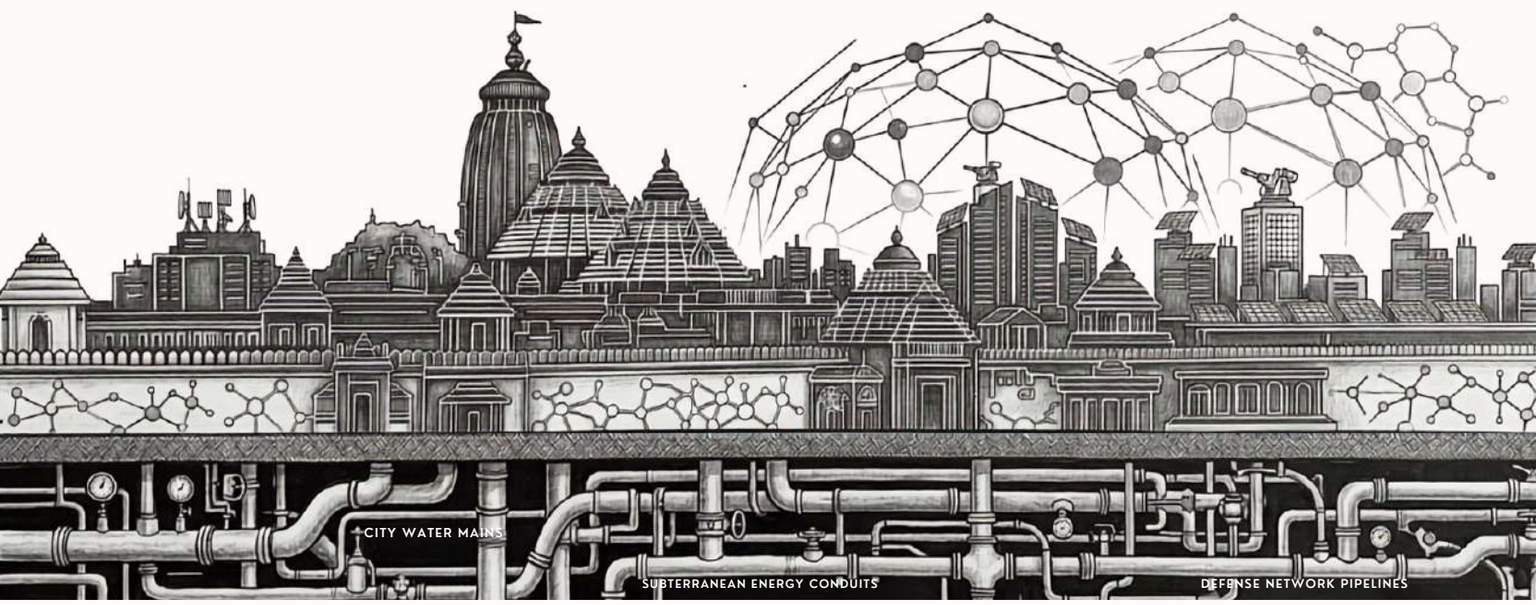
SMARTCOR 2026

1ST INTERNATIONAL CONFERENCE ON
STRATEGIC MATERIALS ADVANCEMENTS IN CORROSION PREVENTION AND RESEARCH- THROUGH SMARTER SCIENCE



DATES: 10th - 11th July, 2026
VENUE: CSIR-IMMT, Bhubaneswar, Odisha, India

CSIR - Institute of Minerals and Materials Technology (CSIR-IMMT), Bhubaneswar

Indian Institute of Technology (IIT) Bhubaneswar

Institute of Chemical Technology - Indian Oil Odisha Campus (ICT-IOCB), Bhubaneswar

Mining, Minerals, Metals & Materials Society of India (4MSI)

Association of Material Performance & Protection (AMPP), Bengal Chapter, Kolkata

Organized By:
ICT-IOC Bhubaneswar (An Extension of ICT Mumbai)
AMPP Bengal Chapter
In Association With:
CSIR-IMMT | IIT Bhubaneswar | 4MSI

Official Web Portal: www.smartcor.org
Contact: smartcorfoundation@gmail.com

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About SMARTCOR

SMARTCOR 2026

The integrity and performance of engineering components and infrastructure are among the foremost requirements in any design. This has led scientists and technologists to extensively investigate the various aspects of material degradation. Corrosion, in particular, remains one of the most prominent and often the sole causes of material loss and component failure. Among the many mitigation strategies, coatings and surface engineering stand out as versatile and widely accepted industrial solutions.

To advance knowledge and foster collaboration in this field, ICT-IOCB and AMPP Bengal Chapter in association with 4MSI, IIT Bhubaneswar and CSIR-IMMT Bhubaneswar is organizing the International Conference on Strategic Materials Advancements in Corrosion Prevention and Research - Through Smarter Science (SMARTCOR 2026). This conference aims to provide a vibrant platform for research organizations, academia, industries, corrosion-control professionals, coating providers, and technologists to exchange technical advancements, discuss challenges, and explore innovative solutions.

About ICT-IOCB

The Institute of Chemical Technology – IndianOil Odisha Campus (ICT-IOCB), which was set up on March 18, 2018 in the beautiful and benevolent Bhubaneswar State of Odisha. Institute of Chemical Technology, Mumbai (ICT) is a World Class Deemed University having an elite status and Centre of Excellence on par with IITs/IISc/IISERs which was granted by the State assembly on October 20, 2012; a unique distinction in the history of India. The off-campus wing of the Institute of Chemical Technology (ICT) located in Mumbai, one of the finest institutes for chemical engineering, chemical technology, and other applied sciences. Established in 1933, the Institute of Chemical Technology in Mumbai has continuously made contributions to scientific progress, technological development, and has trained highly qualified scientists and engineers. The setting up of the ICT-IOCB with the help of the Indian Oil Corporation Limited (IndianOil) is an embodiment of their joint vision of making technical education and research at par in eastern India.

Working in accordance with the standards of ICT, Mumbai, the campus provides students with highly challenging academic courses and creates an environment where classroom studies are coupled with research and industrial collaboration. The institute lays stress on multidisciplinary education that involves chemical engineering, polymer science and technology, material science, energy engineering, sustainability, process systems, and advanced manufacturing. Students are asked to merge theoretical knowledge with practical training, innovational thinking, and problem-solving abilities.

ICT–IOCB has created an exciting research ecosystem where efforts are made to work on problems of relevance at a national and international level. Research activities in the institute revolve around advanced functional materials, electrochemical energy storage, corrosion studies, catalysis, green and sustainable technologies, process intensification, renewable energy, circular economy, and resource efficient manufacturing by faculty members, researchers, and students. The institute fosters interdisciplinary collaboration along with the practice of translational research to connect scientific knowledge with industrial practices.

About AMPP Bengal Chapter

The Association for Materials Protection and Performance (AMPP) Bengal Chapter, Kolkata, is one of the chapters of the Association for Materials Protection and Performance (AMPP), the world's premier professional body devoted to corrosion management, protective coatings, material performance, and asset integrity. Established from the historic amalgamation of NACE International and SSPC in 2021, AMPP combines years of experience in managing and protecting critical infrastructure worldwide along with advancing materials engineering. The Bengal Chapter acts as an important forum for professionals, academicians, researchers, students, and industrialists of eastern India.

The chapter aims at increasing the awareness and excellence in the fields of corrosion engineering, material durability, surface engineering, protective coatings, inspection, cathodic protection, and reliability of infrastructures by fostering the use of international standards and best practices.

In order to learn and network continuously, the AMPP Bengal Chapter provides many options through its technical seminars, conferences, workshops, certification programs, industrial visits, lectures by experts and outreach programs for students. The activities carried out by the chapter help in creating a platform where academia and industry interact and exchange knowledge, discuss about latest technological developments and solve practical engineering problems pertaining to areas like oil & gas, petrochemicals, power plants, infrastructure, marine engineering, manufacturing, and transportations.

Additionally, the AMPP Bengal Chapter encourages students in participating in various technical activities which not only help them learn but also get exposed to the global professional practice. Through innovation and collaboration, the AMPP Bengal Chapter keeps on playing an important role in the advancement of materials protection and performance.

Message

Dr. Hari Babu Kambhampati
Governor, Odisha

सत्यमेव जयते

LOK BHAVAN
BHUBANESWAR - 751 008

No: 476/2026

06th July 2026

MESSAGE

I am pleased to learn that an **International Conference on Strategic Materials Advancements, Corrosion Prevention and Research through Smarter Science (SMARTCOR 2026)** is jointly organized by the Institute of Chemical Technology–Indian Oil Odisha Campus (ICT-IOC), Bhubaneswar and the AMPP Bengal Chapter, in association with the Mining, Minerals, Metals & Materials Society of India (4MSI), Indian Institute of Technology (IIT) Bhubaneswar and CSIR–Institute of Minerals and Materials Technology (CSIR-IMMT), Bhubaneswar. A Conference Souvenir is being brought out to commemorate this important occasion.

The conference provides an excellent platform for scientists, researchers, academicians, industry experts and policymakers to exchange knowledge, foster innovation and explore sustainable solutions in the fields of strategic materials, corrosion prevention and advanced technologies. Such collaborative initiatives are vital for strengthening India's scientific and technological capabilities and supporting the vision of a self-reliant and developed nation.

I extend my best wishes for the grand success of **SMARTCOR 2026** and publication of the souvenir.

(Hari Babu Kambhampati)

Message

ଶ୍ରୀ ସମ୍ପଦ ଚନ୍ଦ୍ର ସ୍ୱାଇଁ
ରାଷ୍ଟ୍ରମନ୍ତ୍ରୀ (ସ୍ୱାଧୀନ)
ଶିଳ୍ପ, ଦକ୍ଷତା ବିକାଶ ଓ ବୈଷୟିକ ଶିକ୍ଷା
ଓଡ଼ିଶା

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ବିଧାନସଭା : (୦୬୭୪)-
ଇମେଲ: minind2024@gmail.com

ପତ୍ର ସଂଖ୍ୟା ...../ମଶିଦବିବୈଶି.

ଭୁବନେଶ୍ୱର

ତାରିଖ ୨୨.୦୬.୨୦୨୬

ବାର୍ତ୍ତା

ICT-IOC ଭୁବନେଶ୍ୱର ଏବଂ AMPP ବେଙ୍ଗଲ ଚାପ୍ଟରଙ୍କ ଦ୍ୱାରା, 4MSI, IIT ଭୁବନେଶ୍ୱର ଏବଂ CSIR-IMMT ର ମିଳିତ ସହଯୋଗରେ ଜୁଲାଇ ୧୦ରୁ ୧୧ତାରିଖ ପର୍ଯ୍ୟନ୍ତ ଭୁବନେଶ୍ୱରରେ ଅନ୍ତର୍ଜାତୀୟ ସମ୍ମିଳନୀ "SMARTCOR 2026" ଆୟୋଜିତ ହେଉଥିବା ଏବଂ ଏହି ଅବସରରେ ସ୍ମରଣିକା ପ୍ରକାଶ ପାଉଥିବା ଜାଣି ମୁଁ ଅତ୍ୟନ୍ତ ଖୁସି ।

ବର୍ତ୍ତମାନ ଯୁଗରେ ଶିଳ୍ପ ଜଗତର ବିକାଶ ପାଇଁ ଅତ୍ୟାଧୁନିକ ଗବେଷଣାର ଯଥେଷ୍ଟ ଆବଶ୍ୟକତା ରହିଛି । ଭୁବନେଶ୍ୱରରେ ଆୟୋଜିତ ହେବାକୁ ଥିବା ଏହି ସମ୍ମିଳନୀରେ ପ୍ରତିଷ୍ଠିତ ବୈଜ୍ଞାନିକ, ଶିକ୍ଷାବିତ୍, ଗବେଷକ ଓ ଶିଳ୍ପ ଜଗତର ନେତୃତ୍ୱବୃନ୍ଦ ସାମିଲ ହେବେ। ସେଠାରେ ଷ୍ଟ୍ରାଟେଜିକ ମାଟେରିଆଲ୍, କ୍ଷୟ ନିୟନ୍ତ୍ରଣ, ଆସେଟ୍ ଇଣ୍ଟିଗ୍ରିଟି ଏବଂ ସ୍ଥାୟୀ ପ୍ରଯୁକ୍ତିବିଦ୍ୟା ଭଳି ଗୁରୁତ୍ୱପୂର୍ଣ୍ଣ ବିଷୟ ଉପରେ ଆଲୋଚନା କରାଯିବ । ଶିଳ୍ପ ଓ ଏକାଡେମିଆ ମଧ୍ୟରେ ଥିବା ଦୂରତା କମ୍ କରି ଏହି ସମ୍ମିଳନୀ ଉଭୟ କ୍ଷେତ୍ରକୁ ମଜବୁତ କରିବାରେ ଏକ ମାଇଲଖୁଣ୍ଟ ସାବ୍ୟସ୍ତ ହେବ । ଏହି ଅବସରରେ ପ୍ରକାଶିତ ପାଉଥିବା ସ୍ମରଣିକାରେ ମୂଲ୍ୟବାନ ପ୍ରବନ୍ଧ ଓ ବୈଜ୍ଞାନିକ ତଥ୍ୟଗୁଡ଼ିକ ଆଗାମୀ ଦିନରେ ଗବେଷକ, ଶିକ୍ଷାବିତ୍ ଏବଂ ଶିଳ୍ପ ଜଗତର ପ୍ରତିନିଧିମାନଙ୍କ ପାଇଁ ଦିଗଦର୍ଶନ ସାଜିବ ବୋଲି ମୋର ଦୃଢ଼ ବିଶ୍ୱାସ ।

ଏହି ଅବସରରେ ଆୟୋଜନକାରୀ ସଂସ୍ଥାର ସମସ୍ତ କର୍ମକର୍ତ୍ତାଙ୍କୁ ଶୁଭେଚ୍ଛା ଜଣାଇବା ସହ ସମ୍ମିଳନୀ ଆୟୋଜନ ଏବଂ ସ୍ମରଣିକା ପ୍ରକାଶନର ସର୍ବସଫଳତା କାମନା କରୁଛି ।

(ସମ୍ପଦ ଚନ୍ଦ୍ର ସ୍ୱାଇଁ)

Message

(Translated Message From)

Shri Sampad Chandra Swain
Minister of State (Independent Charge)
Industries, Skill Development & Technical Education
Government of Odisha

I am extremely pleased to learn that the International Conference "SMARTCOR 2026" is being organized in Bhubaneswar from July 10th to 11th by ICT-IOC Bhubaneswar and AMPP Bengal Chapter, in joint collaboration with 4MSI, IIT Bhubaneswar, and CSIR-IMMT, and that a souvenir is being published to commemorate this occasion.

