments – Dorf Ketal facilitates prompt evaluation to select the appropriate additive and optimum dosages to meet demanding international fuel standards.

Fuel Marketers – Dorf Ketal caters to the needs of its customers with breakthrough offerings in the form of performance additives - milEx and MPH – which reduce engine friction, deliver instantaneous improvement in fuel economy, power and acceleration and also ensure exceptional cleanliness in all vital parts of the engine.

GAIL (INDIA) LIMITED | INDIAS LEADING NATURAL GAS COMPANY

GAIL (India) Limited is India's leading natural gas company with diversified interests across the natural gas value chain of trading, transmission, LPG production & transmission, LNG re-gasification, petrochemicals, city gas, E&P, etc. It owns and operates a network of around 16240 km of natural gas pipelines spread across the length and breadth of country. It is also working concurrently on execution of multiple pipeline projects to further enhance the spread. GAIL commands ~66% market share in gas transmission and has a Gas trading share of over ~ 54% in India. GAIL and its Subsidiaries / JVs also have a formidable market share in City Gas Distribution. In the Liquefied Natural Gas (LNG) market, GAIL has significantly large portfolio. GAIL is also a pioneer in using gas for producing petrochemicals and has an integrated 810 KTPA gas based petrochemical complex in Uttar Pradesh. GAIL is co-promoter of two other petrochemical plants including 280 KTPA BCPL Complex in Assam and 1.1 MMTPA OPaL project in Gujarat. Further, GAIL has acquired JBF Petrochemicals Limited (JBFPL) of 1.25 MMTPA Purified Terephthalic Acid (PTA) through Corporate Insolvency Resolution Process (CIRP). JBFPL has been renamed as GAIL Mangalore Petrochemicals Limited (GMPL) and is now a wholly owned subsidiary of GAIL.GAIL holds participating interest in 10 domestic E&P blocks, 2 E&P blocks in Myanmar and 1 shale gas asset in US. GAIL is also the promoter of Konkan LNG Private Limited which operates LNG regasification terminal at Dhabol with design capacity of 5 MMTPA. GAIL is a pioneer in City Gas Distribution business in India with 8 JVs and 3 subsidiaries in India for its CGD business, notably Indraprastha Gas Limited (IGL) in Delhi and Mahanagar Gas Limited (MGL) in Mumbai. GAIL group companies are authorized in 72 GAs across the nation out of the total 308 GAs. GAIL cater to communities across the country summing up to the mammoth number of approximately 82 lakh PNG customers (65 %) and 2600+ CNG stations (40%) of the country's share. GAIL has successfully commissioned India's First Project for blending of Hydrogen in City Gas Station, at Indore. GAIL has installed its first Green Hydrogen Plant at GAIL Vijaipur in Madhya Pradesh of 10 MW capacity to produce 4.3 TPD of Green Hydrogen. GAIL is also expanding its presence in renewable energy like Solar, Wind and Biofuel.

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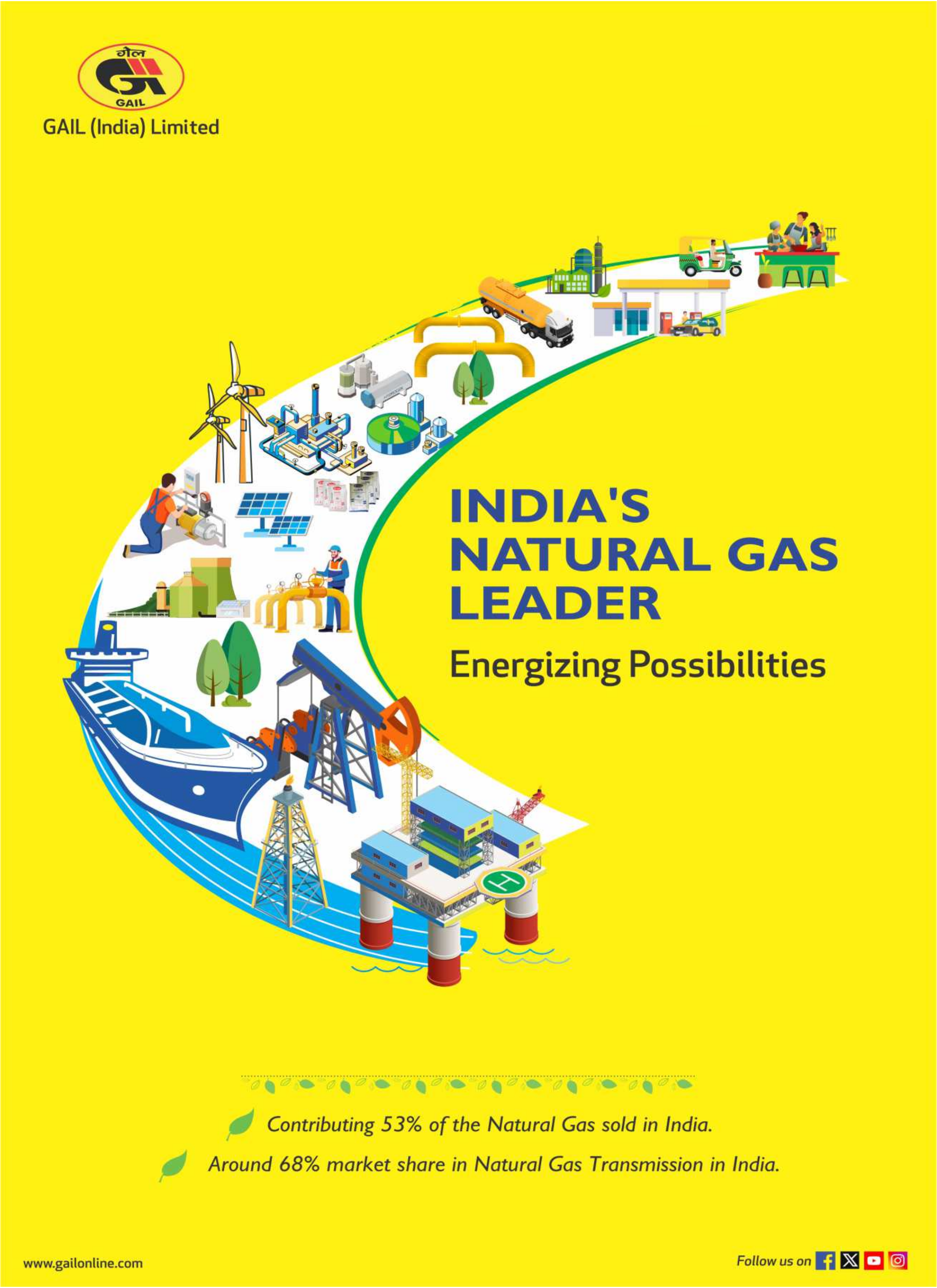
GAIL (India) Limited
INDIA'S NATURAL GAS LEADER
Energizing Possibilities
Contributing 53% of the Natural Gas sold in India.
Around 68% market share in Natural Gas Transmission in India.
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GOLD

Henkel

Henkel Adhesive Technologies – Leading Solutions for Maintenance, Repair, and Overhaul (MRO)

About Henkel

Henkel is a global leader in adhesive technologies, offering cutting-edge solutions that cater to a wide range of industries, including aerospace, automotive, electronics, and the maintenance, repair, and overhaul (MRO) sector. With over 147 years of expertise, Henkel's diverse product portfolio is trusted worldwide for enhancing productivity, improving reliability, and minimizing downtime. Henkel's commitment to sustainability and innovation ensures that its solutions meet the highest standards of performance and environmental responsibility.

Loctite – The Trusted Name in Industrial Adhesives

Henkel's flagship brand, **Loctite**, is synonymous with high-performance adhesives, sealants, and coatings that are essential in the MRO industry. Recognized globally for its reliability and durability, Loctite offers solutions that help maintain equipment, prevent wear, and extend the life of critical assets. The extensive range of Loctite products addresses the needs of various applications, including bonding, sealing, thread locking, gasketing, and corrosion prevention.

Key Benefits of Loctite Solutions:

Increased Equipment Reliability: Prevents breakdowns and unplanned downtime.
Reduced Maintenance Costs: Minimizes the need for frequent repairs and part replacements.
Improved Safety and Efficiency: Enhances operational safety with high-performance materials designed for harsh conditions.

Recent Acquisition – CSNRI Composites

Henkel recently expanded its MRO portfolio with the acquisition of **CSNRI (Composite Solutions for Reinforced Infrastructure)**, a leading provider of composite repair systems. This strategic addition enables Henkel to offer advanced composite repair solutions for high-pressure pipelines and other critical assets, further enhancing its capabilities in asset integrity management.

CSNRI's composite solutions complement Henkel's existing Loctite portfolio, providing an innovative, long-lasting alternative for the repair and reinforcement of aging infrastructure. These lightweight, corrosion-resistant materials are engineered to handle extreme environments, making them an ideal choice for industries such as oil & gas, chemical processing, and power generation.

Why Loctite?

Loctite stands out as the go-to brand for MRO professionals around the world. Here's why:

Unmatched Reliability: Loctite products are trusted by professionals for their proven ability to perform under the most demanding conditions, ensuring optimal equipment performance and reduced downtime.
Complete Solution Provider: Whether you need to **repair, rebuild, or maintain equipment like pumps, heat exchangers, pipelines, or gearboxes**, you can rely on Loctite's high-performance solutions.
Global Leadership in Innovation: Loctite's continuous investment in research and development ensures you get the most advanced solutions, helping you stay ahead in maintaining your assets.
Sustainability Focus: Loctite products are designed to enhance operational efficiency while minimizing environmental impact, making them a sustainable choice for MRO applications.

At Loctite, we go **Beyond the Bond**, delivering solutions that not only fix but fortify your industrial assets, extending their life and maximizing your operational efficiency.
For MRO solutions that deliver reliability, efficiency, and innovation, **Loctite is the name you can trust**.
For more information on how Loctite can support your MRO needs, visit us at www.tryloctite.com or contact your local representative.


LOCTITE
EXTEND PIPE LIFETIME WITH
LOCTITE® COMPOSITE
REPAIR SYSTEM
LOCTITE® Composite Repair System is a fast and economical alternative to pipe replacement. The innovative repair system reinforces and seals pipes designed for high pressure, temperature and chemical resistance.
The all-in-one solution with materials for surface preparation, reinforcement and topcoat consists of below products:
It is fully certified by DNV GL according to ISO/TS 24817 & ASME PCC2.
CSNRI
CSNRI®
IS NOW PART OF THE
HENKEL FAMILY!
CSNRI°s composite solutions address pipeline anomalies from metal loss and small deformations to large deformations, crack/crack-like features, as well as damage to process piping working in the range of -50°F to 597°F (-46°C to 314°C).
CSNRI°s industry-leading products are:
® Easy to install
® Cost-effective to deploy
® Durable for decades
Scan to Enquire
Henkel
Henkel Adhesive Technologies

IndianOil

INDIAN OIL CORPORATION LTD

Indian Oil, a diversified, integrated energy major with presence in almost all the streams of oil, gas, petrochemicals, and alternative energy sources; a world of high-calibre people, state-of-the-art technologies and cutting-edge R&D; a world of best practices, quality-consciousness and transparency; and a world where energy in all its forms is tapped most responsibly and delivered to the consumers most affordably.

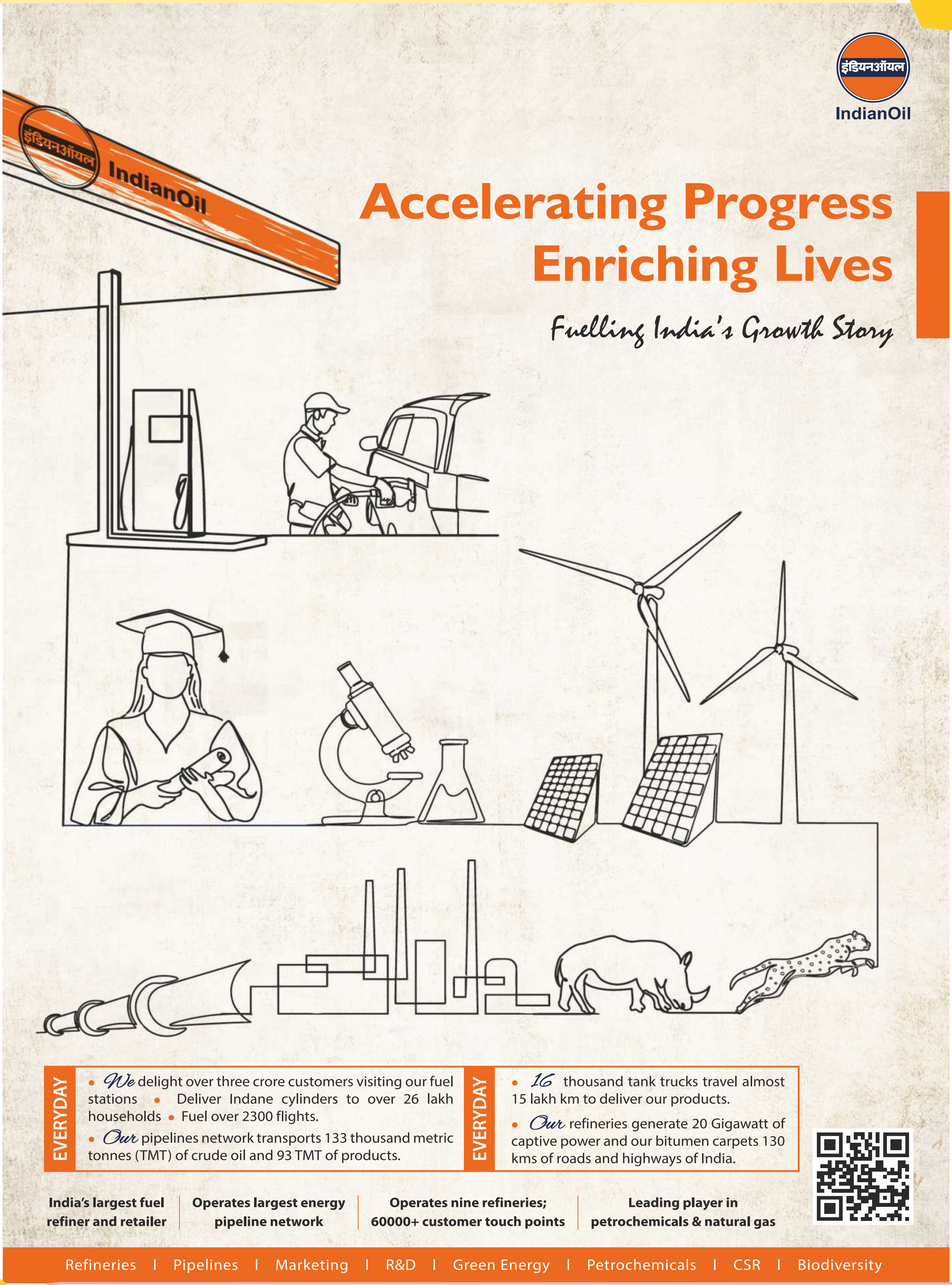
Every day, we process over 1.6 million barrels of crude oil and delight over three crore Indians through an expansive network of 61,000+ customer touchpoints, including 37,500 plus fuel stations. Every day, we deliver more than 26 Lakh LPG cylinders, even to the remotest corners of India. Every day, we fuel over 2,300 flights, with more than half of the flights in Indian skies being refuelled by us. For us, every day is an opportunity to power the progress and possibilities for our nation, demonstrating our Core Values of Nation-First, Care, Innovation, Passion, and Trust.

In 2023-24, demonstrating remarkable resilience, IndianOil attained record-breaking financial and operational milestones. Revenue from operations stood at Rs. 8,66,345 Crore, with a net profit of Rs. 39,619 Crore, a nearly five-fold increase from the previous year, making it the highest-ever profit in the Company's history. Aligned with these milestones, our operational performance touched historical high, with the highest-ever sales volume of 97.551 Million Tonnes of products, a refining throughput of 73.308 Million Tonnes, and the pipelines throughput of 98.626 Million Tonnes. IndianOil has close to 20,000 KM of pipeline network dedicated to fuel India's economic rise.

IndianOil take the 94th spot in the Fortune Global 500 listing 2023. We were the sole Indian Public Sector Enterprise in the global top 100 and have appeared on this list for 28 years in a row. Additionally, IndianOil topped the 'BW Top 500' list for the third consecutive year and lead the oil and gas companies in the 'Most Respected Companies' ranking by Business World.

While we celebrate the laurels, each action and endeavour has been a step towards our vision for tomorrow. Our resolve to become an operational Net-Zero Company by 2046 is one such commitment that is aligned with India's goal to achieve Net-Zero by 2070. This ambition reflects our aim to set new benchmarks in environmental stewardship.

Foraying into the natural gas domain since 2004, we have emerged as a major player, investing in LNG sourcing, import terminals, cross-country pipelines, and City Gas Distribution (CGD) networks. With a sharper focus on reliability and sustainability, we are committed to expanding our reach and ensuring a steady supply of clean energy nationwide.


इंडियनऑयल
IndianOil
Accelerating Progress
Enriching Lives
Fuelling India's Growth Story
EVERYDAY
• We delight over three crore customers visiting our fuel stations • Deliver Indane cylinders to over 26 lakh households • Fuel over 2300 flights.
• Our pipelines network transports 133 thousand metric tonnes (TMT) of crude oil and 93 TMT of products.
EVERYDAY
• 16 thousand tank trucks travel almost 15 lakh km to deliver our products.
• Our refineries generate 20 Gigawatt of captive power and our bitumen carpets 130 kms of roads and highways of India.
India's largest fuel refiner and retailer
Operates largest energy pipeline network
Operates nine refineries; 60000+ customer touch points
Leading player in petrochemicals & natural gas
Refineries I Pipelines I Marketing I R&D I Green Energy I Petrochemicals I CSR I Biodiversity

Lin Scan is a fully-fledged Research & Development Centre with first-class engineers and a multitude of Ph.D. & M.D. holders. We provide intelligent In-line Inspection Services to pipeline operators in the oil and gas industry, ensuring pipeline integrity by delivering highly accurate information for Maintenance & Repair Programs.

Lin Scan Technology was developed by engineers who have created many of the inspection tools and technologies in the market today; through the merger of companies and expertise within those companies.

As a global leader in the ILI industry, Lin Scan's reach extends to an extensive clientele around the globe. It has played a pivotal role in providing efficient ILI solutions to renowned entities within the oil and gas sector worldwide. Among its esteemed clients stand prominent names like SAUDI ARAMCO, ADNOC, GRT-Gas France, TRAPIL, API, ENAGAS, American Pipeline Solutions, Manitoba Hydro, and Canadian Natural Resources Limited, underscoring its remarkable footprint in the industry.

Lin Scan is committed to continuously providing excellent service to our customers to help achieve pipeline integrity and zero incidents, focusing on reaching the highest levels of industry standards through our dedicated team that goes above and beyond for our clients.

For a more comprehensive understanding of Lin Scan's technologies and services, further information can be explored on our official website: www.linscaninspection.com.

LIN SCAN
A PIPECARE COMPANY

CUTTING-EDGE INNOVATIONS FOR IN-LINE INSPECTION EXCELLENCE

LIN SCAN is a global leader in pipeline integrity services with over 20 years of experience. Our in-house designed and manufactured equipment covers all pipeline diameters, supporting oil and gas operators worldwide.

Headquartered in Dubai, LIN SCAN operates in over 80 countries with offices in 15 countries and,, serving regions including Europe, Africa, North America, Russia & CIS, the Middle East, and Asia.

Email: info@pipecaregroup.com
Phone: +91-98 18 64 8089

Mangalore Refinery and Petrochemicals Limited (MRPL) - A Govt.of India Enterprise and a subsidiary of ONGC Ltd., is a Mini Ratna category 1 and schedule 'A' company having its State of the Art 15 MMTPA refinery at Mangalore in Karnataka. MRPL represents around 7% of India's refining capacity. Its main products are LPG, Naphtha, Petrol, Diesel, Kerosene, ATF, Mixed xylene, Propylene, Polypropylene, Fuel oil, Bitumen, Pet coke and sulphur.

MRPL was conceived as a Joint venture company promoted by Hindustan Petroleum Corporation Ltd. (HPCL) and the Aditya Birla group (ABG). However, in 2003, ONGC acquired the Birla's stake in MRPL, and further increased its stake and MRPL became a subsidiary of ONGC. There was no looking back for MRPL after this acquisition. From 3.69 MMTPA capacity in 1996, today MRPL has expanded its capacity to 15 MMTPA. MRPL has also set up a 440 KTPA Polypropylene unit. MRPL has upgraded its facilities to produce BS-VI Petrol and diesel. To reduce its dependence on Netravati river water, MRPL has setup 30 MLD capacity Desalination Unit at Thannirbhavi, Mangalore.

MRPL's refinery complex is certified with ISO 9001, ISO 14001 and ISO 50001. MRPL has been notching benchmarks in the Indian Oil Industry, in production, safety performance, energy consumption and quality management processes.

Infrastructure

MRPL has the finest and the most advanced infrastructure to support production.
It has dedicated oil Jetties at New Mangalore Port Trust, capable of handling 92,000 DWT ships, with 14 M draft. It has a Single Point Mooring (SPM) system at a location 16 KM inside the sea having draft availability of 30 metre for handling Very Large Crude Carrier (VLCC) along with coastal booster pumping station within the NMPT port limits.

Raw Water required for the refinery is pumped through a 42 km long pipeline from the Netravathi river at Sarapady. Phase-III has facilities to consume sewage treated water from Mangalore city along with the water from Mangalore Special Economic Zone (MSEZ) facility.
For its power needs, MRPL has got its own Captive power plant with an installed capacity of around 234 MW.

MRPL's products are transported to Hassan & Bangalore through the Mangalore-Hassan-Bangalore-Pipeline (MHBPL).

MRPL has a modern and sophisticated Laboratory certified to NABL standards. The laboratory is approved by Director General of Civil Aviation (DGCA), Centre for Military Airworthiness Certification (CEMILAC) and Director General of Air Quality Assurance (DGAQA).


ONGC
एमआरपीएल
MRPL
Innovating Excellence,
Inspiring Transformation
High Quality Fuels Experience
MRPL
AUTO FUEL
HiQ
DIESEL
PETROL
STOP n SHOP
ATM
CAFE
PUC
SERVICE
24 HRS
Mangalore Refinery and Petrochemicals Limited
(A Government of India Enterprise & a subsidiary of ONGC Ltd)
MRPL
Category 1 Schedule 'A',
Miniratna 15 MMTPA refinery with
petrochemical complex at Mangaluru, Karnataka
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PERFORMANCE SERVICE SATISFACTION
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Mangalore Refinery and Petrochemicals Limited
MRPL Official
ONGC MRPL

Reliance Industries Limited

Growth is Life

Reliance is India's largest private sector company, with a consolidated revenue of INR 10,00,122 crore (US$ 119.9 billion), cash profit of INR 1,41,969 crore (US$ 17.0 billion) and net profit of INR 79,020 crore (US$ 9.5 billion) for the year ended March 31, 2024. Reliance's activities span hydrocarbon exploration and production, petroleum refining and marketing, petrochemicals, advanced materials and composites, renewables (solar and hydrogen), retail and digital services.

Currently ranked 86th, Reliance is the largest private sector company from India to be featured in Fortune's Global 500 list of 'World's Largest Companies' for 2024. The company stands 45th in the Forbes Global 2000 rankings of 'World's Largest Public Companies' for 2023, the highest among Indian companies. Reliance has been recognized in Time's list of the 100 Most Influential Companies of 2024, marking the only Indian company to have achieved this honor twice. Reliance is the top-ranked Indian company and the only one in the top 100 on Forbes' 'World's Best Employers' 2023 list. Additionally, it is featured among LinkedIn's 'Top Companies 2023: The 25 Best Workplaces To Grow Your Career In India.' Website: www.ril.com

Pipelines are integral part to RIL's business. Pipelines play a crucial role in continuity and growth of its core business sectors of hydrocarbon exploration and production; refining and marketing; and petrochemicals. RIL with its associated and affiliate companies today cumulatively own and operate over 2,100 km of pipelines; handling variety of products like crude oil, refined petroleum products, natural gas, petrochemicals, water etc., both on shore and off shore. Some of these pipelines are over 35 years old. Latest executed cross country pipeline projects includes; 304 km Shahdoi-Phulpur Gas Pipeline (SHPPL) and 480 km Dahej- Nagothane Ethane Pipeline (DNEPL). In addition, as part of deep water exploration and production, it owns and operates over 450 kms offshore flow lines also.

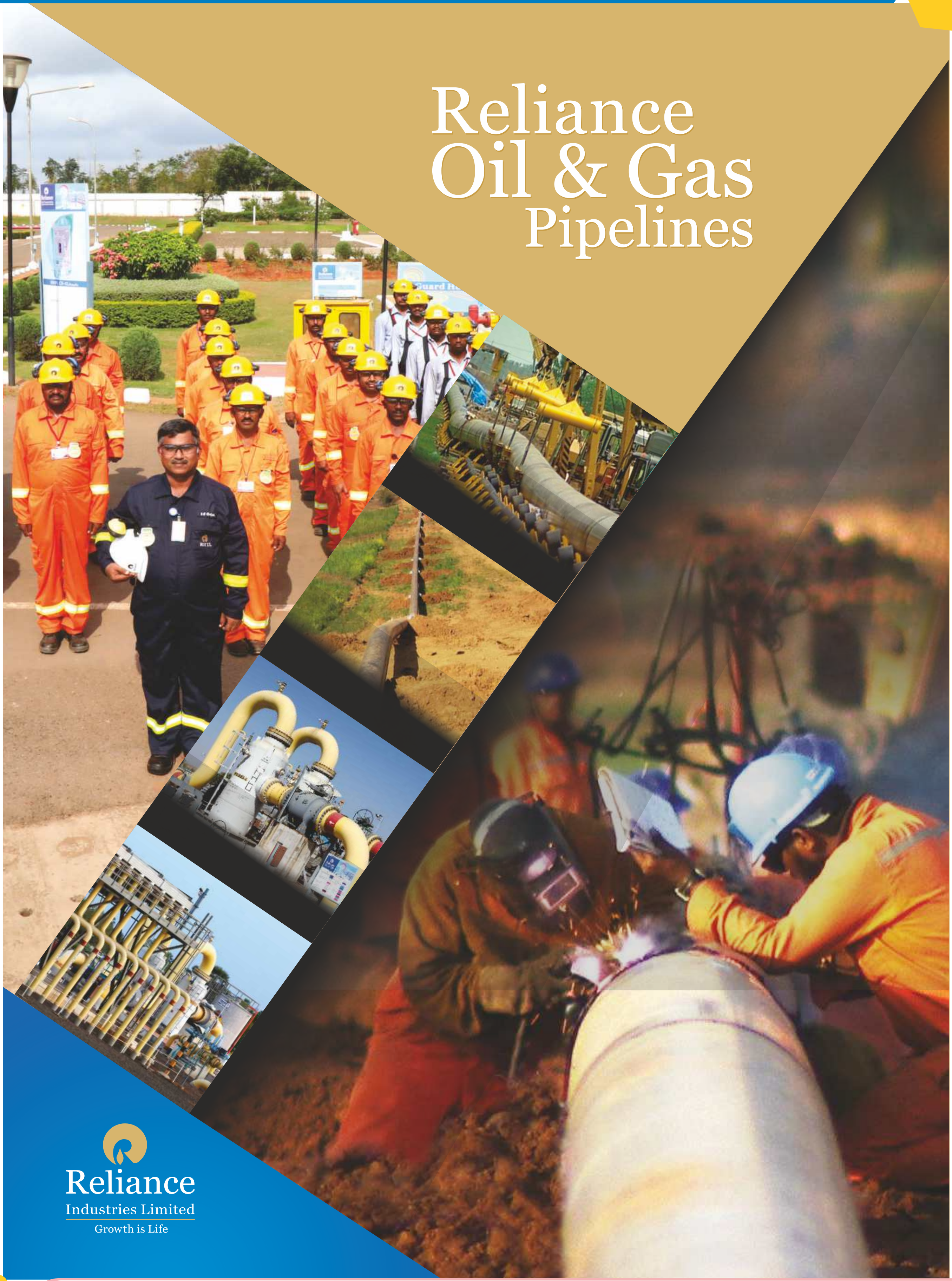
Reliance pipelines group is engaged in constructing and operating pipelines. Pipelines offers transportation service to internal and external customers desirous of availing the service. Reliance pipeline projects group has recently successfully constructed and commissioned two major projects viz. Shahdoi-Phulpur Gas Pipeline (SHPPL) Project and Dahej- Nagothane Ethane Pipeline (DNEPL) Project. At present, Pipeline Projects group is working on multiple pipeline projects across different locations.