In the present era, cutting-edge research is vital for the growth and advancement of the industrial sector. This conference, being hosted in Bhubaneswar, will bring together distinguished scientists, academicians, researchers, and industry leaders. Crucial subjects such as strategic materials, corrosion control, asset integrity, and sustainable technologies will be deliberated upon. By bridging the gap between industry and academia, this conference will serve as a milestone in strengthening both domains. I firmly believe that the valuable articles and scientific insights published in the souvenir will act as a guiding light for researchers, academicians, and industry representatives in the days ahead.

I extend my heartfelt greetings to all the organizers and committee members on this occasion, and wish the conference and the publication of the souvenir a grand success.

Message

होमी भाभा राष्ट्रीय संस्थान

Homi Bhabha National Institute

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Prof. U. Kamachi Mudali

FTWAS, FNAE, FNASc, FNACE, FASM, FAPAM, FIFHTSE
FICS, FIIM, HFECSI, FIIChE, FIE, FASCh

Vice Chancellor

प्रो. यू. कामाची मुदली

FTWAS, FNAE, FNASc, FNACE, FASM, FAPAM, FIFHTSE
FICS, FIIM, HFECSI, FIIChE, FIE, FASCh

कुलपति

MESSAGE

It gives me great pleasure to extend my warm greetings and best wishes to all participants of the International Conference on *Strategic Materials Advancements in Corrosion Prevention and Research Through Smarter Science (SMARTCOR 2026)*. This conference is organized by Institute of Chemical Technology, Indian Oil Odisha Campus (ICT-IOC), Bhubaneswar, and the AMPP Bengal Chapter, in association with the Mining, Minerals, Metals & Materials Society of India (4MSI), Indian Institute of Technology (IIT) Bhubaneswar, and CSIR–Institute of Minerals and Materials Technology (CSIR-IMMT) on 10–11 July 2026 at CSIR-IMMT, Bhubaneswar.

The long-term integrity, reliability, and performance of engineering materials, components, and infrastructure are fundamental to the sustainable development and economic progress of any nation. Material degradation, particularly corrosion, continues to pose significant technical, economic, and environmental challenges across a wide spectrum of industries. Corrosion is one of the leading causes of premature material failure and asset deterioration, resulting in substantial losses and safety concerns. Consequently, the development of effective corrosion mitigation strategies has become a priority area of research and technological innovation. Among the available approaches, advanced coatings and surface engineering technologies have proven to be highly effective, versatile, and widely adopted solutions for enhancing material durability and extending service life. The theme of SMARTCOR 2026 is both timely and relevant, addressing emerging challenges and opportunities in strategic materials, corrosion science, asset integrity management, reliability engineering, and sustainable technologies. By bringing together leading researchers, academicians, industry professionals, and policymakers from across the globe, the conference is expected to foster meaningful scientific exchange, interdisciplinary collaboration, and the dissemination of cutting-edge research findings.

I commend ICT-IOC Bhubaneswar, the AMPP Bengal Chapter, 4MSI, IIT Bhubaneswar, and CSIR-IMMT for their vision and commitment in organizing this important international event. I am confident that SMARTCOR 2026 will provide an excellent platform for advancing knowledge, promoting innovation, and strengthening partnerships among stakeholders working in the field of materials degradation and corrosion prevention.

I extend my heartfelt congratulations to the organizing institutions for their commendable initiative and convey my best wishes to the organizers, speakers, delegates, and participants for a highly successful and productive conference.

Prof. U. Kamachi Mudali
24/06/2026

Message

सीएसआईआर - खनिज एवं पदार्थ प्रौद्योगिकी संस्थान
(वैज्ञानिक तथा औद्योगिक अनुसंधान परिषद)
भुवनेश्वर-751013, ओडिशा, भारत
CSIR - INSTITUTE OF MINERALS & MATERIALS TECHNOLOGY
Council of Scientific & Industrial Research
Bhubaneswar - 751013, Odisha, INDIA

डॉ. रामानुज नारायण
निदेशक

Dr. Ramanuj Narayan
Director

MESSAGE

It gives me immense pleasure to learn that Institute of Chemical Technology, Indian Oil Odisha Campus (ICT-IOC), Bhubaneswar, and the Association for Materials Protection and Performance (AMPP) Bengal Chapter, in association with the Mining, Minerals, Metals & Materials Society of India (4MSI), Indian Institute of Technology (IIT) Bhubaneswar, and CSIR–Institute of Minerals and Materials Technology (CSIR-IMMT), Bhubaneswar are organizing the International Conference on Strategic Materials Advancements in Corrosion Prevention and Research-Through Smarter Science **"(SMARTCOR 2026)"** on 10 & 11 July 2026 at CSIR-IMMT, Bhubaneswar.

Integrity and performance of engineering component and infrastructure are the foremost requirements for sustainable growth of a country. This has attracted scientists and technologists to probe into the various aspects of material degradation. Corrosion is among the most prominent and often the only reason attributing to material loss or component failure. Among various mitigation strategies, coating and surface engineering are the most versatile and acceptable solutions in industries.

In this context I appreciate the objectives of ICT-IOC Bhubaneswar, AMPP Bengal Chapter, 4MSI, IIT Bhubaneswar and CSIR-IMMT to conduct this international conference. I am confident that this conference will serve as a premier forum for sharing and exchanging the latest scientific and technical knowledge in the areas of strategic materials, corrosion science, asset integrity, reliability engineering, and sustainable technologies. I take this opportunity to wish the organizers and participants all success and congratulate ICT-IOC Bhubaneswar and AMPP Bengal Chapter and their associated organizations of this event for their timely initiative.

Date: 01-07-2026
Place: CSIR-IMMT, Bhubaneswar

[Dr. Ramanuj Narayan]

Message

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MESSAGE

Greetings from the Institute of Chemical Technology, Indian Oll Odisha Campus, Bhubaneswar, one of the Offshore compuses of Institute of Chemical Technology (then UDCT), Mumbai. Established in the year 2018 through a unique partnership between the Institute of Chemical Technology, Mumbai and IndianOil Corporation Limited, ICT-IOCB stands as a model for industry-academia collaboration aimed at fostering innovation, excellence, and sustainable development. Our campus in Bhubaneswar is a centre of advanced learning, cutting-edge research, and transformative education, focused on creating future-ready professionals and thought leaders in science and technology.

I am very happy to note that ICT-IOC Bhubaneswar, and the AMPP Bengal Chapter, in association with the Mining, Minerals, Metals & Materials Society of India (4MSI), Indian Institute of Technology (IIT) Bhubaneswar, and CSIR- Institute of Minerals and Materials Technology (CSIR-IMMT) organizing the International Conference on Strategic Materials Advancements in Corrosion Provention and Research-Through Smarter Science (SMARTCOR 2026) on 10–11 July 2026 at CSIR-IMMT, Bhubaneswar.

It is the excellent platform for exchange of knowledge and expertise among the delegates from industries, R&D and academic institutes. Technological innovations in coating technologies and surface engineering will play a pivotal role in sustaining industrial growth, enhancing asset durability, and addressing the evolving challenges foced by modern industries. I am sure the deliberation during the two days among the leading professionals from all over the world will help the stakeholders to move forward in the coming decades.

On behalf of the ICT-IOC Bhubaneswar chapter I would like to extend a warm welcome to all the delegates and with them a pleasant fruitful stay in Bhubaneswar.

Prof. Ravindra V. Adivarekar
Director
ICT-IOC Bhubaneswar

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Message

Mining Minerals Metals & Materials Society of India

(Rgdn. No- 126/18201900038)

MESSAGE

It is with immense pleasure that I extend my warmest greetings to all participants of the International Conference on Strategic Materials Advancements in Corrosion Prevention and Research Through Smarter Science (SMARTCOR 2026).

This conference serves as an important platform for industry professionals, scientists, and academic researchers to exchange knowledge, share innovations, and foster collaboration in the fields of metals, paints, and protective coatings.

Understanding and mitigating corrosion is of critical importance across a wide range of industries, including construction, transportation, oil and gas, maritime and energy, where material degradation can result in substantial economic losses, environmental impacts, and serious safety risks. It is truly inspiring to witness the collaborative efforts and pioneering research being presented at this conference. I am confident that the discussions and interactions at SMARTCOR 2026 will strengthen partnerships, stimulate innovation, and lead to impactful solutions for the challenges facing our industries.

I commend the organizers, speakers, and participants for their dedication and commitment to advancing research and technological developments in these vital fields. I look forward to the meaningful exchange of ideas and to the progress that will emerge from this gathering.

I wish you all a successful, productive, and enriching conference experience.

Dr. S. C. Khattoi
President 4MSI

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Tel. No. 0674-2974441 || E-mail : 4mabser@gmail.com || www.4msi.in

Message

Er. Bijoy Chandra Tripathy,
Vice President, Indian Buildings Congress,
Former E-I-C (Buildings) & Ex-CGM (P&C),
IDCO.
LM: IRC, IGTS, ICI, IIT BBSR BCM
Infra Adviser & Capacity Building Adviser
Email: bijoychandratripathy@gmail.com
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Bhubaneswar
Date : 06 July , 2026

In an era defined by rapid industrial evolution and aggressive Infrastructure expansion, the longevity, reliability and resilience of our built environment dictate both economic and structural success. The themes of this convention strike at the very heart of modern engineering challenges. Metallic corrosion remains a silent yet profound adversary to global structure, making our collective focus on holistic advancement in this area.

The paradigm is shifting from traditional, passive defense mechanisms to highly active, intelligent materials. The breakthrough research we are witnessing in smart coatings- spanning self – healing, superhydrophobic, thermal barrier and hydrogen-resistant technologies is rewriting the rules of asset protection and prevention of huge economic loss. By integrating these advanced surface engineering disciplines with cutting -edge alloy design and sophisticated electrodeposition techniques, we are transitioning from merely managing degradation to actively preventing it.

On behalf of the Indian Buildings Congress, I extend warm greetings to the organizers, researchers, faculty and practicing engineers participating in this prestigious technical event for highly productive deliberations and effective recommendations.

Er B C Tripathy

Message

SMARTCOR FOUNDATION
BHUBANESWAR, ODISHA

MESSAGE

It gives me immense pleasure to extend my warm greetings to all the distinguished delegates, researchers, academicians, industry leaders, and students participating in the 1st International Conference on Strategic Materials Advancements in Corrosion Prevention and Smart Control (SMARTCOR 2026).

Corrosion remains one of the most significant challenges affecting the safety, reliability, and sustainability of infrastructure across sectors such as steel, energy, transportation, marine, oil & gas, and manufacturing. Conferences such as SMARTCOR 2026 provide an invaluable platform for fostering collaboration between academia, research institutions, and industry to accelerate the development and deployment of next-generation corrosion mitigation technologies.

The theme of SMARTCOR 2026 is both timely and relevant, reflecting the growing importance of strategic materials, smart coatings, digital corrosion monitoring, and sustainable engineering solutions in meeting the demands of modern industries. I am confident that the technical deliberations, keynote lectures, and interactive discussions during this conference will inspire new ideas, strengthen collaborative research, and translate scientific innovations into practical industrial applications.

I congratulate the organizing committee, ICT Mumbai–Indian Oil Odisha Campus, in association with IIT Bhubaneswar, CSIR-IMMT, AMPP Bengal Chapter, and 4MSI, for their commendable efforts in bringing together experts from diverse domains to exchange knowledge and share their latest research findings.

I wish SMARTCOR 2026 great success and hope that this conference serves as a catalyst for meaningful partnerships, impactful innovations, and sustainable technological advancements in corrosion science, surface engineering, and smart materials. I extend my best wishes to all participants for a productive conference and a pleasant stay in Bhubaneswar.

Dr. Tapan Kumar Rout
Principal Scientist
Research, Development & Technology (RD&T)
Tata Steel, Jamshedpur

Message

खनिज, धातुकर्म एवं पदार्थ अभियांत्रिकी विद्यापीठ
School of Minerals, Metallurgical and Materials Engineering
भारतीय प्रौद्योगिकी संस्थान भुवनेश्वर
Indian Institute of Technology Bhubaneswar

Soobhankar Pati,PhD
Associate Professor in Materials Engineering
IIT Bhubaneswar

Date : 03/07/2026

MESSAGE

Institute of Chemical Technology, Indian Oil Odisha Campus (ICT-IOC), Bhubaneswar, and the AMPP Bengal Chapter, in association with the Mining, Minerals, Metals & Materials Society of India (4MSI), the Indian Institute of Technology (IIT) Bhubaneswar, and CSIR–Institute of Minerals and Materials Technology (CSIR-IMMT), are organizing the International Conference on *Strategic Materials Advancements in Corrosion Prevention and Research Through Smarter Science (SMARTCOR 2026)* on **10–11 July 2026** at **CSIR-IMMT, Bhubaneswar**. The conference promises to provide an excellent platform for researchers, academicians, industry professionals, and policymakers to exchange knowledge, showcase cutting-edge research, and foster collaborations in the field of corrosion prevention and advanced materials. Understanding corrosion is important for many industries, including construction, transportation, oil and gas, maritime, and energy, where material degradation can lead to economic losses, environmental concerns, and safety risks. The collaborative efforts and innovative research being presented at SMARTCOR 2026 are truly encouraging. I am confident that the discussions and interactions during the conference will promote knowledge sharing, strengthen collaborations, inspire new ideas, and contribute to effective solutions for corrosion prevention and materials protection.