DNEPL is Asia's first cross-country pipeline project built for transportation of Ethane from RIL's Dahej Manufacturing Division (DMD) through a cross country pipeline passing through the states of Gujarat and Maharashtra for use in RIL's Nagothane Manufacturing Division (NMD) and Hazira Manufacturing Division (HMD) in a direct usage mode. DNEPL is a 900# Pipeline System comprising of 12” dia, 439 km long trunkline between DMD and NMD and 8” dia, 46 km spurline to HMD, 2 no. Metering and Regulating Stations, 2 no. Intermediate Pigging Stations, 36 no. Mainline Valve Stations (MLVs) and 1 no. Tap-Off Station. DNEPL is fully remotely operable from Control Rooms at DMD and at Navi Mumbai. During construction, DNEPL has set a record for longest HDD crossing of over 2.6 kms across Narmada river in Gujarat with Meet-in-the middle intersect technique, with simultaneously drilling from both banks of the river. DNEPL was successfully commissioned in September 2018.

Reliance Pipeline Group has to its credit internationally recognized prestigious certifications and awards for demonstrating highest standards of Health, Safety, Environment and Quality. Pipelines have also benchmarked itself to the same level of accolades.

Reliance's pipelines team is committed to build, operate and maintain pipeline systems adopting the best industry practices and establishing highest benchmarks for performance in all areas of project execution, operations and maintenance and business operations.

CORCON SUPPORTER



GOLD

ROSEN
empowered by technology

ROSEN Group

The ROSEN Group is a global supplier of state-of-the-art products and services in the field of inspection and integrity management for a wide range of installations (pipelines, tanks, ships, wind turbines, trains, telecommunications towers, and others) in various industries (oil & gas, energy, process industry, mining, telecommunications, transport, and others). With over 3500 employees and more than 20 branches worldwide, the ROSEN Group can literally take on the whole world.

ROSEN Europe

ROSEN Europe, with over 350 employees spread over 6 branches in 5 different countries, is within the ROSEN Group commercially responsible for the European continent, African continent and the countries of India and Pakistan in Southeast Asia.

We carry out inspection and integrity management projects and supply products and integrity systems to companies that are considered leaders within the aforementioned industries. This is often done based on long-term contracts and with a focus on partnership.

Business lines

ROSEN Group has several business lines where we operate in. These business lines are:

- Advanced Pipeline Diagnostics (ADIA)
- Non-Destructive Testing Diagnostics (NDIA)
- Proficient Pipeline Diagnostics (PDIA)
- Challenging Pipeline Diagnostics (CDIA)
- Field Products & Services (FIPS)
- Integrity Solutions (INS)

Sustainable operations

The corporate philosophy of ROSEN Group is based on innovation and technological development with a view to protecting people and the environment and focusing on a sustainable future.

Ethics are of paramount importance in this regard. In business processes, the principles of reducing, reusing, and recycling are intelligently applied. Procedures and policies for environmental protection cover all aspects of the company and are used worldwide.

Health & Safety

Besides the technical innovations that our employees of ROSEN Group develop and continue to develop every day, the health of our employees is also a priority: health & safety is very important within ROSEN Group.

Thus, a large number of employees participated in the Enschede Marathon and this summer they are taking part in the 'Bike to Work Summer Challenge'.

Accredited training company.

ROSEN Europe offers internships for technical, computer science, logistics, business, human resource, and finance students. Students can apply, expand their knowledge, and learn from qualified trainers in an innovative environment.

SEALFORLIFE Industries

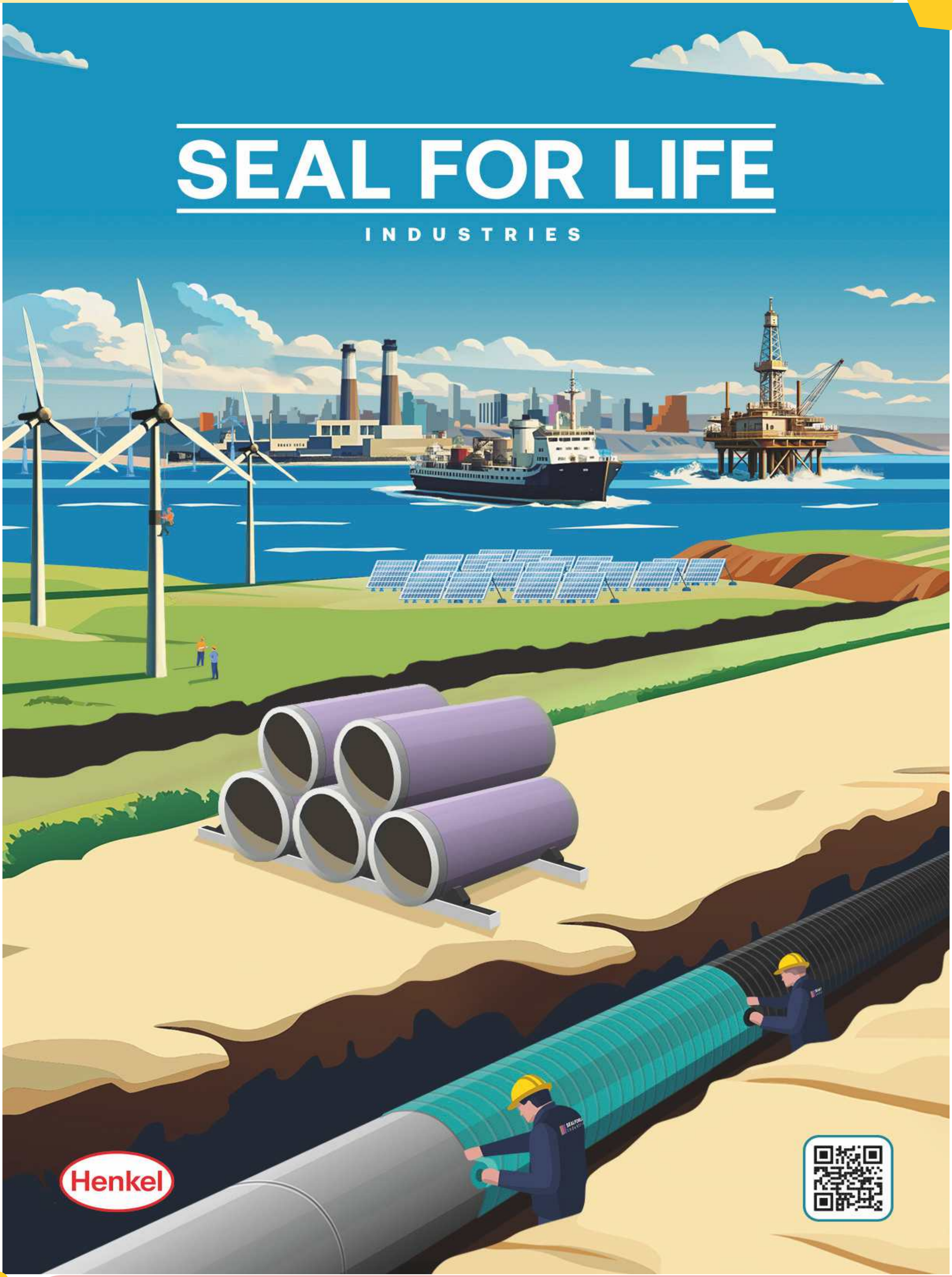
Introduction to Seal For Life Industries – October 2024

The destination for infrastructure protection.

Seal For Life, part of the Henkel Adhesive Technologies Group, offers the most diversified protection, maintenance and repair solutions in the market. With fourteen distinct brands offering products from self-healing coatings to heat-shrink sleeves, anti-corrosion tapes to liquid epoxy coatings, cathodic protection to intumescent coatings, polymer floorings to pipeline logistic solutions, operating across the globe.

We work in a variety of industries including civil and infrastructure, renewable energy, water and wastewater, oil and gas, district heating/cooling and general industrial purposes.

Find out more at www.sealforlife.com



GOLD

sustainable solutions. for a better life.

VA TECH WABAG LIMITED

Preserving Resources. Protecting Environment. Powering Economies.

Overview

VA TECH WABAG LIMITED (WABAG) is a pure-play water technology company, with over a century of expertise. As a pure-play multinational in the water industry, WABAG delivers Total Water Solutions, offering a full spectrum of advanced technologies and services for both municipal and industrial sectors. Headquartered in Chennai, India, WABAG operates globally with a significant presence in Asia, the Middle East, Europe, and Africa, supporting public utilities, industries, and municipalities in addressing their water and wastewater management needs.

Core Capabilities and Expertise

As a comprehensive lifecycle partner in water infrastructure, WABAG offers an extensive portfolio of services encompassing Design, Engineering, Supply, Construction, Installation, Start-up, and Long-term Operations. Its core areas of expertise include :

- Drinking Water Treatment
- Industrial and Process Water Treatment
- Sea and Brackish Water Desalination
- Municipal Wastewater Treatment
- Industrial Effluent Treatment
- Sludge Treatment and Energy Recovery
- Water Reclamation Systems (Recycling & Reuse)
- Green Energy Solutions
- Operations & Maintenance (O&M)

Global Footprint

Operating in over 25 countries, WABAG has completed 6,500+ water and wastewater treatment projects globally, positioning itself as the 3rd largest private water operator and the 5th largest desalination player worldwide. Its state-of-the-art facilities across the globe underscore WABAG's commitment to excellence and sustainability in water management.

Commitment to Sustainability

WABAG's sustainability framework aligns closely with the United Nations Sustainable Development Goals (SDGs), especially SDG 6 (Clean Water and Sanitation). Focusing on conservation, optimization, recycling, and reuse, WABAG addresses global water challenges by promoting water-efficient solutions and minimizing environmental impacts. Its sustainable practices are rooted in Environmental, Social, and Governance (ESG) principles, underscoring WABAG's role as a responsible partner in meeting the water needs of today and tomorrow.

Leadership and Innovation

Driven by a passion for innovation, WABAG continues to lead the industry with a strong focus on Research and Development (R&D) through dedicated centres in Europe and India. With over 125 intellectual property rights, WABAG's R&D initiatives are at the forefront of pioneering solutions for water and wastewater challenges. Guided by a skilled and visionary team, WABAG leverages its expertise in large-scale project management, making it a preferred partner for governments, industries, and communities seeking sustainable water infrastructure solutions.

For more information, visit: www.wabag.com | Email: wabag@wabag.in

CORCON SUPPORTER

GOLD

VASU CHEMICALS LLP is a multi-product, ISO 9001:2015, ISO 14001:2015 & ISO 45001:2018 certified Company, manufacturing a wide range of specialty chemicals. The products developed and manufactured by VASU CHEMICALS LLP, are made to specific needs and have proven invaluable to a wide spectrum of industries. The company divisions include

1. <u>WATER TREATMENT</u>:

VASU CHEMICALS LLP is the leading, and the oldest, manufacturer of Water Treatment Chemicals made to specific needs and proven invaluable to industries in the country. We have been in the business of supplying and servicing water treatment facilities since 1972. Among our prestigious customers are heavy chemical industries, petrochemical units, power plants, refineries and fertilizers plants.

Our experience has evolved into expertise. We deliver solutions that are uniquely designed in the field of:

- Pre-treatment & Water Clarification
- Cooling Water treatment
- Boiler Water Treatment
- Chlorine Dioxide plants
- Reverse Osmosis Chemicals
- Waste Water Treatment
- Dosing and Monitoring System
- Inhibitors for Pipelines
- Water Treatment plants

2. REFINERY PROCESS TREATMENT

HALLIBURTON VASU SOLUTIONS LLP is a joint venture of VASU CHEMICALS LLP & HALLIBURTON, USA specializes in providing Customized solutions for the process side of refinery operations to achieve:

- Improved processes and operate without upsets/limitations
- Reduce maintenance costs by mitigating corrosion and fouling rates
- Enhance capacity
- Flexibility to process opportunity crudes,
- Increase refinery profits.

Our capabilities include following areas in the refinery

- Coker Drum Foam Control
- Coker Furnace Anti-foulants
- Corrosion Control
- Emulsion Breaking
- FCCU Metals Passivators
- Finished Fuel Additives
- High Temperature Anti-foulants
- Inorganic Dispersants
- Metals Removal from Oil
- Naphthenic Acid Corrosion Control
- Online Reactor and Tower Cleaning
- Organic Dispersants
- Polymerization Inhibitors
- Slop Oil Minimization and Treatment
- Solids Management/Centrifuge

GOLD


INNOVATIVE REPAIR SOLUTIONS
FOR YOUR INSTALLATIONS
3X ENGINEERING INDIA
PIPE REPAIR AND PROTECTION
REINFORCEKiT® 4D
REINFORCEKiT® 4D SUBSEA
REINFORCEKiT® 1D
OIL & GAS
ONSHORE / OFFSHORE
OIL & GAS
SUBSEA
OIL & GAS
ONSHORE / OFFSHORE
OIL & GAS
SUBSEA
STOPKiT®
STOPKiT® VESSEL
ROLLERKiT®
ONLINE LEAK REPAIR
PIPE AND SUPPORT PROTECTION
TANK AND PRESSURE VESSEL REPAIR
REINFORCEKiT® PATCH
TANKiT®
OIL & GAS
ONSHORE / OFFSHORE
STRUCTURAL
REINFORCEKiT® BEAM
DKiT®
STRUCTURE REPAIR AND PROTECTION
FLANGE REPAIR (SF6)
REFLANGEKiT®
POWER
ISO 9001:2015 CERTIFIED
3X products are approved by
key certification bodies
Lloyd's Register
TÜVRheinland
BUREAU VERITAS

SILVER

3X ENGINEERING INDIA

PIPELINE REPAIR SPECIALISTS

Corrosion Leak Repair | Pipeline Inspection Services | Engineering Services

ABOUT US

3X Engineering Pvt Ltd, founded in 1989 in Monaco, is a company specialising in repair and rehabilitation of pipelines and pipe assets. Using advanced polymers and composites, we can repair diverse defects like external corrosion, internal corrosion, dents, gauges, pinholes/pitholes, cracks etc., as per international standards (ASME PCC2 and ISO/TS 24817).

We have helped companies in many sectors, including Oil & Gas, Power/Utilities, Railways to increase productivity and profitability by reducing downtime, risks and hot works. Owing to our advanced technologies, we can provide solutions for the Onshore, Offshore and Subsea applications at competitive prices, as experienced by our various customers like ONGC, IOCL, HPCL, BPCL, OIL, CAIRN to name a few.

OUR RANGE OF PRODUCTS

COMPOSITE REPAIR FOR PIPE REINFORCEMENT

All diameters · -50° to +150° · Oil · Gas · Water · Onshore & Offshore

According to ISO/TS 24.817 & ASME PCC-2

REINFORCEKiT® 4D

ONLINE LEAK SEALING

4" to 56" · -20° to +80° · Oil · Gas · Water · Onshore & Offshore

Emergency Pipe Repair System (EPRS)

STOPKiT®

PIPE & SUPPORT PROTECTION

Old & New Installations · 4" to 56" · -30° to +150° · Oil · Gas · Water · Onshore & Offshore

for Corrosion Under Support (CUS)

ROLLERKiT®

OUR CLIENTS

Oil & Gas

Energy

Others

New Delhi: Ashish Tyagi (Director), WA-52, Shakarpur, New Delhi-110092, Tel.: +91 11 4240 2000 M.: +91 98181 85174, Email: info@3x-india.in
Mumbai: Anuj Sood (Director), B-405, Dynasty Building, Andheri (E), Mumbai -59, Board: +91 22 4005 3712 M. +91 9769694472
Monaco: Stanislas B.D' Auria (MD), 9 Avenue Albert II 98000, Monaco, Board: +377 9205 7981 M: +33 607390283

SILVER

AkzoNobel

AkzoNobel is a multicultural, market-driven, and technology-based organization, serving customers worldwide with coatings and chemicals. Based in Amsterdam, Netherland, we are leaders in product technology, development, and manufacturing. Our businesses practically cover every application in the global coatings market. Our paints protect and enhance mobile phones, appliances, pipelines, construction machinery, ships, buildings and more. We are highly committed to innovation and supply our customers with strong brands & leading technologies. Our main development efforts focus on improving protection against harmful influences such as chemical corrosion, sunlight, and heat, ensuring better adaptability to meet specific customer demands, improving ease of application, aesthetic value and reducing ecological impact.

Akzo Nobel India Limited

AkzoNobel started operations in India in 1994 and since then, has made significant inroads into our chosen markets sectors. We transform experience and expertise from our seamless operations into technical excellence, delivering innovative coatings and services locally. Our business areas include Protective Coatings, Marine Coatings, Powder Coatings, Industrial Coatings and Decorative Coatings.

Operations in India – Performance Coatings

Protective Coatings – we offer an extensive range of high-performance coatings for the following sectors: oil & gas, power, original equipment manufacturers, mining & metals, and high value infrastructure.

Marine Coatings – we are the technology leaders in TBT-free antifouling, abrasion resistant coatings, ballast tank coatings and fouling control systems for vessels being built, repaired, or maintained.

Powder Coatings –we are uniquely placed to meet the needs of our customers from a wide range of industries like Automotive, Architectural, Domestic Appliances, Furniture, General Industries, IT and General Trade coaters.

Industrial Finishes - we are leaders in the development and manufacturing of Coil & Extrusion Coatings and Coatings for Specialty Plastics which are used for a wide range of applications such as appliances, mobile phone panels, etc.

Packaging Coatings - Our Packaging Coatings business leads the way in hi-tech internal and external coatings for food and drink packaging. We make and distribute a vast range of products that keep food and drink fresher for longer.

Our protective coatings products are marketed worldwide under our brand name "International." International Paint is the world market leader in heavy duty coatings for shipbuilding and repair, the largest manufacturer of high-performance protective coatings and fire protection for building construction and maintenance, and the leading supplier of yacht paints.

We provide customer focused solutions with an objective to : -

* Identify and meet customer requirements.
* Design and introduce new products that meet customer requirements.
* Establish and maintain control over raw material quality and product formulation.
* Manufacture product right first time.
* Ensure all employees are trained and involved in continuous improvement.
* Ensure customer satisfaction in terms of quality and service.
* Akzo Nobel, Indian operations is an ISO 9002, ISO 14001, and OHSAS 18001 certified plant, and quality can be traced back to enhance customer satisfaction.

International

International

No need for shutdowns

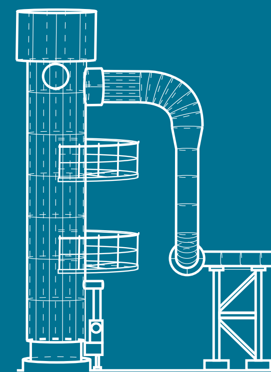
The emergency problem solver

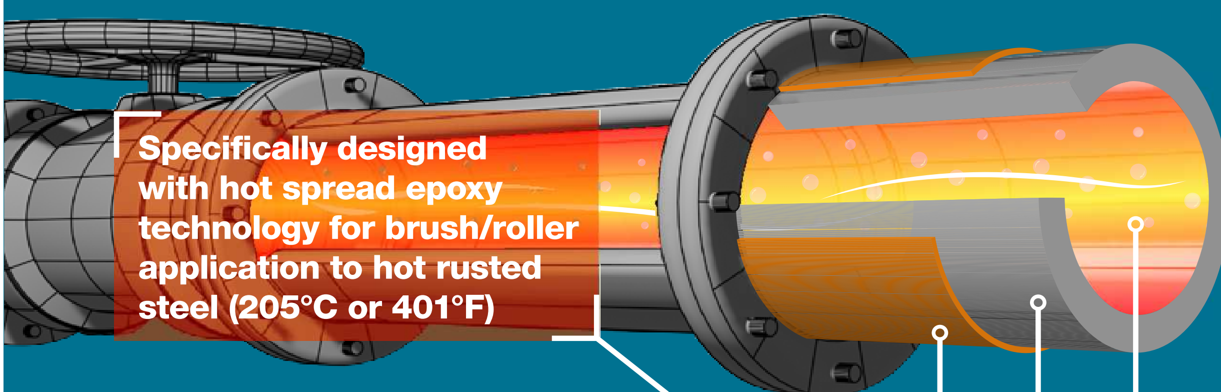
Intertherm© 2205

100% Uptime

100% Operational

100% Profitability maintained





The Applicator

Be the Hero in an emergency situation

Application to minimally prepared steel works on St2 (SP2), excellent adhesion and corrosion resistance.

HSE (Health, Safety & Environmental benefits) of lower VOC emissions compared to competitor products reduces worker impact during application.

international-pc.com/products/intertherm-2205

AkzoNobel

allied engineers
PIPELINE INTEGRITY

50 YEARS OF INNOVATION Since 1973

Contact:
+91 1294026033/ 34/ 35
ae@alliedengineer.com
www.alliedengineer.com

Company Profile

Allied Engineers (AE) celebrates it's 50th year anniversary in 2023. AE provides a wide spectrum of specialized asset integrity tools under one umbrella, ranging from complete turnkey threat assessment programs to customized integrity validation studies. AE has conducted successful pipeline integrity programs for 1,700+ pipelines for various global clients spanning thousands of kilometres. AE was established in 1973 by Mr. Subhash Khera (Petroleum Engineer) who had gained significant experience with Oil and Natural Gas Corporation Ltd (ONGC), India and then with Hudson Bay Oil and Gas, Canada.

AE having its main office in New Delhi & Faridabad (India) with associate offices in Canada, Kuwait, UAE and Saudi Arabia provides an umbrella of asset integrity management solutions. AE boasts of having Subject Matter Experts (SME's) who are lead instructors with NACE/AMPP and ASME Pipeline Integrity Management related subjects, NACE/AMPP Certified Corrosion Specialist, Internal Corrosion Specialists, Cathodic Protection Specialist and Chemical Treatment Specialist.

AE has an extensive wealth of knowledge and experience associated with all integrity aspect for piping and pipelines gained primarily from the petroleum industry. We provide comprehensive and field proven services as:

AE SERVICES (for Piggable & Non-Piggable Pipelines)

1. Turnkey Pipeline Integrity Programs including Corrosion Audits
2. Total Pipeline Integrity Management Solution (T-PIMS) Software
3. Direct Assessment (DA) for Piggable and Non-Piggable Pipelines:
   a. External Corrosion Direct Assessment (ECDA)
   b. Internal Corrosion Direct Assessment (ICDA)
      i. Dry Gas ICDA
      ii. Wet Gas ICDA
      iii. Liquid Petroleum ICDA
      iv. Multi-phase ICDA
   c. Stress Corrosion Cracking Direct Assessment (SCCDA)
4. eXternal Line Inspection (XLI) with simultaneous, continuous and encrypted "All in One" surveys, XLI collects up to ten (10) data sets by walking ONLY ONCE over the complete pipeline right of way:

   DGPS/GIS, DC – CIPS, AC-CIPS, DCVG, ACVG, ACCA/CAT, DOC, Elevation Profile, GLD, Continuous Soil Resistivity, PWA

5. In-line Inspection (ILI)
   a. Ultrasonic Inspection (Metal Loss & Pitting)
   b. Ultrasonic Crack Detection
   c. UT based Invista for Non-piggable pipeline
6. Leak Detection by SmartBall
7. Gas Leak Detection above ground survey
8. Furnace Heater Inspection using FTIS
9. Advanced NDT Inspection
10. Permanent Composite Sleeve repair using Clock Spring® (CSNRI Composites)
11. Environmental Modelling based on CEPA guidelines
12. Fitness for Service (FFS) analysis
13. Training

INDIA CANADA UAE KUWAIT SAUDI

SILVER

INTELLIGENT COATING SOLUTIONS

- **Intelligent coating solutions tailor made to your requirements**
- **We invest thought & time into your project**
- **Optimally crafted solutions based on a wealth of experience**

About Us :

CLEAN COATS has been a leader in the field of Specialty Coatings in India for over 2 decades. We provide state-of-the-art coatings for a wide range of applications, including Wall & Floor Coatings, Tank, structural, pipeline, concrete coatings.
CLEAN COATS has set very high quality standards for its products and each batch of production is subjected to stringent quality tests before being cleared for use. The Company is **accredited with ISO 9001: 2015 certification** for its ability to design and develop solutions /products coupled with a good manufacturing practices / services. We also have received the **ISO 14001: 2015 and ISO 45001:2018 certifications**.

CLEAN COATS has a consistent and established track record of servicing its customers. It has an in-house application team as well in order to provide customers with a comprehensive and end-to-end-service package.

Our coatings are backed by extensive research and development, and are trusted by customers across the country.

The company has organized itself into the following 3 different Strategic Business Units (SBUs) to give greater focus to the end customers.

a) Epoxy Flooring & Hygiene wall Coatings (SBU 1)
b) High performance Corrosion Resistant Coatings (SBU 2)
c) Construction & Waterproofing Chemicals (SBU 3)

Each SBU has its own functional team, with proper emphasis on customer focus.

The Company offers diversified portfolio of products including:
1. Entire Range of High Performance Anticorrosive Coatings
2. Food Grade Epoxy Coating
3. Elastomeric PU Coating
4. Friction Reducing Gas Flow Coating
5. Glass Flake Coatings (Vinyl Ester, Polyester, Epoxy)
6. Coal Tar Epoxy Coating
7. Chemical Resistant Coatings for Tanks, Pipelines, Floors
8. Epoxy & Polyurethane Floor Coatings
9. Water Based Polyurethane & Acrylic Wall Coatings,
10. Bipolar Concrete Penetrating Corrosion Inhibiting Admixture
11. Construction Chemicals

In our High Performance Corrosion Resistant Coatings (HPCC) SBU we offer the complete range of High Performance Protective Coatings designed to effectively solve corrosion problems even in aggressive environments. We offer solution to every industry like Infrastructure, Tank Farms, Pipelines, Power, Oil & Gas, Offshore, Petrochemicals, Industrial OEM etc. These coatings are wel established and proven in aggressive environments, incorporating the latest technological advancements and formulation techniques. **Many of these coatings have High Humidity and High Salt Fog resistance of " 10,000 hrs. no failure", when tested as per ASTM B 117.**

Manufactured by

CLEAN COATS PRIVATE LIMITED

An ISO 14001:2015, ISO 9001: 2015, ISO 45001:2018 Certified Organization

CLEAN COATS® SPECIALITY COATING SOLUTIONS

CLEAN COATS: A SPECIALTY COATING SOLUTIONS PROVIDER





The Company offers diversified portfolio of products including:

- Pipeline coating – Internal & External
- High performance Specialty Corrosion protection coating
- Ultimate Chemical resistant coating
- Epoxy Sealers on Metallized / Thermal Spray coatings
- Metal Repair / Ceramic Repair / Pumps / Valves Rebuilding Systems
- Solvent Free Food grade Epoxy
- Glass Flake Coatings – All types
- Underwater Cure Epoxy
- Waterproofing systems
- Epoxy & PU based flooring systems
- Bipolar Concrete Penetrating Corrosion Inhibiting Admixture
- Elastomeric PU coating for mounded bullets / pipelines
- Hygienic 2KWPU Water based Wall coating
- Anti Carbonation Coating





Manufactured by

CLEAN COATS PRIVATE LIMITED

An ISO 14001:2015, ISO 9001: 2015, ISO 45001:2018 Certified Organization

Contact us: Tel.:- +91 22 2650 5576/ 3468 /2650 0846/ 47/48

Email: office@cleancoats.com www.cleancoats.com

DEHN INDIA - COMPANY PROFILE

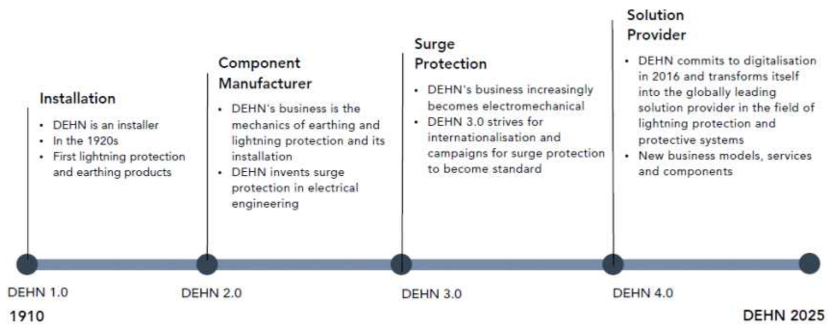
DEHN is a global leader in lightning protection, surge protection and smart safety solutions. Founded in 1910, DEHN brings more than 110 years of experience, with its headquarters in Germany and a presence in more than 70 countries. With over 1,100 patents, DEHN stands at the forefront of innovation in lightning and surge protection, earthing systems, and safety equipment. Our products protect people, critical infrastructure, oil and gas refineries, LPG bottling plants, marketing terminals, pipelines, telecommunication systems, process industries, photovoltaic systems, wind turbines, and more.