On behalf of the IIT Bhubaneswar I would like to extend a warm welcome to all the delegates and wish them a pleasant fruitful stay in Bhubaneswar.

Soobhankar Pati

Dr. Soobhankar Pati

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Message

INSTITUTE OF CHEMICAL TECHNOLOGY रसायन तंत्रज्ञान संस्था
Deemed to be University under Section-3 of UGC Act 1956
Elite Status & Centre of Excellence - Government of Maharashtra
Category I Deemed to be University (MHRD/UGC)
National Rank 1 in Atal Innovation Ranking (ARIIA), by MHRD, Category : Govt Aided Universities (2020)
NAAC A++ CGPA 3.77

Dr. Smrutirekha Mishra
Assistant Professor
Dept. of Materials and Polymer Engg.
ICT-IOC Bhubaneswar

MESSAGE

It gives me immense pleasure to welcome all the distinguished delegates, researchers, academicians, industry professionals, and students to the International Conference on Strategic Materials Advancements in Corrosion Prevention and Smart Control (SMARTCOR 2026).

SMARTCOR 2026 has been envisioned as a dynamic platform to bring together leading minds from academia, research organizations, and industry to deliberate on the latest advancements in corrosion science, strategic materials, smart coatings, electrochemical technologies, hydrogen-related degradation, structural health monitoring, and sustainable engineering solutions. The overwhelming response to this conference reflects the growing global interest in innovative approaches to corrosion prevention and smart control technologies. Through keynote lectures, invited talks, technical presentations, poster sessions, and industry interactions, SMARTCOR 2026 aims to promote meaningful scientific exchange, foster new collaborations, and bridge the gap between fundamental research and industrial implementation.

This souvenir commemorates the collective efforts of our distinguished speakers, authors, delegates, sponsors, exhibitors, organizing committee members, reviewers, volunteers, and our collaborating institutions, whose unwavering support and commitment have made this conference possible. Their invaluable contributions have transformed SMARTCOR 2026 into a truly international forum for knowledge sharing and innovation.

As the Convener, I sincerely thank every participant for being a part of this scientific gathering. I hope the conference provides an enriching experience, inspires new ideas, and leads to lasting collaborations that contribute to the advancement of corrosion science, strategic materials, and smart technologies for a sustainable future.

Smrutirekha mishra

Dr. Smrutirekha Mishra

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SMARTCOR BHUBANESWAR 2026

List Of Invited Speakers

Invited Talks

Prof. Nikhil K. Singha

Designation and Affiliation	**Professor, IIT Kharagpur**
Topic Title	**Designing Bio-inspired Bio-based Polymer Materials for Specialty Coatings and Adhesives**

Profile

Prof. Nikhil Singha is a full professor at IIT Kharagpur and a Fellow of the Royal Society of Chemistry (FRSC). With extensive international research experience, his work spans controlled radical polymerization, click chemistry, self-healing materials, and smart polymer gels. He has published over 220 papers with 11,750+ citations (h-index 51) and holds 22 patents. He is a recipient of the prestigious Fulbright and DAAD Fellowships.

Abstract

Nature-mimetic principles have become prominent in the design of new materials for specialty coatings and adhesives. For example, marine mussels secrete adhesive proteins through which they can strongly bind to different surfaces. Lotus leaves are ultra-hydrophobic in nature, having a water contact angle of ≥ 150° so that they can repel water from their surface. Recently, there has been tremendous interest among the scientific community in using bio-based materials for designing new coatings and adhesives, as this is the essence towards building a sustainable and green world. For example, the anticipated compound annual growth rate (CAGR) in bio-based elastomers is estimated to be ~14% and is expected to reach USD 1.9 billion by 2035. This talk will delineate the development of new polymeric resin based on polyurethanes, modified epoxy-based elastomers using different dynamic chemistries like Diels-Alder, disulfide metathesis etc. In this case, different bio-based monomers like terpene, glyco-monomer, etc., as well as natural polymers, like natural rubber (NR), epoxidized NR (ENR) were used to design new polymer resins for the application of mussel-mimetic adhesives, superhydrophobic coatings, etc.

Keywords: Mussel-inspired; Bio-based; Superhydrophobic; Dynamic chemistry, Lotus effect

Invited Talks

Dr. Sachin Joshi

Designation and Affiliation	**CEO, Greenovoc Specialty Coatings Pvt. Ltd.**
Topic Title	**Development of Zero VOC water-based sustainable protective coating solutions for highly corrosive conditions**

Profile

Dr. Sachin Joshi is the CEO of Greenovoc Specialty Coatings Pvt. Ltd., backed by over 17 years of experience in polymer science and technology. A specialist in industrial surface protection, he drives the development of high-performance, sustainable coating solutions. His leadership centers on advancing innovative polymer applications and cutting-edge technologies for diverse industrial sectors.

Abstract

The coating industry is growing at CAGR of 6.5% with market potential of USD 168 billion. Given the fast paced infrastructure growth, consumption of decorative as well as industrial coatings is expected to increase significantly. However, the present conventional paint systems emit hazardous emissions which are responsible for climate change, global warming and have an adverse impact on human health. The coating industry therefore is looking beyond performance, with sustainability becoming the need of the hour. This points to a gap between the sustainability aspects of paints like, low VOC viz-a-viz performance properties and cost effectiveness, which can be identified as major obstacles in the market for environment friendly coatings. The current development aims at manufacturing of zero VOC, water based, grafted co-polymer technology to bridge the gap and offers a sustainable, environment friendly solution with high performance properties like corrosion resistance, UV radiation resistance, resistance to agig & weathering, high flexinbiity, impact and abrasion resistance. In addition to the high performance properties, the technology offers easy application features like single pack, ready to use system, fast drying at room temperature and unlimited pot life resulting in cost effectiveness. The technology finds its use in various industrial segments like Infrastructure, Oil & Gas, Cement & Steel, Power and HVAC. As such it is a proven technology.

Keywords: Zero VOC; Sustainable; High performance properties; Corrosion resistance; Water-based

Invited Talks

Prof. Pradip K. Maji

Designation and Affiliation	**Professor, IIT Roorkee**
Topic Title	**Polysilazane - and Silane-Derived Hybrid Networks for Corrosion Protection**

Profile

Prof. Pradip Kumar Maji is a Chair Professor at IIT Roorkee, specializing in sustainable polymer science, nanocomposites, and multifunctional aerospace materials. A former DRDO scientist with over 60 developed products and multiple patents, he has published 210+ papers (6,800+ citations, h-index 46). His global contributions are recognized via the APA Young Scientist Award and the prestigious JSPS Invitational Fellowship.

Abstract

Silicon-derived coatings have emerged as an advanced class of anticorrosion materials owing to their unique interfacial chemistry and inorganic-organic hybrid network formation. Polysilazanes undergo moisture-induced hydrolysis and condensation reactions, converting Si–N and Si–H functionalities into highly cross-linked Si–O–Si structures that form dense ceramic-like barrier layers on metallic substrates. These compact networks effectively suppress the diffusion of water, oxygen, and chloride ions, thereby minimizing electrochemical corrosion reactions and enhancing long-term environmental durability. Simultaneously, silane compounds improve substrate adhesion through hydrolysable alkoxy groups that generate silanols, which subsequently condense with hydroxylated metal surfaces to form stable metal–O–Si covalent linkages.The resulting interfacial coupling reduces coating delamination, inhibits underfilm corrosion, and improves coating integrity under aggressive saline and humid conditions. Furthermore, hybridization of polysilazanes with acrylics, fluoropolymers, or functional nanofillers enables tunable hydrophobicity, enhanced weather resistance, and multifunctional surface protection while retaining excellent corrosion-barrier performance. Overall, polysilazane–silane hybrid systems offer a scalable and ambient-curable strategy for next-generation corrosion-resistant coatings by integrating inorganic network evolution, interfacial bonding chemistry, and multifunctional surface engineering into a single protective platform.

Keywords: Silicon polymers, Hybrid coating, Inorganic-organic, Polysilazane, Anticorrosion

Invited Talks

Mr. Subash G. Selvaraj

Designation and Affiliation	**President, Industrial Coating Head, Nippon Paint (India) Private Limited**
Topic Title	**High Performance Coil Coating Solutions for Pre-painted Steel**

Profile

Mr. Subash Gaijes Selvaraj is the President of Industrial Coatings and Head of the India Group Corporate Office at Nippon Paint (India) Pvt. Ltd.. Backed by CA, CS, and Chicago Booth executive credentials, he leads a diverse portfolio—including automotive and coil coating across India, the Middle East, and Africa. Known for driving sustainable growth and cross-market innovation, he also provides strategic oversight through key international board positions.

Abstract

Presentation will provide an overview of High-Performance Coil Coating Solutions for Pre-Painted Steel, highlighting Nippon Paint Group's global presence, heritage, innovation, worldwide operations, key milestones, technological achievements, sustainability, and customer partnerships in the coatings industry. It also showcases our comprehensive coil coating portfolio for home appliances, building & construction, architectural extrusion, and industrial applications, while outlining our future technology roadmap focused on sustainable solutions, for high-performance pre-painted steel.

Invited Talks

Mr. Nitin Bhagwat

Designation and Affiliation	**National Head – Product Management, Asian Paints PPG Pvt. Ltd.**
Topic Title	**Advancement in Anti -corrosive protective coating system beyond zinc rich primer based system**

Profile

Mr. Nitin Bhagwat is the National Head of Product Management, Traffic Solutions, and OEM Sales at Asian Paints PPG Pvt. Ltd., Mumbai. He has extensive expertise in product management, technical marketing, and managing Oil & Gas, PSU, OEM, and traffic solution accounts. He also has international exposure through collaborations in the UK, Netherlands, Singapore, and China.

Abstract

Modified epoxy primers are increasingly being adopted as sustainable and high-performance alternatives to conventional zinc-rich primers, particularly in applications requiring long-term corrosion protection under severe environmental conditions. The modified epoxy primer system described herein is engineered to deliver certified ISO 12944 C5 Very High and CX Extreme corrosion protection, making it suitable for highly aggressive onshore and offshore environments, including oil and gas facilities, chemical plants, renewable refineries, and marine infrastructure.

Unlike traditional zinc-rich primers that rely on sacrificial metallic zinc, this modified epoxy primer employs a barrier and passivation-based corrosion protection mechanism, ensuring durable steel protection while eliminating dependence on metallic zinc. The system demonstrates excellent resistance to corrosion, even when applied at lower total dry film thicknesses (typically 280–360 µm), without compromising performance. This capability enables optimized coating systems that reduce material usage, improve application efficiency, and maintain compliance with stringent international standards.

From an asset integrity and lifecycle perspective, the primer provides extended service life and significantly reduces the frequency of inspection, maintenance, and repair activities. The lower density and high-volume solids formulation contribute to easier mixing, faster curing, and improved applicator productivity compared to zinc-rich systems, resulting in measurable cost advantages during both application and long-term operation.

Sustainability is a key differentiator of this modified epoxy technology. The formulation supports low volatile organic compound (VOC) emissions (<280 g/L) and removes the environmental and health concerns associated with high zinc content coatings. By reducing VOC emissions, lowering coating consumption, and extending maintenance intervals, the system contributes to reduced environmental impact across the full coating lifecycle, aligning with modern sustainability and decarbonization objectives.

Overall, this modified epoxy primer represents a robust, cost-effective, and environmentally responsible replacement for zinc-rich primers, delivering top-tier corrosion performance without compromising durability, compliance, or sustainability

Key words: - Modified epoxy primer, conventional zinc rich primer, corrosion protection, environmental friendly.

Invited Talks

Dr. Nikhil Kamboj

Designation and Affiliation	**Scientist, University of Turku**
Topic Title	**Corrosion-immune response coupling in implants**

Profile

Dr. Nikhil Kamboj is a distinguished researcher and academic specializing in additive manufacturing, biomaterials, and advanced engineering. Currently a Docent at the University of Turku, Finland, he has led internationally funded research, published extensively, secured competitive grants, and contributed significantly to teaching, research leadership, and global scientific collaborations.

Abstract

Metallic implants such as titanium, stainless steel, cobalt–chromium, and biodegradable magnesium alloys are widely used in orthopedic and dental applications due to their mechanical strength and biocompatibility. However, their long-term performance is strongly influenced by corrosion–immune coupling at the implant–tissue interface. Following implantation, electrochemical corrosion can lead to the release of metal ions and particulate debris into the surrounding tissue. These corrosion products are recognized by immune cells, particularly macrophages, triggering inflammatory signaling pathways and the production of reactive oxygen species (ROS) and cytokines. The resulting inflammatory microenvironment destabilizes the protective oxide layer on the implant surface, accelerating further corrosion and ion release. This self-amplifying cycle of corrosion, immune activation, and inflammation can compromise implant integrity, delay tissue healing, and contribute to implant failure. Understanding the mechanisms governing corrosion–immune interactions is essential for developing next-generation alloys, surface modifications, and smart implants that enhance biocompatibility, durability, and long-term clinical performance.

Invited Talks

Mr. Hemant Mewada

Designation and Affiliation	**Associate Vice President - R & D, JSW Paints Ltd.**
Topic Title	**Autonomous Surface Protection: Next-Generation Smart Coatings for Active Corrosion Control**

Profile

Mr. Hemant Mewada is a seasoned coatings industry professional with over 28 years of experience in research, technology, operations, quality, and business development. Currently Associate Vice President–R&D at JSW Paints Ltd., he has driven innovation, commercial success, and global market expansion while earning patents, research recognition, and multiple peer-reviewed publications.

Abstract

Corrosion inflicts severe structural degradation and economic damage globally, costing an estimated $2.5 trillion annually. Traditional passive coatings provide only static protection that fails irreversibly upon mechanical breaching. To address these systemic limitations, smart coating technology has emerged as a revolutionary paradigm shift, transitioning surface protection into an autonomous, multi-functional defense network. This paper reviews advanced smart anti-corrosion coatings, detailing their underlying structural architectures, stimuli-responsive mechanisms, industrial applications, and real-world field validation metrics.

The baseline of smart coating functionality relies on advanced micro- and nano-encapsulation techniques. Active corrosion inhibitors and self-healing agents are isolated within specialized nano-carriers—including mesoporous silica nanoparticles, clay nanotubes, and polymer microcapsules—preventing premature leaching into the host matrix. These systems exploit precise, stimuli-responsive release pathways. Localized chemical variations triggered by early-stage oxidation, such as shifts in pH, increased chloride ion concentrations, or moisture ingress, alter container permeability to deploy targeted inhibitors exclusively at the active corrosion site. Concurrently, autonomous self-healing mechanisms physically repair mechanical fractures via the capillary release and localized polymerization of core monomers, fully restoring the coating's structural barrier integrity. For predictive maintenance strategies, these formulations integrate early-stage detection systems utilizing colorimetric or fluorescent smart pigments that visually flag sub-surface electrochemical activity before macroscopic rust manifests. Finally, this paper addresses critical industrial scalability challenges, including high upfront raw material costs, nanoscale synthesis scale-up hurdles, and long-term environmental weathering durability. Ultimately, smart coatings represent a critical milestone in sustainable materials engineering, drastically extending industrial asset lifespans while minimizing operational maintenance overhead.

Keywords: Smart Coatings; Corrosion Control; Stimuli-Responsive Release; Self-Healing Materials; Nano-encapsulation; Early-Stage Detection.

Invited Talks

Designation and Affiliation	**MD, TATA Pigments Ltd.**
Topic Title	**Sustainability Through Circular Manufacturing and Building a zero harm culture, Safety Felt Leadership**

Mr. Saroj Kumar Banerjee

Profile

Mr. Saroj Kumar Banerjee is the Managing Director of Tata Pigments Limited with over 32 years of leadership experience across steel, mining, and industrial operations. Renowned for driving operational excellence, ESG transformation, sustainability, and safety, he has led large-scale business initiatives while fostering innovation, governance, and organizational growth across diverse industries.

Abstract

Tata Pigments lays down a short strategic road map towards the integration of sustainability, operational excellence and safety leadership across its pigment and industrial paint businesses. The presentation features a circular-manufacturing model that converts steel by-products into high-quality iron oxide pigments while implementing the 4R principles (Reduce, Reuse, Recycle, Remanufacture) and digital process control to ensure product consistency and reduce energy intensity. The 4C culture (Collaboration, Change, Care, Commitment), combined with TPM/5S practices and AI monitoring, drives operational excellence and boosts productivity and quality. Safety initiatives, such as the Safety Leadership Development Centre and contractor certification, enhance risk intelligence and maturity. Digital solutions like the Safety Performance Index and video-analytic CCTV offer real-time insights to prevent incidents and enhance emergency response, aiming to reduce environmental impact, improve workforce capabilities, and support sustainable growth through waste-to-value solutions and strong safety governance.

Invited Talks

Designation and Affiliation	**Sr. Vice President, Electrotherm (India) Ltd.**
Topic Title	**Innovative Material Strategies for Sustainable & Resilient Infrastructure**

Mr. Gouranga Charan Rout

Profile

Mr. Gouranga Charan Rout is the Senior Vice President at Electrotherm (India) Limited with over 30 years of experience in the steel industry. Holding advanced qualifications in engineering, finance, and quality management, he has worked with leading steel companies and is recognized for his expertise in steel manufacturing and material innovation.

Abstract

Meeting needs of present without compromising the needs of future. Sustainability is no longer about doing less harm.- It's about doing better.

Corrosion damages the structural integrity of steel, thus challenging the sustainability of infrastructure. The International Zinc Association (IZA) estimates that India loses 5–7% of its GDP each year due to corrosion. Fusion bonded epoxy coating on the TMT bars used in Infrastructures is a corrosion resistant; which increases the life span of an infrastructure resulting in less steel consumption and more enhanced life and loss to the economy as well. This is an innovative material Strategy and sustainable resilient infrastructure.

Carbon footprint is the total amount of greenhouse gases (GHGs) released into the atmosphere due to human activities. Manufacturing Process of ET is driven by EIF & LRF refining process technology.

We have a 45 MW Captive Power Plant powered by WHRB and solar. 0.1% Vanadium addition lowers steel consumption by 10-15% and reduces carbon footprint. Uniform Vanadium distribution during rolling minimizes rolling loads. Emerging Steel Grades; Fe 650, Fe 700 Vanadium micro alloyed steel.

Invited Talks

Mr. Rajes Bardia

Designation and Affiliation	**GM-Technology, Asian Paints PPG Pvt. Ltd.**
Topic Title	**Stimuli-Responsive and AI-Enabled Smart Coatings for Industrial Applications: From Passive Protection to Adaptive Functional Systems**

Profile

Mr. Rajes Bardia is a highly accomplished technology leader with over 27 years of experience in research, product development, and techno-commercial operations in the coatings industry. Currently serving as General Manager–Technology at Asian Paints PPG Pvt. Ltd., he has driven innovation in high-performance coatings, implemented sustainable technologies, and led global collaborations to enhance operational excellence and business growth.

Abstract

Corrosion-induced degradation remains a critical challenge impacting the reliability, safety, and lifecycle costs of industrial assets across infrastructure, marine, energy, and transportation sectors. This work presents a next-generation approach to smart anti-corrosive coatings, integrating stimuli-responsive materials, nanotechnology, and AI-driven design frameworks to transition from passive barrier protection to self-adaptive, intelligent corrosion management systems. Recent advances in nano-engineered anti-corrosive coatings incorporating zinc, cerium compounds, carbon nanotubes, and multifunctional metal oxides demonstrate enhanced barrier properties, electrochemical stability, and inhibitor release mechanisms for prolonged durability. Complementary innovations in self-healing coatings, based on microcapsule- triggered healing and intrinsic reversible polymer networks, enable autonomous repair of microcracks, thereby restoring coating integrity and minimizing corrosion propagation under real-world service conditions. Corrosion-induced degradation significantly impacts asset reliability across industrial sectors. This study presents AI-enabled smart anti-corrosive coatings that transition from passive barriers to adaptive, self-healing protection systems. Nano-engineered formulations incorporating zinc, cerium, carbon nanotubes, and metal oxides enhance barrier performance and enable controlled inhibitor release. Self-healing mechanisms based on microcapsule-triggered repair and reversible polymer networks restore coating integrity and suppress corrosion propagation. Additionally, photocatalytic TiO_2-based coatings provide self-cleaning and anti-fouling capabilities, reducing surface degradation. Integration with AI-driven formulation and curing technologies, including low-temperature and IR-assisted curing, improves coating performance and energy efficiency. These multi- functional systems support predictive maintenance and lifecycle extension of assets.

Key words: - Smart anti-corrosive coatings; Self-healing coatings; Corrosion mitigation; Nano-engineered coatings; AI-driven formulation; Predictive maintenance; EMR-functional coatings; Powder coatings; Stimuli-responsive systems; Asset integrity; Sustainable coatings; Adaptive materials

Invited Talks

Dr. Kishore Kumar Jena

Designation and Affiliation	**Research Scientist, United Arab Emirates University**
Topic Title	**2D materials enhanced superhydrophobic protective coatings**

Profile

Dr. Kishore Kumar Jena is an achievement-driven Visiting Scientist at CSIR-IMMT with over 20 years of academic and industrial R&D experience, alongside three years in teaching. A UAE Golden Visa holder, his expertise spans advanced polymer coatings, 2D materials, battery recycling, and corrosion engineering. He holds an impressive H-Index of 26, backed by 53 high-impact Q1 publications and multiple US patents.

Abstract

The propose of this work is to develop superhydrophobic coatings by using functionalized graphene 2D materials. The objective was achieved by developing hybrid coatings through sol-gel process and functionalization reaction. The role of hybrid molecules was particularly important for enhancing the hydrophobic properties of the hybrid coatings. The approach of current research is to develop a low temperature sol-gel coating process that gives better performance on metal surface. In this work two hybrid coatings were synthesized by Michael addition reaction and Ring opening reaction mechanisms. 3-trimethoxy silyl propyl diethylene triamine and 3-trimethoxysilyl propyl methacrylate (TMSPM) precursors were mixed by stirring under nitrogen environment at 50 deg C for 24 hours to formulate TSP-TM @hybrid coating. The TSP-GLY @hybrid coating was synthesized by ring opening polymerization process using 3-trimethoxy silyl propyl diethylene triamine and 3-glycidoxypropyltrimethoxysilane (GPTMS) silane precursors. In the second step, TSP-TM @ hybrid coating and TSP-GLY @hybrid coating were mixed with functionalized thermal reduced graphene (2wt% of total coating materials) to synthesize TSP-TM@ f-GR and TSP-GLY @ f-GR hybrid coatings. Thermal reduced graphene (TRG) and functionalized TRG (f-TRG) were synthesized by thermal reduction process and functionalization reaction of TRG with (3-Aminopropyl) triethoxysilane (APTES). In the final step, (3,3,3-trifluoro propyl) trimethoxy silane at different concentration (1 wt %, 3wt%, and 5wt%) of total hybrid coating materials were mixed with TSP-TM@ f-GR and TSP-GLY @ f-GR hybrid coatings to develop TSP-TM@ f-GR /FL-1 , TSP-TM@ f-GR /FL-3 and TSP-TM@ f-GR /FL-5 hybrid coating and TSP-GLY @ f-GR /FL-1 , TSP-GLY @ f-GR /FL-3 and TSP-GLY @ f-GR /FL-5 hybrid coating , respectively. Structure and morphology of the hybrid coatings were analyzed by FTIR, XPS, SEM, TEM and AFM instruments. FTIR analysis confirms the reaction kinetics and presence of functional groups in the hybrid coatings. SEM and TEM confirms the smooth and uniform morphology of hybrid coatings. Surface roughness of the hybrid coatings was confirmed by AFM analysis. TGA analysis shows that the thermal stability of the coatings increases with increasing the siloxane concentration in the hybrid coatings. Contact angle measurement shows that contact angle of the hybrid coatings increases with increasing concentration of Fluro siloxane. The novelty of this work was the development of hybrid coatings by two different mechanisms and role of silane coupling agent. In this work, we explore the possibility of developing hybrid materials using 3-trimethoxy silyl propyl diethylene triamine, 3-glycidoxypropyltrimethoxysilane (GPTMS), 3-trimethoxysilyl propyl methacrylate (TMSPM), (3,3,3-trifluoro propyl) trimethoxy silane silane coupling agent and functionalized graphene and study their morphology and hydrophobic nature.

Invited Talks

Mr. Krishna Chetnani

Designation and Affiliation	**GM, Electrotherm (India) Ltd.**
Topic Title	**Chloride-Induced Corrosion in FBE-TMT Reinforced Pre-Cracked Concrete: A Comparative Study**

Profile

Mr. Krishna Chetnani is the General Manager at Electrotherm (India) Limited with extensive expertise in anticorrosive coatings, corrosion protection technologies, and infrastructure durability. A Mechanical Engineer by profession, he is dedicated to advancing sustainable corrosion mitigation solutions. At SMARTCOR 2026, he will present his research on chloride-induced corrosion in FBE-TMT reinforced pre-cracked concrete, contributing valuable insights into structural durability and long-term performance.

Abstract

In the context of reinforced concrete infrastructure exposed to aggressive coastal and marine environments, early-age cracking remains one of the most critical factors accelerating corrosion-induced deterioration. Pre-cracked concrete elements, which simulate real-world damage such as shrinkage or flexural cracks, create preferential pathways for chloride ingress and moisture, thereby significantly reducing the service life of structures. Understanding the corrosion behavior of reinforcement in such pre-damaged systems is essential for evaluating long-term durability and for developing effective mitigation strategies. While Fusion Bonded Epoxy (FBE) coated TMT rebars have demonstrated excellent corrosion resistance in uncracked concrete, their effectiveness under pre-cracked conditions where the coating may be exposed to direct ionic attack and mechanical stresses remains insufficiently explored. This study addresses this challenge by investigating the corrosion performance of pre-cracked reinforced concrete beams incorporating TMT, Corrosion-Resistant Steel (CRS-TMT, also referred as CRS in further discussions), and FBE-coated rebars under both accelerated chloride cycling and natural coastal exposure conditions.