A true pioneer, DEHN invented Surge Protection Devices (SPDs) in the early 1950s, revolutionizing the global safety market. Our commitment to the highest quality standards and customer-centric solutions has fueled our growth and leadership in the industry.

At DEHN, we prioritize responsible, resource-efficient practices, balancing environmental protection with exceptional quality management. Our products safeguard both people and valuable assets.

DEHN India, a 100% subsidiary of DEHN Germany, has over 20 years of expertise in India, specializing in lightning protection, surge protection (SPDs), earthing systems, safety equipment, and advanced engineering services. Our solutions are built to protect vital installations according to both Indian and international standards, including IS/IEC 62305, OISD 180, NBC 2016, IEC 61643, IS 3043, and IEEE 80.

One of our standout capabilities is our advanced testing facilities in Germany. Our lightning impulse current laboratory can generate currents with peak values of up to 400 kA (10/350 µs) and 100 kA (8/20 µs), making it one of the most powerful labs of its kind in the world. It is accredited by the German Accreditation Body (DAKKS), underscoring our commitment to rigorous testing and quality assurance.

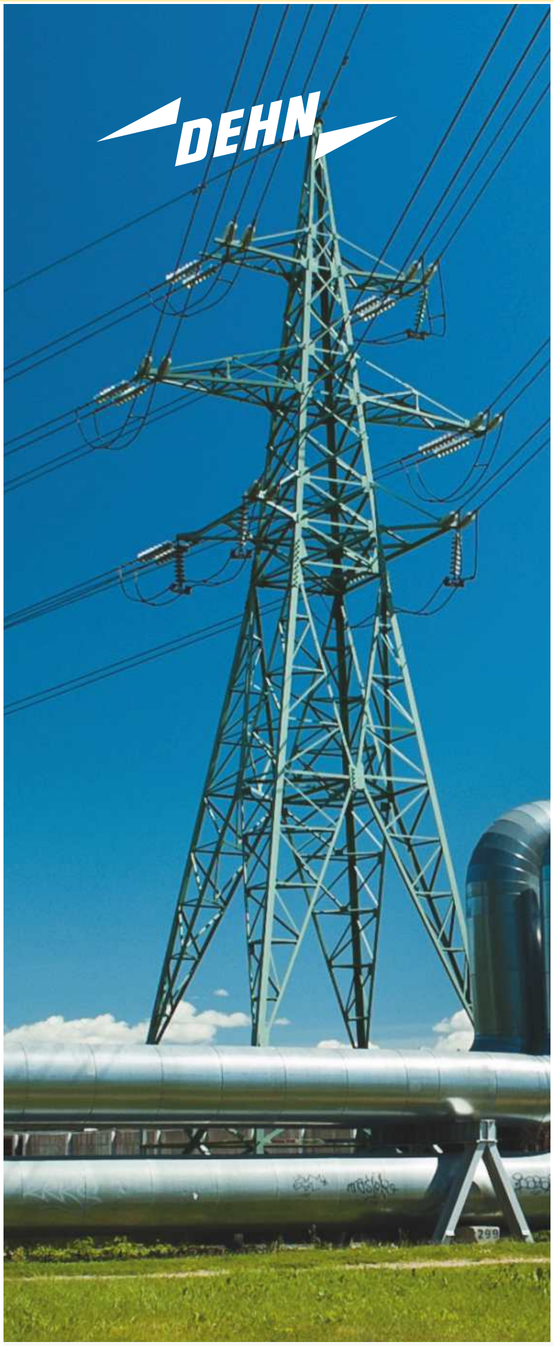


DEHN is a trusted name in lightning risk mitigation, providing engineering solutions in surge protection, lightning protection, and safety equipment. DEHN India leverages the expertise and innovation of DEHN SE to offer an extensive range of patented products and solutions that ensure reliable uptime for your business.

We hold strong expertise in combating infrastructural challenges, serving industries such as infrastructure like - Real Estate, Oil and Gas, Telecommunication, Wind Energy, Solar Energy, Sewage Plant, Railway systems, and Process Automation. Our advanced solutions, analytics and deep understanding of global markets position us as the preferred solution provider for lightning and surge protection solutions worldwide.

Our Every solution is designed and undergoes rigorous performance testing to withstand extreme lightning conditions, "DEHN protects.", two words that define our vision and mission.

Driven by our mission and vision of securing businesses, we continuously enhance our R&D capabilities to deliver quality, reliability, and most importantly, improved workplace safety.



DEHN Offerings for Pipeline Protection

Services -

- AC Interference Study
- DC Interference Study
- Design of Cathodic Protection System
- Cathodic Protection System - Root Cause and Recommendation
- Power Quality
- Earthing Health Assessment
- Lightning Adequacy Services

Solutions -

DC Decoupler -


DASD


DASD 2.0


VCSD

Surge Diverter / Isolating Spark Gap -


EXFS L


EXFS 100 KU


EXFS 100


EXFS Coaxial Connection Box

Other Solutions -


EPMS


Blitzductor


DEHNvap


Earthing Rod & DEHNterra

Capabilities -

- AMPP (former NACE) Certified and Skilled Manpower
- World Renowned Modelling Software
- Software Developer Trained Engineers
- Dedicated Field Team with Modern Instruments
- State of the art R&D Lab for Developing Solutions

DEHN INDIA Pvt. Ltd.
Plot No. 283, Sector 7,
IMT Manesar, Gurugram

+91-124-400-7680
www.dehn.in
info@dehn.in

Demech Chemical Products Pvt. Ltd.

www.demechchemical.com

Demech Chemical is engaged in providing products and long-term solutions to industries for prevention of corrosion, abrasion and erosion. A wide range of equipment such as pipelines, tanks, vessels, pumps, ducts, chimneys, structures, floorings and many more are protected by these high build coatings with Anti Corrosive Paints.

Company started its operations in 1993. It has state of the art ISO 45001-2018 and OHSAS 18001 certified manufacturing facility at Baramati near Pune.

With continuous investment in research and development, company has enlarged its product range. In all types of high performance specialty coatings such as glass flake composites, elastomeric polyurethanes, ceramic composites, chemical resistant coatings, metal powder embedded compounds etc.

Because of company's robust composites; almost all of the corrosion, abrasion and wear related problems can be solved. Industry problems such as material losses, efficiency decline, increase in energy & maintenance costs and safety hazards are eliminated. We PROTECT the equipment to PREVENT further degradation and as a result PROLONG the life of the valuable ASSETS.

Demech Chemical is a technology-driven company. Which provides turn-key services with a strong focus on protection of the industrial assets. Executing coating projects from concept to commissioning in every industrial sector such as power, steel, petrochemicals, oil and gas, mining, fertilizers, chemicals, cement, paper, marine, sugar, water and waste water treatment and many more. Evaluate your requirements so you choose the products and application processes and furthermore. We also take up application of our products. As a result, we take single point responsibility of performance of our products and services.

Quality Policy

We are manufacturer and service provider for High Build Specialty Coatings, Wear & Abrasion Resistant Products & Flooring Systems.

Strive to create value for customers through value added services & endeavor for total customer satisfaction with respect to quality, timely delivery & reliability of our products & services.

Committed to improve unceasingly with periodical reviews & revised performance standards in every aspect of our business.

Vision

To be a leading global brand in the race of creating a corrosion-free world by providing passive protection to assets by specialty polymer coatings.

30 Years EXCELLENCE

Demech Chemical
Protect › Prevent › Prolong

Demech Chemical specialises in providing erosion and corrosion prevention solutions to core sector industries. Our expertise serves a diverse range of sectors like oil and gas, power, steel, mining, cement, and more.

Our Services:
We offer comprehensive solutions:
1. Problem diagnosis
2. System recommendation
3. Product supply
4. Application implementation

Product Portfolio:
Our high-performance specialty coatings include:

- Glass Flake Coatings
- Maintenance, Repair & Operation (MRO) Products
- Polyurethane Coatings
- Protective Coatings
- Chemical Resistant Linings
- Ceramic Coatings
- Floor Coatings
- Crusher & Backing Compounds

Product Features:
Our High-Performance Coating products are of low VOC & designed to protect prevent prolong equiment life. They offer protection from aggressive chemical environment at elevated temperatures.
These high build coatings offer execellent abrasion resistance, corrosion resistance in salty environment & have resistance to cathodic disbondment.

Demech Chemical Products Pvt Ltd

T-77, M.I.D.C., Bhosari Industrial Estate, Pune - 411026 (India)
Ph: 020-40775507/40775518
E-Mail: marketing@demechchemical.com | www.demechchemical.com

MAKE IN INDIA

For More Information
www.demechchemical.com

WHO WE ARE ?

Dutchwerk™ is a premier provider of cuting-edge engineering solutions and innovative products to protect, prolong and preserve your critical energy assets. We are committed to excellence, quality, and sustainability. Our diverse range of tailored offerings includes advanced coating, surface preparation, repair, rehabilitation and inspection solutions for asset integrity management, ensuring the efficient operation, long-term reliability, and safety of critical infrastructure.

PRODUCTS

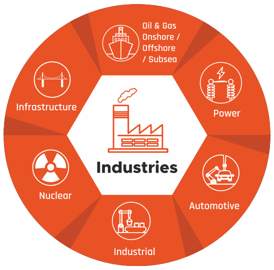
- Montipower® Surface Preparation Technologies
- Montipower® Subsea Surface Preparation solutions
- Allter ® Liquid Applied Coatings Services
- Allter® Visco-elastic Corrosion Prevention System
- Allter ® Field Joint Coating and Insulation Services
- Allter® High Temperature and Chemical Resistance Coatings
- Strongpipe® Engineered Composite Solutions
- Strongpipe® lnternal Weld Sleeves
- Strongpipe® Pipeline Emergency Repair Clamps
- Allter Strongpipe® Epoxy Grouted Pipeline Repair Clamps
- Allter Strongpipe® Epoxy Grouted Structural Repair Clamps
- Allter Strongpipe® Conductor/Riser Repair and Strengthening system
- Allter Strongpipe® Conductor Stabilizing and Protection system
- Allter Strongpipe® Subsea Morine Growth Removal Tool

SERVICES

- Asset Integrity Management
- Cathodic Protection Services
- Corrosion Prevention, Monitoring & Inspection Services
- Hot Tapping, Online & Offline Corrosion Coupon Retrieval
- Oil Field Microbiology & Corrosion / Erosion Data Analysis
- Onshore & Offshore Diving, Inspection & Survey Services
- Onshore, Offshore, Subsea Oil & Gas Field Maintenance Services
- Pipeline Integrity Management Service (PIMS)
- Emergency Pipeline Repairs Services (EPRS)
- Above Ground Storage Tank Repairs, Reinforcement & Rehabilitation

KEY FEATURES

- Go Carbon Neutral, Emission free products and services
- A Our top priority is always safety with quality
- Driven by European technology and supported by gasuine
- Strong knowledge and provisions for turnkey services
- Provide Total PIMS package with support and field work expert
- We enhance asset performance and operational effectiveness
- We reduce risk and minimize downtime and reduce operational cost
- Skilled and competent engineers using cutting-edge techniques



Certifications

DUTCHWERK
Total Integrity Management & Engineering Services
Netherlands England Mexico UAE India
UAE: +971 50 415 5134 | India: +91 95674 77953
info@dutchwerkme.com www.dutchwerkme.com

No.299/A, 1st Cross, BTM 2nd Stage,
7th Main, Mico Layout, Bangalore - 560 076

SILVER

ELECTRO CORR - DAMP PVT. LTD

Think Corrosion, Think ECD

Electro Corr-Damp Pvt Ltd. established in 1989 is a premier provider of cathodic protection, corrosion monitoring, corrosion prevention, surveys, commissioning, supply and installation of material, in field of cathodic protection. The head office of ECD is in Santacruz, Mumbai and manufacturing facilities at Mira Road, Thane.

ECD supports your goals for preserving assets and environment. Our continuous quest for new technologies and techniques is grounded in the knowledge that corrosion prevention is an integral part of integrity management, helping improve the reliability and safety of your operation, reducing costs, and giving you a competitive advantage in an ever changing industry.

ECD's Engineers develop the most cost-effective solution for corrosion problems. Based on the scope of the project, ECD provides the below array of services.

Service Domain
- Commissioning & installation of TCP and PCP.
- External Corrosion Direct Assessment.
- Internal Corrosion Direct Assessment.
- Supply and Installation of cathodic protection material.

MC Miller
ECD is also an authorized distributor of MC Miller products.

In-house Manufacturing
ECD has a manufacturing workshop at Mira Road, Thane.

ECD Manufactures
Junction Boxes: Test station, normal test station for Polarization Cell, Anode Junction Box, Cathode Junction Box, Reference Electrode: Cu-CuSO4 Permanent Reference Electrode, Cu-CuSO4 Portable reference electrode Polarization Cell. AC-DC Coupons, Canisters.

ECD in its conquest to bring efficient and cost effective solutions to the industry.