Keywords: Pre-cracked reinforced concrete, FBE-coated rebars, Chloride-induced corrosion, Accelerated cyclic corrosion, Coastal infrastructure durability

Invited Talks

Mr. Khalid

Designation and Affiliation	**Deputy Chief - Industrial & Decorative Coating Services at Tata Pigments Limited, TATA Pigments Ltd.**
Topic Title	**Responsible ways to control Industrial Corrosion and way forward in nation building**

Profile

Mr. Khalid is a seasoned Deputy Chief at Tata Pigments Ltd., leveraging over 25 years of extensive expertise in corrosion protection and coating technologies. He specializes in comprehensive inspections, damage analysis, and life-cycle cost evaluation across diverse global industrial sectors. Known for leading critical corrosion impact audits, he has successfully designed innovative protection frameworks. Seamlessly combining an MBA with prestigious AMPP Level 2 and TBEM Silver certifications, he effectively bridges technical excellence with strategic business and operational leadership.

Abstract

Corrosion is one of the quietest but costliest threats in industry, often not showing itself until damage has already been done. This paper addresses the integrated approach to industrial corrosion management at Tata Pigments, which is based on three pillars: stringent audits, focused control strategies and detailed impact studies that translate technical findings into real business decisions. Instead of reacting to failures, the framework focuses on early detection through field inspection, corrosion mapping, and risk-based assessment, together with proven mitigation techniques including protective coatings, cathodic protection, and disciplined material selection. What makes this approach unique is its lifecycle orientation, where each audit finding and mechanism study feeds directly into practical recommendations for asset integrity, safety, operational reliability and cost. The outcome is a coating and inspection process that not only solves problems but also extends asset life, enhances safety compliance and facilitates more intelligent long-term maintenance planning in difficult industrial settings.

Invited Talks

Er. Lingaraj Gouda

Designation and Affiliation	**Engineer in Chief, Water Resources Dept.,Govt. of Odisha**
Topic Title	**Corrosion Control of Reinforced Concrete Structures**

Profile

Mr. Lingaraj Gouda, a Civil and Structural Engineering graduate from VSSUT and NIT Rourkela, has over 37 years of experience in Odisha's Water Resources Department. He led major dam projects, served on national technical committees, trained engineers, taught at OUTR, and represented India in international dam safety programs.

Abstract

Corrosion of steel reinforcement is one of the main reasons which lower the bond strength and yield strength of steel as well as affects the concrete causing cracking, spalling and delamination thereby seriously affecting the durability of reinforced concrete structures. The control in corrosion of reinforcement bars is very much inevitable which can be achieved by using Corrosion-Resistant (CRS) TMT bars, Galvanized Rebars, Fusion Bonded Epoxy (FBE) coated rebars, Stainless Steel (SS) Rebars, Fibre Reinforced Polymer (FRP) rebars .The control in corrosion can also be achieved by protection of reinforcing steel in concrete structures from corrosion by various protection techniques such as use of patch repairing, protective coating, impressed current method and sacrificial anodes. Among these protection methods, electrochemical protection technique using sacrificial anodes can be suggested as a very effective tool for corrosion mitigation. This paper provides a review on the measures taken or can be taken at construction sites for corrosion control of reinforced concrete structures to reduce its impact and thus increasing the durability of RCC structures.

Invited Talks

Dr. Khushbu Dash

Designation and Affiliation	**Asst. Professor, Amrita Vishwa Vidyapeetham Chennai**
Topic Title	**The Evolution of Corrosion Modelling: From Empirical Laws to Physics-Informed Digital Twins**

Profile

Dr. Khushbu Dash is an Assistant Professor and in the department of Chemistry in Amrita School of Engineering at Chennai, India. He obtained his Ph.D. in Materials and Metallurgical Engineering from NIT Rourkela, and worked at Charles University, Prague, University of Oxford, UK as well as IISc Bangalore and IIT Madras post her PhD. Her specialization includes corrosion of materials especially high entropy alloys and Data-driven Materials Science. He is the author of more than 30 research papers. She was awarded NPDF fellowship as well as Erasmus Mundus fellowship in her postdoctoral period of career. She has delivered invited lectures in the field of 3D printing as well as corrosion. She also won the CII award for best corrosion innovation in 2026.

Abstract

The Finite Element Method (FEM) has revolutionized corrosion modelling by enabling quantitative prediction of electrochemical phenomena for complex geometries. The evolution of FEM-based corrosion analysis from its inception in the late 1970s to contemporary hybrid approaches has been discussed here. The methodology encompasses two primary frameworks: the computationally efficient Laplace equation for low-corrosion-rate systems, and the comprehensive Nernst-Planck formulation that captures full species transport for high-fidelity predictions. Applications span pitting, crevice, galvanic, atmospheric, and pipeline corrosion, with notable success in predicting irregular corrosion morphologies through Cellular Automaton-FEM coupling, yielding prediction errors. Persistent challenges include physics-based computational modelling of electrochemical kinetics. Emerging paradigms integrating Machine Learning as surrogate models, physics-informed neural networks, and multi-scale coupling from atomistic to continuum levels are positioned to overcome these limitations. The convergence of these methodologies towards digital twin implementation promises a transformative shift from maintenance to proactive integrity management based on real time data.

Keynote Talks

Er. Sagarika Panda

Designation and Affiliation	**Sales Manager, Sika India Pvt. Ltd.**
Topic Title	**Extending Structural Service Life Through Sika's Multi-Mechanism Corrosion Protection System**

Profile

Er. Sagarika Panda is a structural engineer with an M.Tech from CET Bhubaneswar and over ten years of experience in academia and the construction industry. She has served as Head of the Civil Engineering Department at Centurion University and led quality initiatives at OBCC. Currently, she is a Sales Manager at Sika India Pvt. Limited, specializing in corrosion protection, waterproofing, and concrete repair solutions to enhance infrastructure durability.

Abstract

Structures situated in maritime and industrial environments face accelerated deterioration due to high atmospheric salinity, sustained relative humidity above 80%, and cyclonic moisture loading, all of which accelerate chloride-induced and carbonation-induced corrosion of embedded reinforcement. This paper presents a comprehensive, multi-phase corrosion protection framework developed using Sika technologies, supported by the company's R&D presence across 103 countries and a 115-year legacy in construction chemicals. The proposed system addresses structural vulnerability across three distinct phases: new construction, existing hardened structures, and rehabilitation of deteriorated elements.

For new construction, integral corrosion-inhibiting admixtures (Sika FerroGard-901, Sika FerroGard CI 220/210) are incorporated during batching to form a bipolar protective film on reinforcing steel while simultaneously creating a hydrophobic pore-blocking matrix, delaying the onset of chloride ingress from the outset. For existing hardened structures, a combination of migratory corrosion inhibitors (Sika FerroGard-903) and silane-based hydrophobic impregnations (Sikagard 705S, Sikagard 72W IN) provide deep-penetrating, vapor-permeable protection that repels moisture and soluble salts without altering surface aesthetics, while elastomeric and anti-carbonation coatings (Sikagard 550W Elastic, Sikagard PU UR, Sikagard 300 IN, Sikagard 680MY) form continuous, crack-bridging barriers against liquid water and gaseous CO_2 ingress. For structural rehabilitation, damaged concrete is removed, exposed rebar is treated with corrosion-neutralizing primers (Sika Rustoff-100), and passivating zinc-rich or polymer-modified coatings (Sika Top Armatec 108/110, Sika FerroGard 950 IN) are applied prior to restoration using structural repair mortars (Sika MonoTop-1010/412/122F, Sika Emaco S348/S488).

Collectively, this phase-specific, multi-mechanism strategy—spanning admixture protection, surface impregnation, active rebar passivation, and external barrier coatings—demonstrates the potential to extend structural service life by up to 15 years while significantly reducing lifecycle repair costs. The findings underscore the value of an integrated materials-science approach, combining chemical admixtures, migratory inhibitors, and protective coatings, in delivering durable, long-term corrosion resistance for RCC and steel structures operating under aggressive environmental exposure conditions.

Keywords: corrosion inhibitors, Sika FerroGard, hydrophobic impregnation, structural rehabilitation, chloride-induced corrosion, carbonation protection, service life extension

Invited Talks

Dr. Amit Sarkar

Designation and Affiliation	**Principal Scientist, Vedam India Metallurgical Research Laboratory**
Topic Title	**Effect of Hydrogen Pre-charging on Passive Film Stability and Hydrogen Embrittlement Behavior of Austenitic Stainless Steel**

Profile

Dr. Amit Sarkar is the Principal Scientist at Vedam India Metallurgical Research Laboratory Pvt. Ltd., specializing in corrosion science, hydrogen embrittlement, and e-waste recycling through bioleaching. He has authored over 15 research papers and worked on 10 projects, including two funded by the Ministry of Mines focused on sustainable gold and rare earth element recovery from e-waste.

Abstract

316L austenitic stainless steel is widely used in marine, biomedical, chemical, and hydrogen related environments due to its excellent corrosion resistance, good ductility, and stable chromium-rich passive film. However, under cathodic protection, acidic service conditions, or hydrogen-containing environments, atomic hydrogen can enter the steel surface and alter both passivation behaviour and mechanical integrity. In the present study, the effect of hydrogen precharging on the passivation and hydrogen embrittlement susceptibility of 316L stainless steel is investigated. Hydrogen was introduced into the steel by electrochemical precharging under controlled current density and charging time. The changes in passive film stability were evaluated using open circuit potential, potentiodynamic polarization, and electrochemical impedance spectroscopy. Mechanical degradation after hydrogen charging was assessed through tensile/fracture behaviour, surface cracking tendency, and ductility loss. The results indicate that hydrogen precharging modifies the electrochemical response of 316L stainless steel by affecting passive film compactness, charge transfer resistance, and pitting tendency. A decrease in polarization resistance and impedance response suggests partial destabilization of the protective oxide layer after hydrogen absorption. Hydrogen entry also promotes localized plastic deformation, microcrack initiation, and reduction in elongation, indicating enhanced hydrogen embrittlement susceptibility. Although 316L stainless steel possesses a stable face-centered cubic austenitic structure that generally provides better resistance to hydrogen embrittlement than ferritic or martensitic steels, prolonged hydrogen precharging can weaken the passive film and accelerate damage at slip bands, grain boundaries, and inclusion sites. The study highlights the coupled role of surface passivation and absorbed hydrogen in controlling the corrosion–mechanical degradation of 316L stainless steel. These findings are important for the safe application of 316L stainless steel in hydrogen energy systems, marine structures, biomedical implants, and cathodically protected components.

Keywords: 316L stainless steel; passivation; hydrogen embrittlement; hydrogen precharging; passive film; electrochemical corrosion; EIS; pitting corrosion

Invited Talks

Mr. Chittaranjan Kabi

Designation and Affiliation	**AVP & HOD - Corrosion Control Cell, Jindal Steel Ltd., Angul**
Topic Title	**Industry 4.0 Expectations for Smart, Effective, and Efficient Anti-Corrosion Technologies and Special Protective Coatings for Structures, Vessels, Equipment, and Buildings.**

Profile

Mr. Chittaranjan Kabi is a distinguished engineering and industry professional with extensive experience in the steel sector. Throughout his career, he has been committed to enhancing operational excellence, sustainability, and the long-term reliability of industrial assets. His professional interests include corrosion prevention, protective coatings, and surface engineering, recognizing their crucial role in extending the service life of steel structures and infrastructure. He has consistently advocated the adoption of effective anti-corrosion practices and advanced coating technologies, contributing to improved durability, safety, and cost-effective maintenance in the steel and paint industries. Respected for his technical expertise, leadership, and collaborative approach, he continues to inspire innovation and excellence while mentoring young professionals and promoting knowledge sharing across the engineering community.

Abstract

Smart coatings are advanced surface coatings that can respond to changes in their environment and alter their properties in a useful way. Unlike conventional coatings that simply protect or decorate a surface, smart coatings can sense and react to stimuli such as temperature, light, pressure, moisture, chemicals, or electrical fields

PROGRAMME SCHEDULE - SMARTCOR 2026

1st *International Conference on*

STRATEGIC MATERIALS ADVANCEMENTS IN CORROSION PREVENTION AND RESEARCH - THROUGH SMARTER SCIENCE

Date - 10th - 11th July 2026
Venue : CSIR-IMMT, Bhubaneswar

Day - 01 (10th July 2026)

Registration (08:45 am to 09:30 am) – S S Bhatnagar Hall, CSIR-IMMT, Registration Desk

Inaugural program & Poster Inaugural (09:30 am to 10:30 am) – S S Bhatnagar Hall, CSIR-IMMT

Tea Break – 10:30 am to 10:45 am

Technical Sessions

Day 01 : Technical Session 1 (10:45 am to 01:00 pm)

Session Chairman - Dr. Partha Sarathi De (IIT Bhubaneswar)

Invited Speaker	Time	Speaker	Affiliation	Topic Title
Invited Speaker_1	10:45 am to 11:05 am	**Prof. Nikhil K Singha**	**Professor, IIT Kharagpur**	**Designing Bio-inspired Bio-based Polymer Materials for Specialty Coatings and Adhesives**
Invited Speaker_2	11:05 am to 11:25 am	**Dr. Sachin Joshi**	**CEO, Greenovoc Specialty Coatings Pvt. Ltd.**	**Development of Zero VOC Water-based Sustainable Protective Coating Solutions for highly Corrosive Conditions**
Invited Speaker_3	11:25 am to 11:45 am	**Prof. Pradip K Maji**	**Professor, IIT Roorkee**	**Polysilazane - and Silane-Derived Hybrid Networks for Corrosion Protection**

Invited Speaker	Time	Speaker	Affiliation	Topic Title
Invited Speaker_4	11:45 am to 12:05 pm	**Mr. Subash G Selvaraj**	**President, Industrial Coating Head, Nippon Paint (India) Pvt. Ltd.**	**High Performance Coil Coating Solutions for Pre-painted Steel**
Invited Speaker_5	12:05 pm to 12:25 pm	**Mr. Nitin Bhagwat**	**National Head – Product Management, Asian Paints PPG Pvt. Ltd.**	**Advancement in Anti -corrosive Protective Coating System beyond Zinc rich Primer based System**
Invited Speaker_6	12:25 pm to 12:45 pm	**Dr. Nikhil Kamboj**	**Scientists, University of Turku**	**Corrosion-Immune Response Coupling in Implants**
12:45 pm to 01:00 pm		**Dr. Smrutirekha Mishra**	**ICT-IOCB and Greenewelty Pvt. Ltd.**	**Advanced Hydrogen Permeability Analyzer for Industries**

Lunch Break (01:00 pm to 02:30 pm) – Near Auditorium Hall

Day 01 : Technical Session 2 (02:30 pm to 04:10 pm)

Session Chairman - Mr. Nitin Bhagwat (Asian Paints PPG Pvt. Ltd)

Invited Speaker	Time	Speaker	Affiliation	Topic Title
Invited Speaker_7	02:30 pm to 02:50 pm	**Mr. Hemant Mewada**	**Associate Vice President - R & D, JSW Paints Ltd.**	**Autonomous Surface Protection: Next-Generation Smart Coatings for Active Corrosion Control**
Invited Speaker_8	02:50 pm to 03:10 pm	**Mr. Saroj Kumar Banerjee**	**MD, TATA Pigments Ltd.**	**Sustainability Through Circular Manufacturing and Building a Zero Harm Culture, Safety Felt Leadership**

Invited Speaker	Time	Speaker	Affiliation	Topic Title
Invited Speaker_9	03:10 pm to 03:30 pm	**Mr. Gouranga Charan Rout**	**Sr. Vice President, Electrotherm India Ltd.**	**Innovative Material Strategies for Sustainable & Resilient Infrastructure**
Invited Speaker_10	03:30 pm to 03:50 pm	**Mr. Rajes Bardia**	**GM-Technology, Asian Paints PPG Pvt. Ltd.**	**Stimuli-Responsive and AI-Enabled Smart Coatings for Industrial Applications: From Passive Protection to Adaptive Functional Systems**
Invited Speaker_11	03:50 pm to 04:10 pm	**Dr. Kishore Kumar Jena**	**Research Scientist, United Arab Emirates University**	**2D materials Enhanced Superhydrophobic Protective Coatings**

Tea Break - (04:10 pm to 04:45 pm) - S S Bhatnagar Hall

First Panel Discussion for Day 01 (04:45 pm to 06:15 pm) - S S Bhatnagar Hall

Panel Members **(Theme - The Role of Mineral Beneficiation in Material Synthesis and Subsequent Corrosion Resistance in Aggressive Environments)**	**Dr. Ramanuj Narayan** **Dr. S K Biswal** **Mr. Bibhu Mishra** **Prof. Pradip K Maji** **Mr. Saroj Kumar Banerjee** **Mr. Gouranga Charan Rout**
Moderator	**Dr. Sudesna Roy (KIIT)/ Dr. Pranati Nayak (ICT-IOCB)**

END OF DAY 01 SCHEDULE - GALA DINNER at Hotel SWOSTI PREMIUM from 7 pm onwards

Day - 02 (11th July 2026)

Day 02 : Technical Session 3 (09:30 am to 11:25 pm)

Session Chairman - Mr. Mahesh Kumar Aradhye (Nippon Paints (India) Pvt. Ltd.)

Invited Speaker	Time	Speaker	Affiliation	Topic Title
Invited Speaker_12	09:30 am to 09:50 am	**Mr. Krishna Chetnani**	**GM, Electrotherm India Ltd.**	**Chloride-Induced Corrosion in FBE-TMT Reinforced Pre-Cracked Concrete: A Comparative Study**
Invited Speaker_13	09:50 am to 10:10 am	**Mr. Khalid**	**Dy. Chief - Industrial & Decorative Coating Services, Tata Pigments Ltd.**	**Responsible Ways to Control Industrial Corrosion and Way forward in Nation Building**
Invited Speaker_14	10:10 am to 10:30 am	**Mr. Lingaraj Gouda**	**Engineer in Chief, Water Resources Dept.,Govt. of Odisha**	**Corrosion Control of Reinforced Concrete Structures**

Tea Break - (10:30 am to 10:45 am) - S S Bhatnagar Hall

Invited Speaker	Time	Speaker	Affiliation	Topic Title
Invited Speaker_15	10:45 am to 11:05 am	**Dr. Khushbu Dash**	**Asst. Professor, Amrita Vishwa Vidyapeetham Chennai**	**The Evolution of Corrosion Modelling: From Empirical Laws to Physics-Informed Digital Twins**
Invited Speaker_16	11:05 am to 11:25 am	**Er. Sagarika Panda**	**Sales Manager, Sika India Pvt Ltd.**	**Extending Structural Service Life Through Sika's Multi-Mechanism Corrosion Protection System**

First Panel Discussion for Day 02 (11:30 am to 01:00 pm) - S S Bhatnagar Hall

Panel Members **(Theme - Rust, Risk, and Resolution: Advanced Practices in Industrial Corrosion Management)**	**Dr. B K Satpathy** **Dr. Sachin Joshi** **Mr. Rajeev Shukla** **Mr. Hemant Mewada** **Mr. Subash G Selvaraj** **Mr. Krishna Chetnani**
Moderator	**Dr. Laxmidhar Besra (CSIR-IMMT)**

Lunch Break (01:00 pm to 02:05 pm) – Near Auditorium Hall

Day 02 : Technical Session 4 (02:05 pm to 02:45 pm)

Session Chairman - Mr. Dipesh Vyas (Demech Chemicals)

Invited Speaker	Time	Speaker	Affiliation	Topic Title
Invited Speaker_17	02:05 pm to 02:25 pm	**Dr. Amit Sarkar**	**Principal Scientist, Vedam India Metallurgical Research Laboratory**	**Effect of Hydrogen Pre-charging on Passive Film Stability and Hydrogen Embrittlement Behavior of Austenitic Stainless Steel**
Invited Speaker_18	02:25 pm to 02:45 pm	**Mr. Chittaranjan Kabi**	**AVP & HOD – Corrosion Control Cell, Jindal Steel, Angul**	**Industry 4.0 Expectations for Smart, Effective, and Efficient Anti-Corrosion Technologies and Special Protective Coatings for Structures, Vessels, Equipment, and Buildings.**

Second Panel Discussion for Day 02 (03:00 pm to 04:15 pm) - S S Bhatnagar Hall

Panel Members **(Theme - The Blueprint for Corrosion Control: Practical Resolutions for High-Risk Industries)**	**Mr. Chittaranjan Kabi** **Dr. Anupam Agnihotri** **Mr. Prafulla Maharana** **Dr. Subash Chandra Mallick** **Prof. Nikhil K. Singha**
Moderator	**Dr. Nimai Mishra (ICT-IOCB)**

Valedictory Program and Award Ceremony - 04:15 pm to 05:15 pm

High Tea Break (05:15 pm onwards) – S S Bhatnagar Hall

End of the Programme - SMARTCOR 2026

ABSTRACT

Corrosion Case Studies from Refinery Assets: Learning from Field Experience

MVNSS Sastry[1] , Sanjeev Rajak[2] , Aditya Jeengar[3]

[1]GM – Inspection: HPCL VR
[2]Senior Manager- Inspection: HPCL VR
[3]Engineer- Inspection: HPCL VR

Background and Research Problem: Corrosion-related degradation remains a major challenge in refinery operations, causing equipment failures, unplanned shutdowns, higher maintenance costs, and safety risks. Despite established corrosion management programs, unexpected failures still occur due to complex process environments, changing operating conditions, and evolving damage mechanisms. Capturing and sharing lessons learned from field incidents is essential for improving asset integrity and preventing recurrence. Objectives: To analyze selected corrosion-related failures in refinery assets, identify the damage mechanisms and contributing factors, evaluate inspection and mitigation measures, and develop practical recommendations to improve corrosion management and equipment reliability. Methodology / Analytical Approach: The study is based on field experiences from refinery equipment and piping systems. Investigations included review of operating history, process conditions, inspection records, and NDE techniques such as Ultrasonic Testing, Phased Array Ultrasonic Testing (PAUT), hardness testing, visual inspection, and metallography. Metallurgical evaluations and root cause analyses were conducted, and findings were assessed against industry standards and asset integrity practices. Key Results / Outcomes: The case studies showed several corrosion mechanisms, including stress-relaxation cracking, ammonium bi-sulphide corrosion, and naphthenic acid corrosion. A notable case involved failure of the Hydrogen Generation Unit (HGU) reformer inlet header due to Stress Relief Cracking (SRC), and leakage in the Amine Regeneration Unit (ARU) regenerator overhead column line, highlighting the need for material degradation assessment and focused inspection of susceptible circuits. Enhanced Risk-Based Inspection (RBI), targeted monitoring, and multidisciplinary reviews improved damage detection and mitigation. Conclusions and Significance: The case studies demonstrate the value of learning from field experience to improve corrosion management practices. The lessons learned provide practical guidance for safer operations, better reliability, optimized inspection strategies, and longer asset life in refinery environments.

Keywords: Corrosion Management; Refinery Assets; Stress Relief Cracking; Internal

ABSTRACT

Beyond Wear and Corrosion: Emerging Techniques of Tribocorrosion Evaluation

Debdutt Patro, PhD, Chief technologist,

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Tribocorrosion is the degradation of materials caused by the combined action of mechanical wear and electrochemical corrosion. Unlike wear and corrosion occurring independently, their interaction produces synergistic effects that can significantly accelerate material loss, shorten component life, and reduce system reliability. Understanding this interplay has become increasingly important for designing durable components operating in aggressive environments, from biomedical implants to marine, aerospace, automotive, and energy applications. This talk will provide an overview of the fundamental mechanisms of tribocorrosion and review modern approaches to tribocorrosion testing. Advanced platforms that integrate tribometers with electrochemical cells and enable simultaneous measurement of friction, wear, and corrosion and surface imaging, will be discussed. Case studies from orthopedic implants, modular junctions, and engineering components will illustrate how tribocorrosion influences performance, reliability, and service life.

ABSTRACT

Assessment of the status of the end-of-life scenario of photovoltaic solar panels and their management in the 21st century in India: a model-based approach

Bikram Sen Sahu[1*]

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India's rapid push for solar energy is a vital step toward a cleaner, renewable, low-carbon future. However, as solar photovoltaic (PV) installations accelerate across the country, a challenge in managing the rising volumes of end-of-life (EoL) solar panels has arisen in parallel. This study explores this issue by projecting future PV waste, analysing material flows, and assessing the environmental impacts of key waste management strategies. Using a logistic growth model, we estimated that India's installed solar capacity could exceed 550 GW by 2050. Based on the material composition, we projected the volumes of waste and recoverable components, including glass, aluminium, silicon, and copper. A Material Flow Analysis (MFA), performed in STAN software, compared two scenarios: one representing current landfill-dominated practices, and another reflecting a circular economy approach with high rates of recycling and incineration. The circular approach significantly reduced landfill loads, emissions, and leachate generation. To evaluate environmental trade-offs, a Life Cycle Assessment (LCA) was conducted in OpenLCA using the ReCiPe 2016 Midpoint (H) method. Results showed that recycling consistently had the lowest environmental impact, while landfilling was the most harmful, particularly in terms of ecotoxicity, resource depletion, and long-term emissions. Incineration offered some energy recovery benefits but contributed more to air pollution. The study clearly shows that sustainable solar energy growth depends on the availability of infrastructure to counter solar waste. A shift toward recycling, backed by strong policies and infrastructure, will be essential to ensure India's solar future remains clean—not just in generation, but also in disposal.

Keywords: Solar PV waste, End of Life, Logistic model, STAN, OpenLCA

ABSTRACTS

Eco-Friendly synthesis of Carbon Dots: Prominent material for coating application

Shivani Dhall1 Srijan Pushkarna1,2 and Kapil Sood3

1Department of Physics, D. A. V. College, Jalandhar, Punjab, India
2School of Physics and Materials Science, Shoolini University of Biotechnology and Management Sciences, Solan, India
3Department of Physics, Govt Degree College, Dhaliara, H.P., India

The growing demand for sustainable materials encourages researchers to adopt eco-friendly synthesis methods for carbon dots (CDs), which show potential applications in various fields such as energy storage, bioscience, water purification, and sensors. Therefore, green synthesis is emerging as a potential and economical approach for the synthesis of CDs using different biomass wastes and their derivatives. It is the most reliable and reproducible method for synthesizing high-quality CDs by controlling their size and surface-to-volume ratio. In this work, low-cost lemon juice is used as a single precursor to synthesize the CDs via the hydrothermal route. The structural and optical properties of the CDs were investigated by X-ray diffraction (XRD), Fourier-transform infrared spectroscopy (FTIR), photoluminescence (PL), and UV-Visible spectroscopy. Interestingly, it was observed that a bluish color was emitted when the CDs were placed under an ultraviolet lamp. Interestingly, this green material has potential application in coatings to improve the barrier properties and corrosion resistance when combined with epoxy.