Software
Ease of monitoring the project, the software has features to create users, contractors, client, feature to directly upload the raw data of the survey or recorded reading, it interpolates the same into a report with interpretation. The Software has features to be able to present the desired levels of control. Not only does it make Report but also have outputs of Recommendations. Ease of maintaining and retrieval of data and reports. Features to monitor the progress of the work.

ELECTRO CORR-DAMP PVT. LTD.

Think Corrosion, Think ECD

ECD

Authorized Distributor For

T&R M.C. MILLER

MONITORING & MAINTENANCE OF CP SYSTEM

- PSP MONITORING
- CPTRU/CPPSM MONITORING
- HEALTH CHECKUP OF CPTRU/CPPSM
- CALIBRATION OF PANEL METER
- INTERNAL CORROSION/ER PROBE MONITORING

CP SURVEY

- ECDA (CIPL/CAT/DCVG/ACVG/SOIL RESISTIVITY)
- ICDA (FLOW MODELING & LRUT)
- AC & DC INTERFERENCE

INSTALLATION

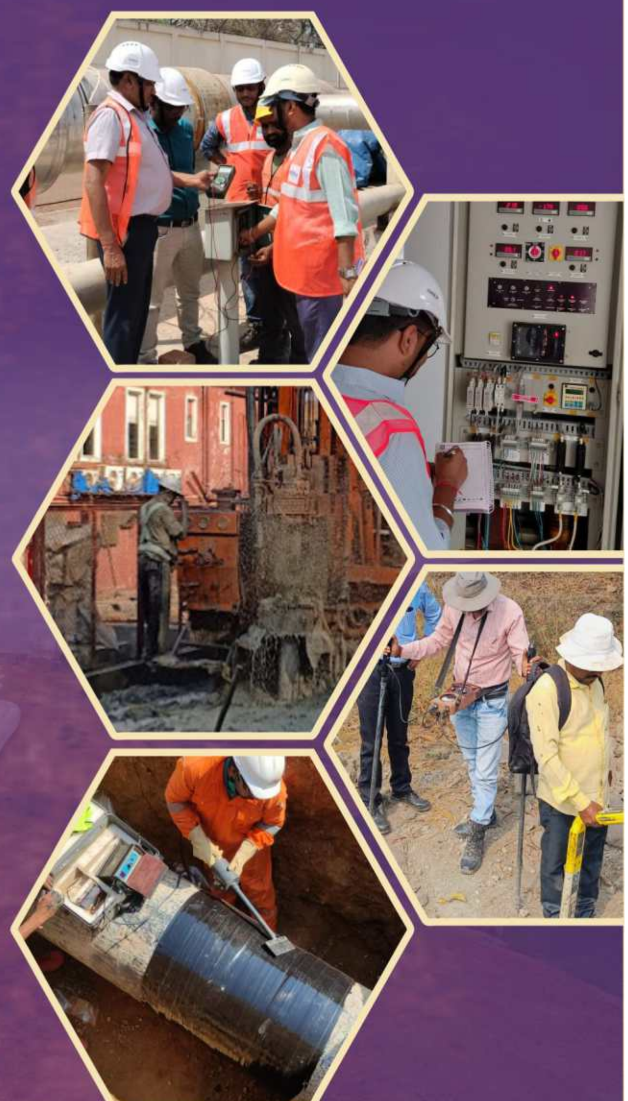
- SACP SYSTEM
- ICCP SYSTEM
- AC MITIGATION

SUPPLY OF CP MATERIAL

- CPTRU/CPPSM
- JUNCTION BOX (AJB,CJB,TLP)
- POLARIZATION CELL (SSD/ELECTROLYTE)
- REFERENCE CELL (PORTABLE/PERMANENT)
- SACRIFICIAL ANODES (Zn/Mg/Al)
- AC-DC COUPONS
- BACKFILL MATERIAL
- All CP ACCESSORIES

IN HOUSE MANUFACTURING

- JUNCTION BOX (AJB,CJB,TLP)
- POLARIZATION CELL (ELECTROLYTE)
- AC-DC COUPONS
- CANISTERS



CORPORATE OFFICE

22/23, Goodwill Premises, Swastik Estate, 178 CST Road,
Kalina, Santacruz (E),Mumbai- 400 098, Maharashtra, India.
Tel: 022-42200900, 9322311111,
Email: info@ecdpl.com Web: www.ecdpl.com

OUR GROUP OF COMPNIES

ICS ICS ASSURE Intech SURYANSH Ausadha Pharma Pvt. Ltd.

SILVER


THINK ELECTRICAL
THINK JEF
JEF
SINCE 1994
PARTNER WITH
ASIA'S LEADING
EMI/AC/DC INTERFERENCE EXPERTS
OUR SERVICES
- AC INTERFERENCE STUDIES
- DC INTERFERENCE STUDIES
- DC STRAY CURRENT ANALYSIS
- EM ZONING, MATRIX & EVALUATION
- ELECTROMAGNETIC SHIELDING
- STATIC & HIGH-FREQUENCY GROUNDING
- ELECTRO MAGNETIC ISOLATION
- EARTHING HEALTH ASSESMENT
- LPS ADEQUACY STUDIES
- POWER SYSTEM STUDIES
- POWER QUALITY STUDIES
- ELECTRICAL SAFETY AUDIT
- ARC FLASH STUDIES
- BREAKER CO-ORDINATION
- RCD & ELCB TESTING
- ELECTRICAL THERMOGRAPHY
OUR PRODUCTS
- GROUNDING SYSTEM
- SURGE PROTECTION DEVICES
- LIGHTNING PROTECTION SYSTEM
- ESE LIGHTNING PROTECTION
+91 80 37569000
marketing@jeftechno.com
SCAN FOR MORE

SILVER

Jotun India Pvt. Ltd.
Address
Fulcrum, A wing - 601/602, Next to Hyatt Regency, Sahar Road, Andheri East,
Mumbai, Maharashtra 400099
Telephone : 91 22 6787 2100
Sector : Paints and coatings

Web www.jotun.com

Company Profile :

The Jotun Group is one of the world's leading manufacturers of paints, coatings and powder coatings. Jotun's operations cover development, production, marketing and sales of various paint system and products to protect and decorate surface in the residential, shipping and industrial markets.

The matrix organisation is divided into 4 divisions responsible for the sale of Decorative Paints, Marine, Protective & Powder Coatings.

With more than 90 years of experience, the group has 64 companies and 40 production facilities on all continents.
Including the total network of legal companies, agents, branch offices and distributors Jotun is represented in more than 100 countries and has around 9700 employees

Jotun India Private Limited is a 100% subsidiary of Jotun A/S, Norway in India with corporate office in Mumbai and a state-of-the-art manufacturing facility at Ranjangaon near Pune.

On 5th March 2008 Jotun opened its first manufacturing facility in India and thereafter increased the capacity in 2015. The factory represents an investment of approximately $ 35 million and will has a production capacity of 50 million liters of paint and 10,000 tons of powder coating.

Our vision is to achieve exceptional growth and profitability by exceeding customer expectations. Jotun aims to be a leading player in defined market segments worldwide. We aim to deliver the highest possible level of service through our dedicated and competent employees. We seek to partner with our customers right from the identification of the problem, to delivery and application of suitable quality products. Jotun builds long term relationships with all its stakeholders including customers, suppliers and employees. We strive and aim to exceed the expectations of our stakeholders


JOTUN
jotun.com
Stay ahead
of corrosion
With unconditional steel protection from Jotun,
your assets will better withstand harsh operating
environments and benefit from extended service life,
even in unpredictable application and surface conditions.
Maintain steel integrity*
Explore our range of products and services on www.jotun.com
Reach out for further discussions
Rajdeep Dhar
rajdeep.dhar@jotun.com
+91 9820116488
ENERGY MAINTENANCE

Formed in 1920, Nerolac Paints has always been symbolized excellence and contributed in preserving, protecting our National assets from corrosion. We are one of Leading Paint Industry supplying and servicing at all industrial verticals meeting to Paint coating technical specification requirements suited for protection of both onshore and offshore from corrosive environments.

We as a Paint company providing technical support to all types of customers with total involvement from Project designing, planning, execution, applications and even after sales supports.
We have 8 manufacturing plants and 120+ warehouses across PAN India closely located at industries verticals for services. We have over 200 + paint technologist working at our Research and Development Centre on new product innovation, eco-friendly system, nano technology, green environment, VAVE resulting to long durable paints products. This chemist working evaluates 360-degree perspective on corrosion and ensure that maintenance coating cycle at industries is extended to maximum possible thereby maintaining strength of structural steel and avoiding loss of steel.

We always provide guidelines to end users with check points, application standards, Surface preparation standards and inspection ensuring coatings jobs are executed as per designed specifications and buildings trust to have long term basis associations and relations.

Key Projects executed Mumbai Coastal Road Project, MTHL (Atal Setu), Bullet Train (MAHSR / NHSRCL), Metro Projects , Vande Bharat , NTPC , NPCIL , Tata Projects , L&T Projects, Reliance ….many others……

Our Focused Product segment servicing to all industrial verticals across:

- **High Performance Coatings** (C5 system, IPNET, Epoxy Glass Flake, Corrosion under Insulation (CUI), Inorganic Zinc Silicates, Heat Resistent, Solvent free Polyurethane/Epoxies, Anticarbonation , Epoxy Zinc Rich Primer , Coal Tar Epoxy…..
- **General Industrial Coatings** (Architectural, OEMS, Cylinders, Helmets, Agricultural/Construction equipment's, Pre-Engineering Buildings,.......)
- **Automotive Coatings** (All Heavy, Light Passengers / Commercials vehicles,2 Wheelers.)
- **Powder Coatings** (White goods appliances, Electricals, Domestics, Export .....)
- **Decorative (**Interior & Exterior Wall Coatings)
- **Auto refinish** – (Auto Garages, Bus Body, Auto Ancillaries ......)
- **Floor Coatings –** Self levelling Epoxies, Polyurethanes, Antistatic for Industrial sectors….)
- **Coil Coatings –** (Steel, Appliances Industries)
- **Road Markings –** (Hot Melt Thermoplastics MORTH 803.4, Water Based IS 164)
- **Intumescent Coatings –** (for Steel, Concrete, Wire Cables surfaces ….)
- **Bridge Coatings – (**Anticarbonation and Epoxies system.)
- **Marine Coatings.**

Marine Solutionz
Marine Solutionz Ship Management Pvt. Ltd

CIN U74120DL2009PTC187606
Registered Office:
Marine Solutionz Ship Management Pvt. Ltd
201, First Floor,TSL Corner,DDA Local Shopping Complex
Near HDFC Bank, Mayur Vihar, Phase - III
Delhi – 110096

Company Overview

Marine Solutionz Pvt Ltd is a leading contractor in Corrosion Protection Materials for pipelines, specializing in Cold Applied Tapes and Heat Shrinkable Wraps. With over 16 years of industry experience, we are trusted for our high-quality, field-proven products designed to protect buried and cross-country pipelines.

Corrosion Protection Tapes and Sleeves:

Our Cold Applied Tapes and Heat Shrink Sleeves provide durable, non-invasive protection against corrosion and mechanical damage for buried pipelines. These solutions are easy to apply, enabling protection even during active fluid transfer, which means zero downtime. The 3-ply structure of our tapes fuses layers to form a fully sealed, long-lasting protective barrier.

Recent Project Success:

We recently supplied a 2/3 ply tape coat system totaling 1.3 million sq. meters of tape, primer, and filler material (weighing over 1200 tons) valued at approximately USD 6 million for a major client. This accomplishment reflects our commitment to excellence and reliability in corrosion protection.

Why Choose Marine Solutionz for Corrosion Prevention?

- Proven Quality: High-performance materials designed for field durability.
- Reliability: Solutions that protect without interrupting operations.
- Expertise: Extensive experience in corrosion protection for challenging environments.

Contact Us:

For corrosion protection solutions, reach out at **tapes@marinesolutionz.com** or visit www.marinesolutionz.com.

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Ph.: +91 120 6157777
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Web : www.marinesolutionz.com

POLILEN ® 2135/350 EN 12068 C50

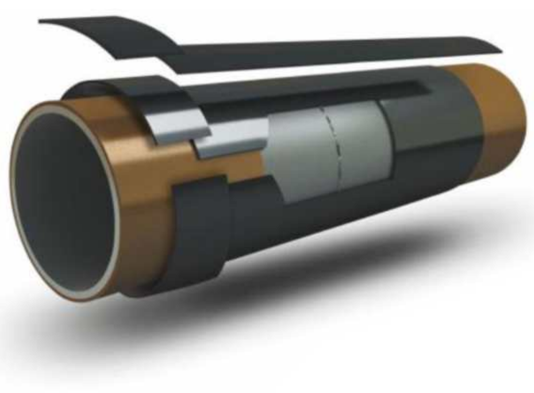
POLILEN ® 2135/350 is a cold-applied two-tape coating system, based on tapes with butyl rubber adhesive.
The system is designed for being applied to steel pipes under field and factory conditions. It can also be used for coating of fittings and welded joints and for repairing of damaged corrosive coatings on active pipelines.
POLILEN ® 2135/350 system includes:

1)	Primer	**POLILEN ® Primer NK-122**
2)	Corrosion protection layer:	**POLILEN ® 2135**
3)	Mechanical protection layer:	**POLILEN ® 350**

HEAT-SHRINKABLE WRAPAROUND SLEEVES

Heat shrinkable wraparound sleeve for corrosion protection of welded joints. The sleeve provides superior girth- weld protection of pipelines.

TYPE	LAYERS	USE	TEMP. UP TO
TIAL M	3	Girth weld joints	60°C
TIAL M80	3	Girth weld joints	80°C
TIAL M50	2	Girth weld joints	50°C
TIAL NNB	3	HDD Pipeline weld joints	60°C



Capt Sumit
+91 99580 06592

Capt RKP Sinha
+91 98672 99591

Mr. Akshay
+91 90990 52930

email: tapes@marinesolutionz.com

Metal Samples supplies a complete range of corrosion monitoring products, including:

Corrosion Monitoring Instruments

We provide an extensive line of corrosion monitoring instrumentation to interface with probes and interpret, analyze, and display the collected data.
Our instrumentation covers the spectrum from portable meters to transmitters to remote data loggers. New instruments include High Resolution meters, transmitters and data loggers that detect smaller increments of metal loss, providing faster response than traditional instruments (obtaining corrosion rates in hours instead of days).

Corrosion Probes

Our broad range of monitoring probes includes electrical resistance (ER), linear polarization resistance (LPR), erosion, hydrogen, and biological probes. We also design and manufacture custom probes to meet your special requirements.

Corrosion Coupons

Metal Samples has the world's largest selection of corrosion monitoring test coupons available in any size or shape, and in more than 2,000 alloys. In addition, we offer coupon holders, coupon insertion systems, and coupon test racks.

Access Systems

We offer both mechanical and hydraulic access systems for high-pressure/ temperature systems to insert and retrieve probes, coupons, etc.

Injection & Sampling Systems

Metal Samples also provides injection systems to inject a wide range of chemicals into processes and sampling systems to take samples of the process fluid or medium.

Non-Intrusive UT Monitoring

Metal Samples offers non-intrusive ultrasonic corrosion/erosion monitoring products. Take advantage of remarkably cost-effective, modular and robust solutions for remote, non-intrusive monitoring of ID corrosion and erosion using the latest solid-state electronics, wireless or wired technologies, cloud-based software and innovative ultrasonic transducer designs.

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Trenton Corporation products represent the finest in effective, long-lasting anticorrosion systems for aboveground and belowground pipe, irregulars fittings, bridge spans and transitions.

Founded in 1949 by Ted Kennedy, Sr., Trenton corporation remains a family business that is dedicated to manufacturing quality anticorrosion products.

Since its founding, the Trenton Corporation has pioneered the development of petroleum wax-based anti-corrosion products. Trenton's range of products includes Wax-Tape® brand anticorrosion wraps, hot-applied microcrystalline and cold-applied wax coatings, casing fillers for pipeline and cable casings, and marine pile protection. Thousands of miles of gas and oil transmission pipelines are now protected by Trenton systems. They are used by major oil, gas, water and chemical processing companies throughout the world.

With distribution facilities and sales offices worldwide, Trenton Corporation is recognized throughout the world for its unique products across many industries. The organization continues to strive to continually improve their products and satisfy the expectations of their customers.

Trenton Corporation Innovations:

Anticorrosion Wraps

- First to develop a solventized anticorrosion wrap which "firms up" after application
- First to develop a moldable anticorrosion wrap system capable of withstanding a 230°F (110°C) operating temperature

Casing Filling

- First to utilize insulated tank trucks with self-contained heating and a variable flow pump system for filling casings
- First to develop a wrap-around end seal adaptable to non-concentric carrier pipe and casing
- First to develop a patented process for inhibiting corrosion in water that may have remained in a casing after it was filled
- First to develop a systematic program for removing water from casings prior to filling

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- Readily conforms to irregular surfaces
- Compatible with other coatings
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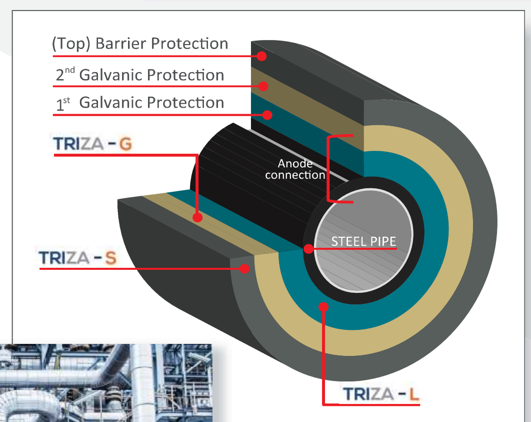

- **Smart Savings, Long-Lasting Protection:**
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- Pipeline

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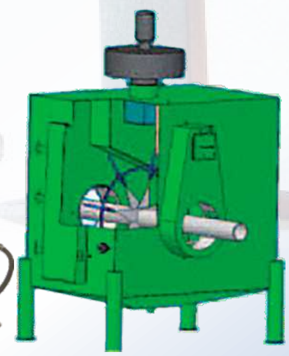

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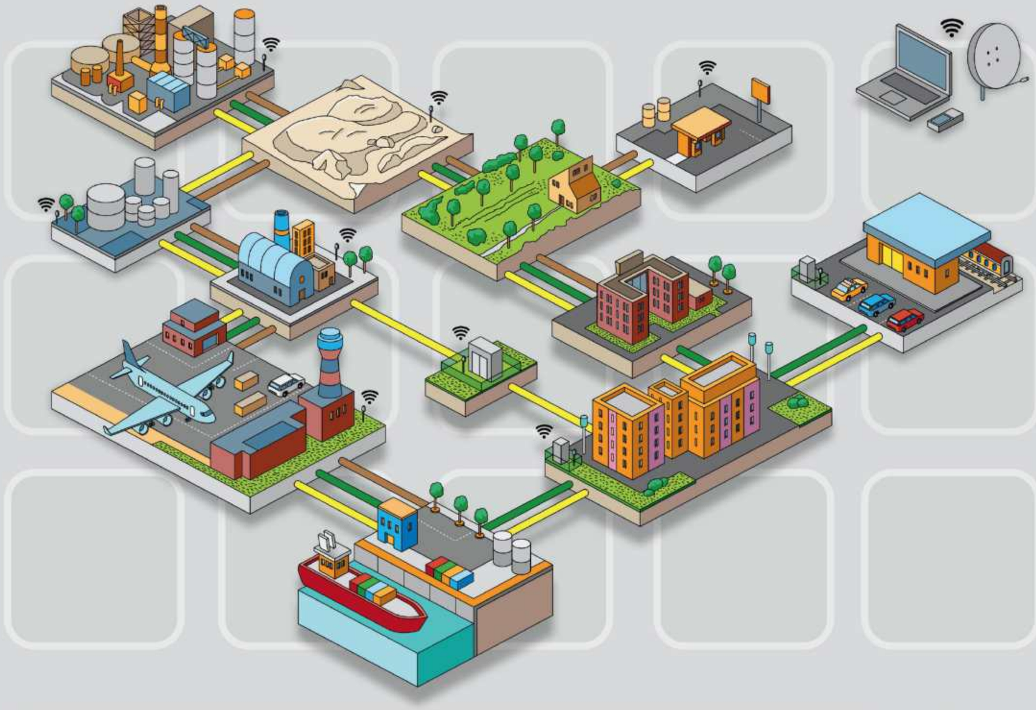

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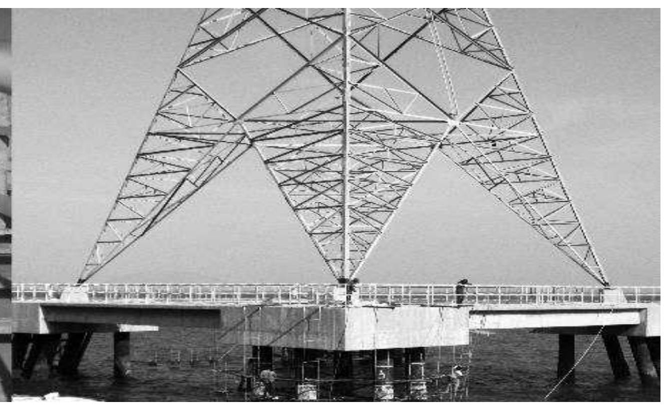

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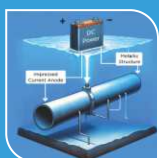

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Clean Blast International headquartered in Dubai in the United Arab Emirates with branches in Abu Dhabi (UAE), Doha (Qatar), Dammam (Saudi Arabia), Ahamadi (Kuwait), Cochin (India), Kuala Lumpur (Malaysia) and a network of distributors in other Middle East countries and the Indian sub-continent.

Clean Blast International distributes products from leading internationally acclaimed manufacturers and a team of experienced professionals well versed in surface preparation industry used their knowledge and experience in selecting quality products and each item is subject to in-house testing for quality assurance and performance before leaving to customers.

SCOPE OF SUPPLY

Blasting Machines: CE Marked Conventional Blasting Pot ranging from Single Chamber 18 ltr/ 50 ltr/ 100 ltr/ 200 ltr Blast Machines, Double Chamber 300 ltr Blasting Machines, Bulk Blasting Machines and Accessories

Blasting Abrasives: Garnet, Copper Slag, Steel Shot, Steel Grit, Aluminum Oxides, Glass Beads, Ceramic Beads

Painting Machines: Airless, Conventional, Air Assisted Airless and Electrostatic Painting Machines and Accessories

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All Sizes of Pneumatic Hoses and Fittings

Dedicated Service and Rental Department cater to the requirement of surface preparation industry.

PROJECTS

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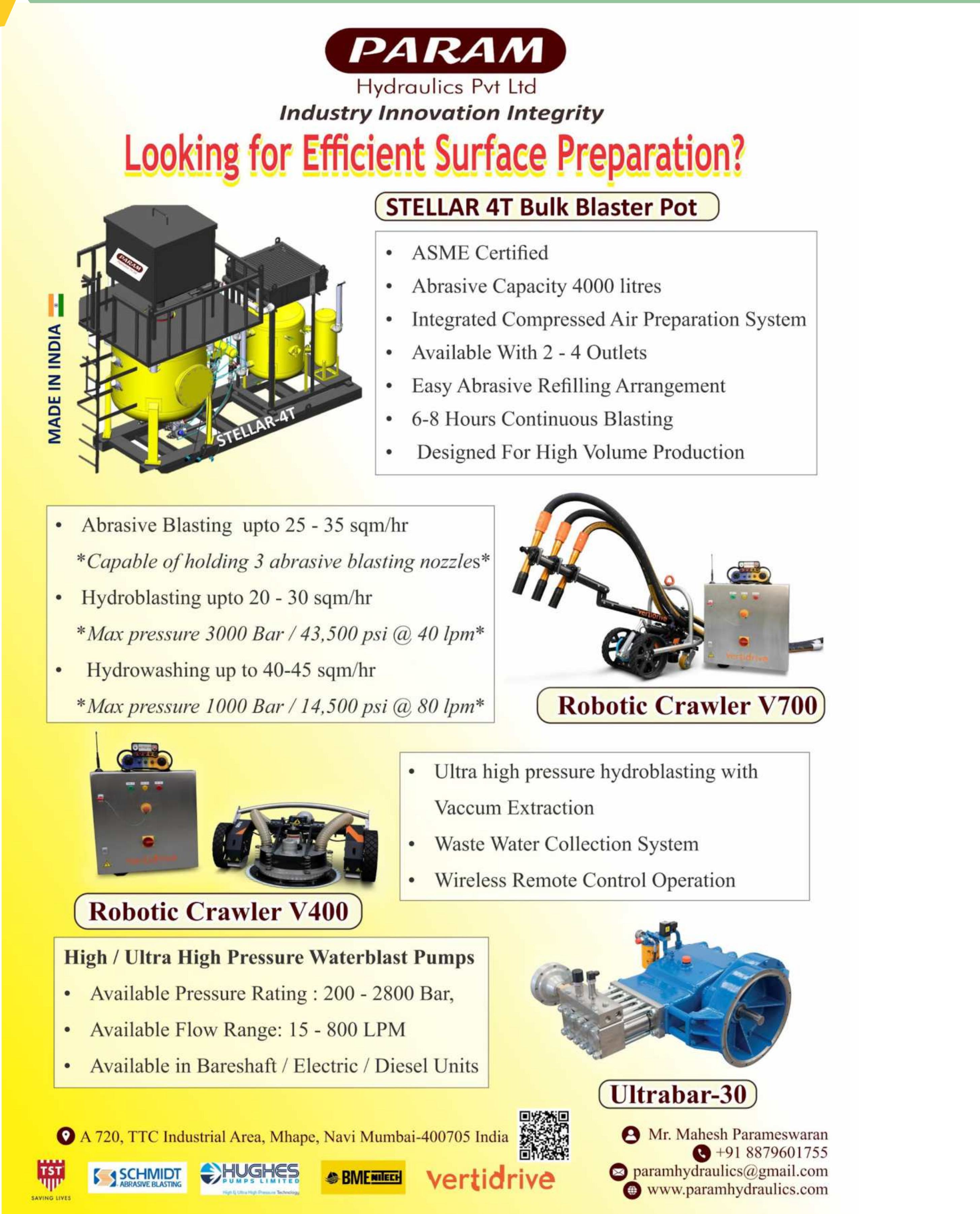
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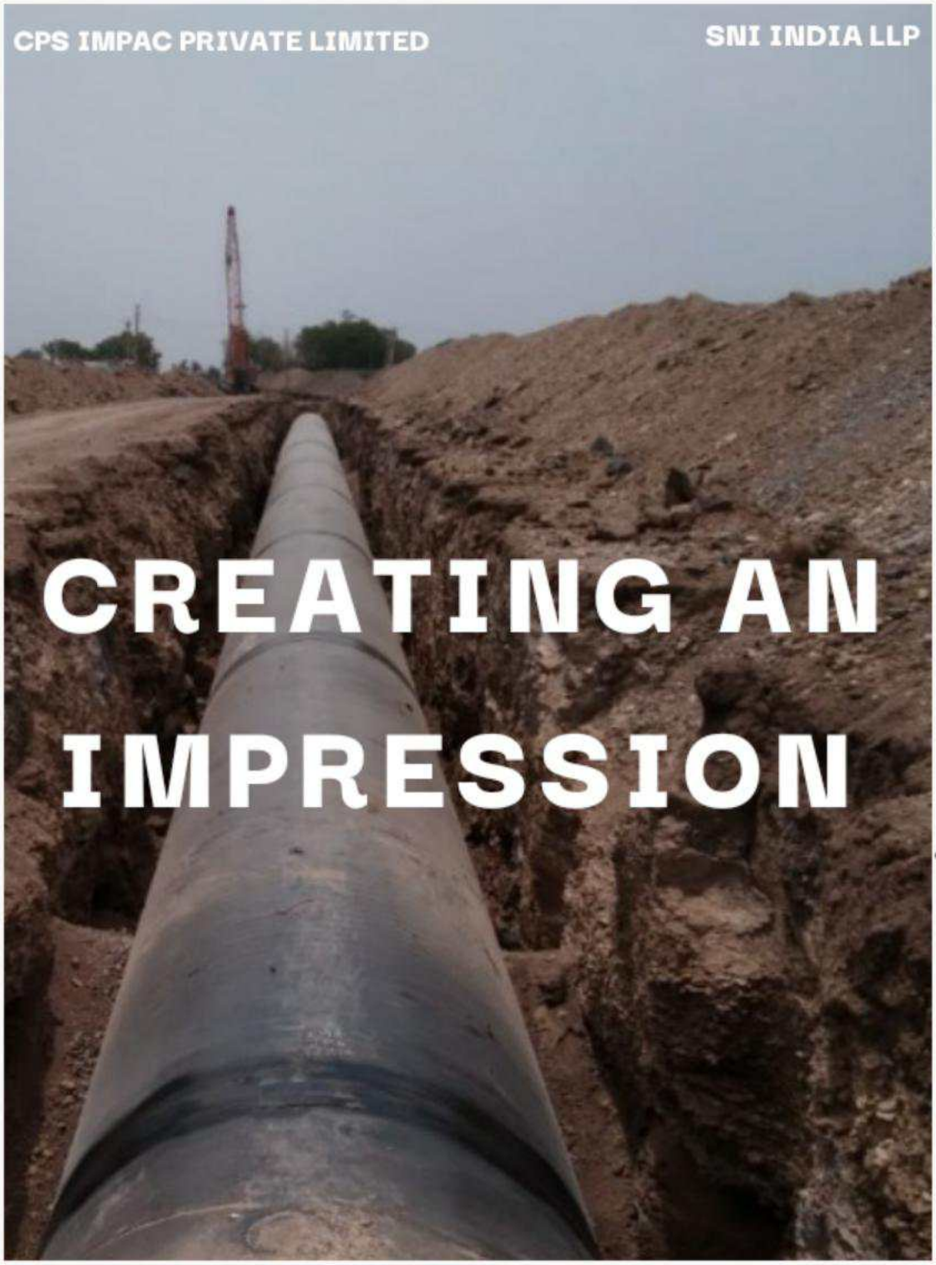