Keywords: Green synthesis, Carbon dots, structural and optical investigation, coating application

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Tea Leaf-Extract Mediated Hydrothermal Synthesis of Graphene Oxide Nanoparticles

Kapil Sood1*, Rishabh Vashist1, Lavlesh Thakur1, Lakshika Sharma1, Amit Verma2, Shivani Dhall3

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2Bhabha Atomic Research Centre, Mumbai, India 3DAV College Jalandhar, Punjab, India
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This study reports a sustainable, green route for the synthesis of graphene oxide (GO)/carbon nanoparticles (CNPs) from tea leaves via a facile hydrothermal method. To optimize the material properties, three distinct samples were prepared at varying hydrothermal temperatures of 170 ?C, 180 ?C, and 190 ?C. The synthesised solutions were purified by filtration through a 0.22 m membrane and then subjected to dialysis for 24 h using a 5000 Da dialysis membrane to remove unreacted precursors. Structural and phase analyses were carried out using X-ray diffraction (XRD), which revealed a distinct but minor peak at approximately 2? = 12? corresponding to the characteristic graphene oxide phase, alongside a broad hump centered near 22? that signifies oxygen-containing functional groups attached to the graphite core within a predominantly amorphous framework. Field Emission Scanning Electron Microscopy (FESEM) demonstrated the formation of spherical particles distributed within the 10-100 nm size range. Optical characterisation via UV-Visible spectroscopy revealed three distinct absorption bands at ~228 nm, ~270 nm, and 353 nm, indicating characteristic ?→?* and n→?* electronic transitions. The photoluminescence (PL) properties of the synthesized materials were thoroughly investigated under varied excitation wavelengths ranging from 360 nm to 560 nm. The fluorescence emission demonstrated a highly excitation-dependent behavior; the emission intensity initially increased with excitation wavelength, reaching its pinnacle at an excitation of 460 nm before gradually diminishing at higher excitation wavelengths. Under this optimal 460 nm excitation, the sample exhibited a strong emission peak at 552 nm, confirming bright primary fluorescence localized in the green region of the visible spectrum. These favorable structural features and tunable optical profiles highlight the potential of these eco-friendly, tea leaf-derived nanomaterials for advanced optoelectronic, bioimaging, and sensing applications.

Keywords: Green synthesis; Graphene oxide; Hydrothermal method; Tea leaves; Photoluminescence; Excitation-dependent emission.

ABSTRACTS

HYDROGEN PERMEATION RESISTANCE OF HEXAGONAL BORON NITRIDE AND CHOPPED CARBON FIBRE REINFORCED EPOXY COATINGS UNDER HIGH-PRESSURE CONDITIONS

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The global transition to a hydrogen-based clean energy economy has heightened the need for safe hydrogen storage. However, hydrogen embrittlement in steel complicates matters due to hydrogen atoms diffusing and trapping in the metal lattice. Despite research, many commercial coatings are ineffective against hydrogen permeation in the long term. Existing inorganic and metallic barrier coatings face challenges like poor adhesion, brittleness and pinhole defects, highlighting the necessity for flexible, scalable and cost-effective solutions. This study addresses the gap by developing a solvent-free, multi-scale nanocomposite coating using hexagonal boron nitride and chopped carbon fibre. Hexagonal boron nitride can contribute improved resistance to hydrogen and damping capacity of epoxy systems, while chopped carbon fibre offers exceptional mechanical strength. Four coating formulations were prepared using epoxy resin (EP), hexagonal boron nitride powder (h-BN), and chopped carbon fibre (CF). Under high-pressure conditions of up to 100 bar, the hydrogen diffusivity and solubility coefficients were successfully determined from the primary composite coating (EP/h-BN/CF). FESEM and AFM demonstrated a dense, void-free microstructure in the coating, contrasting sharply with processing-induced voids and higher permeability despite superior filler dispersion. The coatings satisfied mechanical integrity requirements under 20 J impact loading and mandrel bending evaluation. Accelerated weathering demonstrated gloss retention across all formulations, confirming satisfactory UV and moisture resistance. The expected outcomes are enhanced service life of industrial coatings, reduced failure rates and improved cost efficiency in hydrogen resistance-based coating. Keywords: Boron Nitride; Carbon Fibre; Epoxy; Coatings; Hydrogen Permeability.

K*eywords: Boron Nitride; Carbon Fibre; Epoxy; Coatings; Hydrogen Permeability*

GRAPHENE-ALUMINA REINFORCED POLYMER COMPOSITES FOR DURABLE WEAR AND CORROSION PROTECTION COATINGS

Amit Kumar Samal[1*], Sandeep Sekhar Pradhan[2], Sagarika Padhan[3], Smrutirekha Mishra[4]

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Industrial coatings are central to industries such as construction, mining, and materials engineering. In industrial coatings, it is required to accelerate wear and corrosion, often resulting in premature failure, frequent replacements, and higher operational costs. Addressing these challenges requires advanced protective coatings that enhance durability and performance. This study explores the development of a graphene–alumina reinforced epoxy composite as a high-performance coating. Activated alumina contributes to improved hardness, thermal stability, and resistance to oxidation, while graphene offers exceptional mechanical strength and self-lubricating properties. When combined, these reinforcements create a synergistic effect, significantly improving wear resistance, adhesion, and corrosion protection compared to conventional coatings. The research involves synthesising and characterising the hybrid composite, with key evaluations including surface adhesion, hardness, and corrosion resistance. The expected outcomes are enhanced service life of industrial coatings, reduced failure rates, and improved cost efficiency in coating resistance. By extending the operational lifespan of critical components, this innovative coating presents a sustainable and high-performance solution to meet the rising energy demands and growing exploration activities, particularly in developing economies.

Keywords: Graphene; Alumina; Wear resistance; Corrosion protection coatings

ABSTRACTS

POLYSILAZANE-CROSSLINKED HYBRID COATINGS FOR CORROSION PROTECTION, ANTI ICING, AND SURFACE DURABILITY OF PUBLIC INFRASTRUCTURAL METALLIC SURFACES

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Public infrastructural metallic surfaces are continuously exposed to harsh outdoor conditions, leading to corrosion, surface degradation, and high maintenance costs. Conventional coatings often address only a single degradation pathway, requiring multiple protective systems. In this work, a multifunctional polysilazane-based hybrid coating is developed as a single formulation solution capable of simultaneously providing corrosion resistance, environmental durability, anti-icing behaviour, and surface protection for metallic substrates. The coating forms a dense cross-linked Si–O–Si network that acts as an effective barrier against water, oxygen, and corrosive ions. Electrochemical impedance spectroscopy revealed nearly a 100-fold enhancement in corrosion resistance compared to bare metal substrates, with a significant increase in charge-transfer resistance (~1.2×10^6 Ω) and a substantial reduction in corrosion current density. The coating effectively suppressed electrolyte penetration and interfacial electrochemical reactions under aggressive saline conditions. Beyond corrosion protection, the coating exhibited excellent outdoor durability, retaining structural integrity after 150 cycles of thermal shock and accelerated UV–acid rain weathering without cracking or delamination. The engineered low-energy surface also delayed ice formation under subzero conditions and demonstrated anti-graffiti, antifouling, and easy-cleaning behaviour, minimizing contaminant adhesion and maintenance requirements. Overall, the developed coating offers a scalable, ambient-curable, and substrate-independent strategy for next-generation metallic infrastructure protection, demonstrating how a single coating system can effectively address multiple outdoor degradation challenges simultaneously.

Keywords: Hybrid coating, Inorganic-organic, Polysilazane, Anti-corrosion, Anti-icing, Weather resistant, Anti-graffiti

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STRUCTURE-FUNCTION CORRELATION IN GREEN AND CHEMICALLY ENGINEERED SILVER NANOSTRUCTURE TOWARDS SUSTAINABLE SMART SURFACE APPLICATIONS

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The increasing demand for sustainable materials has significantly accelerated the development of environmentally friendly nanofabrication strategies. These green methods are vital for designing functional nanostructured systems tailored for advanced surface engineering applications. In this present study, silver nanostructures (AgNPs) were successfully fabricated via both traditional chemical reduction and green synthesis. The green pathway utilized Ocimum sanctum L. mediated reducing systems within both aqueous and ethanol media. It comparatively investigates the direct influence of these synthesis pathways on the physicochemical characteristics, colloidal behaviour, and functional surface activity of the engineered nanomaterial. Chemically synthesized AgNPs were fabricated using some standard chemical precursors. Conversely, the green-synthesized AgNPs were obtained through specific phytochemical-assisted reduction mechanisms. Following fabrication, the synthesized materials were purified by centrifugation and thoroughly characterized by UV-Visible spectroscopy, X-ray diffraction (XRD), and dynamic light scattering (DLS). Optical characterisation revealed characteristic surface plasmon resonance peaks within the range of approximately 390-436 nm. This outcome confirms successful nanoscale silver formation and highlights synthesis-route-dependent optical behaviour. Furthermore, XRD studies clearly demonstrated crystalline face-centred cubic silver nanostructures. Meanwhile, DLS analysis indicated notable variations in hydrodynamic particle size distribution and colloidal stability among the different synthesis systems. Functional antimicrobial evaluation against Escherichia coli and Bacillus aureus demonstrated enhanced surface activity in the ethanol-mediated nanoparticle systems. This behavior suggests improved nanoscale interaction and enhanced functional surface performance. Ultimately, the comparative findings establish a distinct structure function correlation between the synthesis methodology, nanostructural properties, and functional activity. The engineered silver nanostructures exhibit promising potential as sustainable functional additives for smart antimicrobial interfaces, anti-biofouling surfaces, and next-generation environmentally sustainable coating architectures.

Keywords: Nanofabrication, Nanostructures, Phytochemicals, Anti-biofouling, Coating

ABSTRACTS

SYNTHESIS AND ELECTROCHEMICAL INVESTIGATION OF CONDUCTING POLYMER REINFORCED BIMETALLIC NICO-MOF@MXENE TERNARY NANOCOMPOSITES FOR SUPERCAPACITOR APPLICATIONS

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Bimetallic Nickel-Cobalt based metal-organic framework (NiCo -MOF) nanofiller intercalated into MXene matrices has shown tremendous potential for energy storage given its capacity to prevent MXene sheet restacking and oxidation, thereby improving electrochemical stability, capacitance and cycling retention. This study presents a comparative analysis of of NiCo MOF@MXene nanofillers reinforced with conducting polymers (CPs) to form a ternary nanocomposite (NC) using three CPs- Polyaniline (PANI), Polypyrrole (PPy) and Polyindole (PyI) for advanced supercapacitor electrodes. Here, MXene provides rapid electron transport pathways, while the porous bimetallic NiCo-MOF contributes abundant electroactive sites and enhanced ion diffusion. The incorporation of conducting polymers further improves electrical conductivity and pseudocapacitive behavior through reversible redox reactions. Each ternary NCs were synthesized via a facile hydrothermal and in-situ oxidative polymerization route and the resulting materials were characterized using electron microscopy, X-Ray diffraction (XRD) and electrochemical tests. Electrochemical studies revealed that PANI/NiCo-MOF@MXene exhibited superior charge storage performance compared to PPy- and PyI-based nanocomposites due to the highly conductive π-conjugated structure and enhanced pseudocapacitive nature of PANI. The improved electrochemical behavior originates from the synergistic combination of electric double-layer capacitance from MXene and faradaic redox activity from both NiCo-MOF and conducting polymers. The synthesized ternary nanocomposites demonstrate strong potential as advanced electrode materials for high-performance supercapacitor applications in Energy Storage.

Keywords: Supercapacitor; Bimetallic MOF; Ternary nanocomposite; CPs; MXene nanosheets

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METAL-DOPED POLYANILINE–POLYIMIDE COMPOSITE COATINGS FOR ENHANCED CORROSION PROTECTION OF MILD STEEL

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Polyaniline (PANI) is one of the most investigated conducting polymers for the corrosion protection due to its stability, tunable conductivity, and surface-modification capability. This study is on synthesis of newly developed metal-doped PANI–polyimide composite coatings and an in-depth investigation into their physical and corrosion-protective properties in relation to steel substrates. Iron (Fe) was used in this work to improve charge transport, thermal stability, and also barrier effect of the coating. The incorporation of Fe ions in the PANI main chain and the interaction between them have been proven by X-ray diffraction (XRD) and by Fourier transform infrared spectroscopy (FTIR) spectroscopy. Its thermal stability and decomposition behavior of coating films were evaluated using thermogravimetric analysis (TGA) and differential scanning calorimetry (DSC). For evaluation of electrical conductivity as well as the corrosion protecting capability of the synthesized coating, the electrical conductivity of undoped PANI–polyimide and iron-doped PANI–polyimide films was calculated using an LCR meter. Corrosion protection performance of the composite coatings on steel substrates was evaluated by Salt Spray Test (SST), potentiodynamic polarization, and electrochemical impedance spectroscopy (EIS). Results showed that Fe-doped PANI polyimide coatings significantly enhanced electrical conductivity, thermal stability and corrosion resistance compared to the undoped PANI–polyimide coatings. The improved performance is attributed to synergistic effects between Fe dopants, resulting in effective anodic passivation and a dense barrier protection. It has been found that the Metal-doped PANI polyimide can serve as efficient, environmentally friendly and multifunctional coating for advanced corrosion protection of steel structures.

Key Words: Corrosion; Polyaniline; Metal Doping; Polyimide; Coatings; Electrical Conductivity.

ABSTRACT

STUDY ON INTERNAL PIPELINE CORROSION AND MIC USING PIGGING RESIDUE CHARACTERIZATION TECHNIQUES

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Pipeline pigging residue can be defined as a heterogeneous mixture consisting of corrosion by-products, hydrocarbons, mineral scales, sand particles, water, and microbes, which are found on the internal surfaces of oil and gas pipelines after long-term exploitation. There are several types of degradation processes that can happen due to these deposits. However, among all other forms of pipeline corrosion, MIC has become one of the main concerns because of its potential to intensify localized corrosion. MIC refers to the biological activities of microorganisms, such as sulphur-reducing bacteria (SRB), acid-producing bacteria (APB), and iron-oxidizing bacteria (IOB), that can proliferate in biofilms and under-deposits inside pipelines. The pigging procedure is applied in order to eliminate accumulated deposits and provide optimal flow efficiency. Nevertheless, apart from removing these deposits, pigging also allows evaluating the internal corrosion condition of the pipeline through the collected pigging residue. This work aims to characterize pipeline pigging residue in order to assess its physicochemical properties, microbial population, and association with the existing internal corrosion mechanisms. Therefore, FESEM, EDS, XRD, and microbiology analyses have been used for assessing corrosion by-products, mineral phases, and microorganism distribution inside the pigging residue sample. This paper underscores the importance of analyzing pigging residue with regard to gaining insights into the nature of internal pipeline corrosion behavior, detecting biological contaminants, and formulating effective corrosion protection techniques. Monitoring of MIC and maintaining appropriate pigging practices are key elements in ensuring efficient performance of pipelines and increasing their lifetime.