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CTS Group has been actively engaged in design and consultancy services, installation, supervision and maintenance surveys, temporary cathodic protection / sacrificial cathodic protection and permanent cathodic protection / impressed current cathodic protection.

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- GOSPS

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- Intake Pumps and Screens
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Crystal industrial

Crystal Industrial Syndicate Pvt. Limited, incorporated in the year 1991, is an ISO 9001 : 2008 ,ISO 14001 : 2004, OHSAS 18001 : 2007. Crystal has specialized into design and fabrication of various complex equipments and special fabricated items in exotic materials.

Product Range: Injection Quills and Access Fittings with Corrosion Coupons | Specialty Pipings in Cladded Inconel 625 / 825, Hastelloy B3, Hastelloy-C, Monel and Hard facings | Cladding of Pipe, Fitting and Valves, Well Heads and X-Mass Trees in Inconel / Monel and other Nickel Alloys | Gas Scrubbing Systems | Fire Safe Flange Guards for sandwiched check valves and Bund Sleeves | Pipe Hangers & Spring Supports | ASME U Stamp Pressure Vessels & Heat Exchangers.

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3. Non- Retrievable Type
4. Forged Type
5. Retractable Type
6. Injection Quill with Spray Nozzle
7. Access Fittings with Retrievable Tools and Service Valve
8. Corrosion Coupons

All the above products are manufactured in MOC of CS, SS304, SS316L, UNS N0 4400, UNS N0 6625, UNS N0 8825,HASTELLOY C276, DUPLEX STEEL, COPPER ALLOY, etc.

CLADDING AND WELDOVERLAY SERVICES:

Crystal has developed extensive range of procedures and techniques for Clad and weld overlay applications for the Oil & Gas, Petrochemical and Refineries. Clad and Weloverlay is carried out in following materials:

Base Material:
Carbon Steel, Stainless Steel & Low Alloy Steel

Clad Material:
SS304, SS316L, SS317L, SS410, UNS N0 8825, UNS N0 6625, Hastelloy C22, Hastelloy C276, Hastelloy B3, UNS N0 4400

Weld Overlay Material:
SS 401S,SS 304, SS304L, SS 316, SS 316L, SS 309, SS 309L, UNS N0 8825, UNS N0 6625, Hastelloy C22, Hastelloy C276, Hastelloy B3, UNS N0 4400

COMPLIES WITH NACE MR0175 SOUR SERVICE SPECIFICATION

To cater to the needs of its clients for weld overlayed items, Crystal has indigenous Automatic Overlaying Machines and Endless Torch Rotation (ETR) welding machine from Fronius which has advantage of overlaying on 3D curved surfaces.

Crystals has its global presence and has supplied the products to companies like Mangalore Refinery and Petrochemicals Limited, Larsen & Toubro Ltd, Reliance Industries Limited, Hindustan Petroleum Corporation Limited , Kuwait Oil Company, Occidental Petroleum Corporation, Indian Oil Corporation Limited and consultancies like Bechtel, Jacobs, Technip, Toyo, Petrofac, Aker Kavaerner, EIL Etc.

CERTIFICATIONS:

ASME U Stamp – R Stamp
National Board Certified – IBR approved

www.crystalindustrial.in

Crystal Industrial Syndicate Pvt. Limited.
403,404,412, Raheja Arcade, Sector-11, CBD Belapur, Navi Mumbai-400614 Maharashtra, India.
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For further details contact :

Mr. K. A. Kamat

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E-mails : kristronsystems@gmail.com / krishnakamat@gmail.com


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We have established in the year 2014, known as N R ENTERPRISE has come a long way and established as a Proprietorship Company in Ahmedabad, India and converted to Private Limited on Dec, 2019.
Our Proficiency
•Surveys
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•Monitoring and Maintenance
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We have carried out AMC contract for monitoring and maintenance of sacrificial anode and ICCP system.
Mainly:-
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§Supervision and Review of Reports.
§Verification of System Integrity.
§Action to be Planned.(Short term/ Long term)
§Recommendation for System up-gradation.
Our Clientele
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Bharat Petroleum
BHARAT OMAN REFINERIES LIMITED
BENGAL GAS COMPANY
HP
Contact Us
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- Increasing the lifeline of the assets
- Operational Efficiency
- And much more...

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- Preparation of operational manuals for CP Systems
- Upgradation of existing cathodic protection systems
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Our team has good experience and working spirit for giving-achieving perfection of work. SAP is Lead by professional management comprising of NACE qualified and richly experienced technocrats and supported by well trained and highly motivated teams of engineers/technicians. The very important part of our organization is set up and teamwork with unity, so appreciable output will be achieved by our workforce.

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- Titanium Anode
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- Zinc Permanent Reference Cell

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- DESTRUCTIVE TEST (CUTTING)
- ELECTRO CHEMICAL TESTING
- ASTM G97 TEST NABL ACCRETED
- LOAD TEST
- WEIGHT ANALYSES TEST
- DNV RP-B401 NABL ACCRETED
- 14-DAY WEIGHT LOSS TESTING
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Factory Address (Unit 1) : Plot No .3 , Swaminarayan Industrial Park Ahmedabad, Indore Highway Chandiyal Dis Ahmedabad – 382433 : +91 8866143560
Factory Address (Unit 2) : 28, Shiv Dhara Estate, Ramol Cross Road, G.I.D.C., Phase-iv,Vatva, Ahmedabad-382415 : +91 98795 71046
Kanpur Unit : Plot No. 2, Site No.-1, U.P.S.I.D.C. Rania, Kanpur-209304 : 05111-240219 : +91 8866143560

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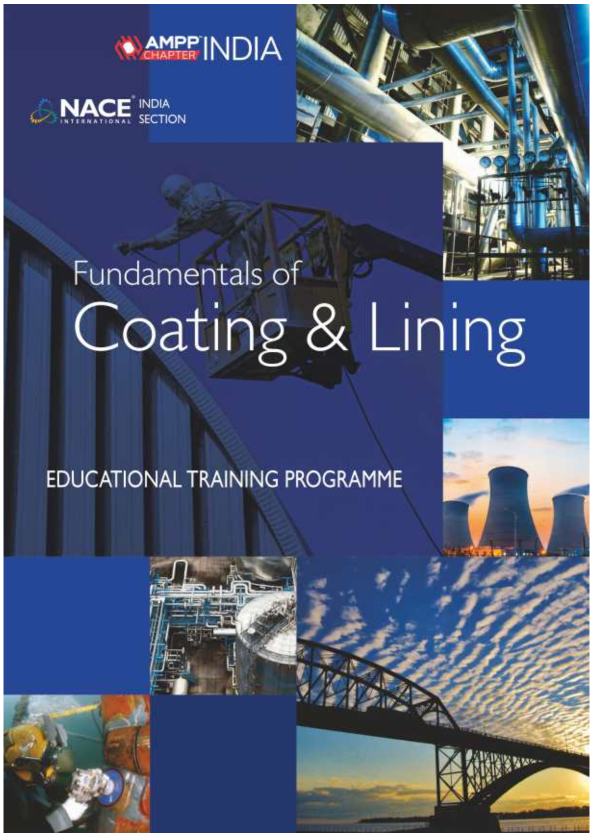

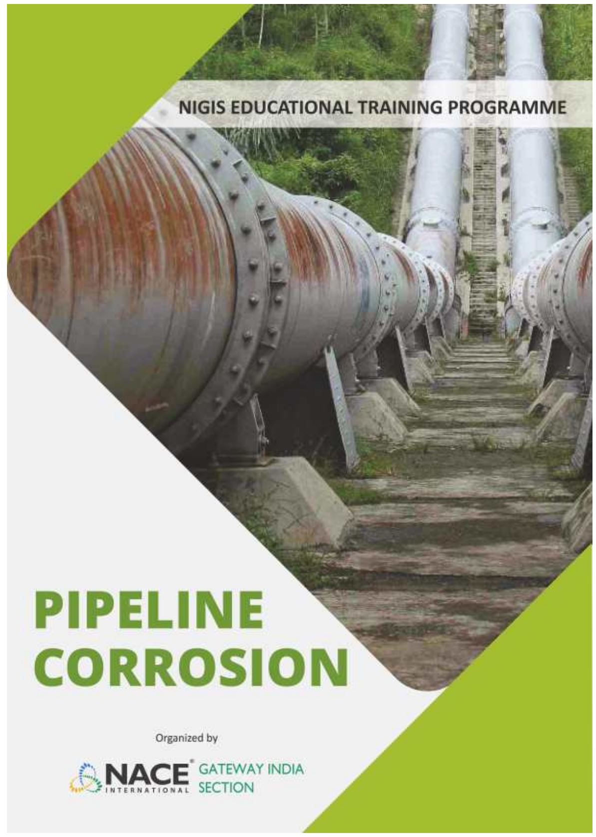

OBJECTIVE

When failure happens and is analysed, the root causes should be identified, and steps should be taken to change the conditions that allowed the failure to happen. Knowing how a failure happened, the investigator can ascertain why it happened. The prevention of failure is neither a simple task, nor is it easily accomplished . It requires application of both new technology and lessons learnt from failure analysis.

The aim of the program is to describe and analyse typical failures and their solutions in different industries. The Program content is designed to impart systematic understanding on various aspects related with failures and solutions for failure prevention.

WHO SHOULD ATTEND?

Personnel engaged in manufacturing industries, design, metallurgical investigations, process and operating engineers, monitoring and maintenance planners, service company representatives, metallurgists, coating inspectors, inspection supervisors, material engineers and academic researchers.

CLASS TIMING

09:00 hrs - 14:00 hrs

FACULTY

The faculty includes professional experts from organisations & institutions.

TOPICS TO BE COVERED

- Failure Analysis Techniques
- Prevention of Failure in Continuously Cast Steels
- Flow-accelerated Corrosion Failure in Petrochemical Plants
- Elevated Temperature Failures
- Fatigue Failures
- Corrosion Failures
- Q & A

FOR DETAILS
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NACE INTERNATIONAL GATEWAY INDIA SECTION

Educational Virtual Training Program

FAILURE ANALYSIS AND PREVENTION

Educational Virtual Training Program

OIL REFINERIES

NACE INTERNATIONAL GATEWAY INDIA SECTION

OBJECTIVE

Failure is not an option. In high risk, high value industries, such as oil and gas production, refining, nuclear and thermal power, aviation, shipping etc., corrosion failures have many repercussions: loss of money, loss of production, safety and environment damage. Best industry practices are implemented to avert or minimize corrosion failures. But failures still happen. Wise men say, "We should learn from others' failures". Failure is an opportunity to learn.

The proposed program covers Case Studies in Oil Refineries describing the failures, analyses of such failures and remedial actions. Failure investigation is an intricate exercise, mainly because of the variety in practices, operations and events. This program will not only teach participants the reasons for various failures, but will also enable understanding the methodology of failure analyses for appropriate corrective actions.

WHO SHOULD ATTEND

Personnel engaged in refining industries, design, metallurgical investigations, process engineers, operations officers, monitoring and maintenance planners, service company representatives who support refiners, corrosion and equipment engineers, metallurgists, coating inspectors, inspection supervisors, material engineers and academic institutes.

CLASS TIMING

09:00 hrs - 14:00 hrs

FACULTY

The faculty includes professional experts from organizations & institutions.

TOPICS TO BE COVERED

- An insight into common failures observed in oil Refineries
- Steps on Failure Investigations (Root Cause Analysis)
- Case Study : Stress Relaxation Cracking of SS 347 Piping
- Case Study : Failure case studies in hydro-processing unit
- Case Study : Failure of SS Vessel by Chloride SCC
- Case Study : Thermal Fatigue Failure of SS Piping
- Case Study : Failure case studies in crude distillation unit
- Case Study : Failure of Flue Gas Cooler in FCC
- Case Study : Failure of Bitumen Storage Tank/ Failure of REAC Channel box weld joint

PARTICIPATION CERTIFICATE WILL BE ISSUED AFTER THE PROGRAM.

FOR DETAILS
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NIGIS Trustee & Programme Coordinator
Email: manoharrao1374@gmail.com / Cell: +91- 9820039527

FOR REGISTRATION
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