Keywords: Pigging residue; MIC; hydrocarbons; iron-oxidizing bacteria.

ABSTRACTS

HEXAGONAL BORON NITRIDE-REINFORCED POWDER METALLURGY FABRICATED TITANIUM COMPOSITES: ENHANCED TRIBOMECHANICAL PROPERTIES AND CYTOCOMPATIBILITY FOR BIOMEDICAL IMPLANTS

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The limited wear resistance and debris-induced biological complications of commercially pure titanium (Ti) restrict its long-term reliability in load-bearing biomedical implants. This study aims to develop a tribologically robust and biologically compatible Ti-based composite by incorporating hexagonal boron nitride (hBN) as a multifunctional reinforcement that simultaneously enhances mechanical performance and reduces wear-induced failure. Ti (1-5 wt.%) hBN composites were synthesized via powder metallurgy (PM) and sintered at 1300 °C for 1 h in argon (Ar) atmosphere to investigate the influence of reinforcement content on microstructure, tribomechanical behaviour, and cytocompatibility. Microstructural analysis confirmed the uniform dispersion of hBN and the in-situ formation of TiB/TiB2 whiskers, which contributed to significant strengthening. Among the compositions, Ti-3 wt.% hBN exhibited optimal performance, achieving ~91.8% relative density, ~376.7 HV hardness (≈109% higher than pure Ti), and a compressive strength of 435 MPa (~2.4× improvement). Tribological testing revealed a minimum wear rate of ~0.21 mm^3/min, indicating superior wear resistance. Cytotoxicity evaluation using L929 cells demonstrated excellent biocompatibility, with cell viability exceeding 190%. These results establish Ti-3 wt.% hBN as a promising candidate for advanced biomedical implants requiring a synergistic balance of strength, wear resistance, and biological safety.

Keywords: Titanium-based composite; Hexagonal boron nitride (hBN); Powder metallurgy (PM); Wear; X-ray diffraction (XRD), Field emission scanning electron microscopy (FESEM); Biomedical implants.

CORROSION STUDIES ON STEEL IN MONOETHANOLAMINE(MEA) SOLUTION DURING CARBONDIOXIDE CAPTURE

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In recent years, monoethanolamine (MEA) based absorption systems have gained significant attention for carbon capture applications aimed at reducing greenhouse CO2 gas emissions from industrial sectors such as coal-fired power plants, cement plants, steel industries, and hydrogen and ammonia production units. However, amine degradation and corrosion are major operational challenges in MEA absorption systems due to the strong corrosive nature of amine solutions. Furthermore, degradation products formed during amine operation can intensify the corrosive environment, leading to increased material deterioration, reduced equipment durability, and decreased process efficiency. The present study aims to investigate the corrosion behaviour of different steels exposed to aqueous MEA solutions with varying concentrations. Electrochemical corrosion studies were carried out using Open Circuit Potential (OCP), Tafel polarization, and Electrochemical Impedance Spectroscopy (EIS) techniques to evaluate the electrochemical characteristics and corrosion performance of the materials in MEA media. The expected outcomes of the study include understanding the influence of MEA concentration on the corrosion rate (mm/year) of three different steels, namely mild steel, SS304, and SS316, and identifying suitable steel materials with improved corrosion resistance in amine environments. The findings would contribute to improved material selection, corrosion mitigation strategies, and enhanced operational reliability of industrial CO2 absorption systems.

Keywords: Monoethanolamine; Corrosion; Steel; Potentiodynamic Polarization; Electrochemical Impedance Spectroscopy; Open Circuit Potential.

ABSTRACT

HIGH-PERFORMANCE CORROSION BARRIER: IN-SITU SYNTHESIZED FE/MG-DOPED POLYANILINE–POLYIMIDE COMPOSITE COATING

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Metal-doped polyaniline (PANI) is a promising material for anticorrosion coatings due to its ability to passivate the metal surface and potentially release corrosion inhibitors. As a conductive polymer, PANI offers excellent electrical conductivity and environmental stability. However, its application is limited by poor mechanical strength and low solubility, which compromise its structural integrity and corrosion protection performance. Incorporating metal oxides into PANI has proven effective in enhancing its mechanical properties, thereby improving the durability and effectiveness of PANI-based coatings in harsh environments. In this study, an in-situ synthesized metal-doped polyaniline-polyimide (PANI-PI) composite coating is developed to enhance corrosion resistance. Here, two types of metals are doped with PANI: iron (F1-PANI, F3-PANI, F5-PANI) and magnesium (M1 PANI, M3-PANI, M5-PANI), each at different weight percentages. The incorporation of metal dopants into polyaniline enhances passive film formation on metal substrates, reducing localized corrosion and increasing charge-carrier mobility within the polymer matrix, thereby improving electron-transfer kinetics in electrochemical applications. To prepare polyimide composites, in-situ polymerization of polyamic acid (PA) and metal-doped PANI (PA, PANI/PA, F5-PANI/PA, M5-PANI/PA) has been performed. Further, it is coated on cold rolled cold annealed (CRCA) grade steel substrate and cured to prepare polyimide composite coatings. The polyimide matrix synergistically improves the coating's conductivity, adhesion, and barrier properties. Polyimide ensures thermal and mechanical stability, while polyaniline provides active corrosion inhibition through redox behavior. Electrochemical impedance spectroscopy (EIS), potentiodynamic polarization studies, and salt spray tests confirm the superior anti-corrosion performance of the coating. Electrochemical studies revealed that the F5-PANI/PI composite exhibited a higher Icorr at 82.90 nA and a corrosion rate of 37.87 e-3 mpy. In contrast, the M5-PANI/PI composite showed the lowest corrosion current at 32.70 nA and a corrosion rate of 14.94 e-3 mpy among all the coated samples, indicating superior corrosion protection performance. The metal-doped polyaniline polyimide composite exhibits higher charge transfer resistance, reduced corrosion current density, and prolonged durability in aggressive environments as compared to normal PANI/PI.

Keywords: Polyaniline; Composites; In-situ polymerization; Anti-corrosion, coatings.

ABSTRACTS

CORROSION COMBATING ACTION OF MODIFIED LIGNIN FOR BIODEGRADABLE MG ALLOYS

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Magnesium (Mg) alloys have emerged as promising biodegradable materials for temporary orthopedic implants owing to their favorable mechanical properties and biocompatibility. However, their rapid degradation in physiological environments limits their clinical applicability, necessitating the development of effective corrosion protection strategies. The present study focusses on development of sustainable bio-based anti-corrosive coating. The modified lignin was synthesized through esterification reaction and subsequently deposited onto the surface of Mg alloy substrate using a solution-based coating approach. The structural modification was confirmed using FTIR spectroscopy, while the morphology and surface characteristics of coated samples were analyzed through SEM-EDS. The anti-corrosive performance of the coating was evaluated in simulated body fluid using electrochemical techniques and conventional immersion studies. The findings further investigate the corrosion inhibition mechanism adopted by modified lignin to control the degradation behavior of Mg alloy.

Keywords: Mg alloy; Lignin modification; Corrosion protection; Sustainable coatings

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PREDICTION OF CORROSION PARAMETERS USING DEEP LEARNING MODELS IN HIGH ENTROPY ALLOYS

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High Entropy alloys (HEAs) are alloys that have configurational entropy greater than 1.5R. Among the HEAs, AlCoCrCuFeNi family has attracted significant attention due to its tunable microstructure and superior performance in corrosive environments. The evaluation of properties in HEAs which have a huge compositional space is time-consuming and expensive Therefore, data-driven methodologies have become effective tools for alloy performance prediction. In this work machine learning and deep learning models were utilized to predict the corrosion properties of the AlCoCrCuFeNi family of high entropy alloys. A composite database was constructed from recently published studies and from experimental databases. Data preprocessing, feature selection, and missing value imputation were performed to improve the reliability and accuracy of the models. For hardness prediction, descriptors including d-electron concentration, average electronegativity, average melting point, and configurational mixing entropy were used as input features. Corrosion potential (Ecorr) and current density (Icorr) were predicted using atomic size difference, electronegativity difference and elemental composition as key descriptors. Artificial Neural Network (ANN), Random Forest (RF), XGBoost and CatBoost were developed to establish relationships between alloy descriptors and target properties. quantitatively depict the nonlinear relationships between alloy and specific target properties. The results revealed strong correlation between compositional descriptors and alloy performance. Among the models investigated, XGBoost and CatBoost demonstrated superior predictive accuracy, while RF exhibited robust generalization capability which effectively captured complex nonlinear relationships associated with alloy behavior.

Keywords: High Entropy Alloys, Deep Learning Neural Networks, Corrosion resistance, Nonlinear correlations.

ABSTRACTS

MXENE-POLYIMIDE HYBRID COATINGS: A PROMISING STRATEGY FOR LONG-TERM STEEL PROTECTION

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2D nanomaterials, such as graphene, boron nitride, and molybdenum disulfide, can form composites with anti-corrosion properties. However, interactions with saline environments can significantly influence this property. Here, the superior anti-corrosion properties of a 2D MXene composite coating derived from the MAX phase are obtained over mild steel. MXene-polymer interactions serve as an efficient electron donor for the corrosion pathway, where electrons modify oxygen-containing functional groups on MXene surfaces to generate reactive hydroxide. Therefore, the cathodic electrochemical reaction due to oxygen reduction is significantly controlled by MXene, as confirmed by the reduced cathodic slope in the Tafel polarization measurements. The lack of an anti-corrosion effect in the pure polymer film of 10±2µm on mild steel was addressed by MXene polyimide composite coating, by electrochemical studies having an impedance of 2.18×107 Ω.cm2 after 360 hours of immersion in 3.5% NaCl medium. Including MXene improves the corrosion resistance and increases the film's adhesion strength, contact angle, and conductivity to 1.17×10-3 S/cm of MXene polyimide nanocomposite coating. Lastly, a mechanism has been proposed to understand the anti-corrosion behaviour of MXene in a polyimide matrix.

Keywords: MXene, Polyimide, EIS, Anticorrosion, Coating.

PH-ACTIVATED DYNAMIC IONOMER-ACETAL NETWORKS FOR SELF-HEALING AND RECYCLABLE ELECTRODEPOSITED ACRYLIC COATINGS

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Dynamic multifunctional coatings capable of simultaneously providing corrosion protection and anti-icing performance are highly desirable for advanced engineering applications. Herein, a fluorine-free and isocyanate-free acrylic nanocomposite coating was developed through cathodic electrophoretic deposition using a dynamically crosslinked ionomeric acrylic matrix reinforced with hydrophobically modified multiwalled carbon nanotubes (MWCNTs). Incorporation of HDTMS-functionalized MWCNTs generated controlled nanoscale roughness and reduced surface energy, increasing the water contact angle from 79.4° to 89.7° for the optimized formulation. SEM and AFM analyses revealed uniform CNT dispersion at low filler loading, increasing surface roughness from 4.4 nm to around 27.1 nm, while excessive loading resulted in agglomeration and reduced coating performance. Electrochemical impedance spectroscopy demonstrated significantly enhanced anticorrosion performance in 3.5 wt.% NaCl solution, with the optimized coating exhibiting the highest impedance of 3x105 Ω.cm-2 and largest Nyquist capacitive loop. The improvement originates from synergistic blocking of ionic diffusion pathways by uniformly dispersed CNTs together with reduced electrolyte wetting due to siloxane-functionalized hydrophobic surfaces. The coating maintained durable barrier performance even after prolonged abrasion, UV exposure, and saline immersion. The nanocomposite coatings further exhibited excellent anti-icing and photothermal de-icing behavior. Infrared thermography showed rapid surface heating to ~27 °C within 180 s, enabling complete de-icing in 270 s compared to 750 s for bare substrates, while frosting delay increased from 300 s to 3500 s under sub-zero conditions. Additionally, the dynamic ionomer-acetal framework imparted intrinsic self-healing capability through reversible acetal exchange, enabling recovery of damaged regions and restoration of coating integrity.

ABSTRACT

HYDROPHOBIC CARBON DOTS AND PMMA-GRAFTED NATURAL RUBBER REINFORCED EPOXY NANOCOMPOSITE COATINGS FOR ENHANCED ANTI-CORROSION PERFORMANCE

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The deterioration of metallic structures due to corrosion remains a critical global challenge, causing enormous economic losses across the marine, automotive, and infrastructure industries. Despite widespread use, conventional epoxy coatings suffer from inherent brittleness, microcracking, and inadequate long-term barrier performance, highlighting the urgent need for flexible and multifunctional protective solutions. This study addresses the gap by developing a nanocomposite coating system integrating hydrophobic carbon dots (HCDs), synthesised from Rhodamine B via a solvothermal route, and PMMA-grafted natural rubber (PMMA-g-NR) into an epoxy matrix. PMMA-g-NR acts as a green corrosion inhibitor and toughening agent that improves the flexibility, while HCDs function as nanofillers that enhance stress transfer, increase surface hydrophobicity, and create an effective barrier pathway that restricts the penetration of corrosive ions and moisture into the coating matrix. The synthesised HCDs were characterised using UV–Visible spectroscopy and FESEM analysis, confirming their successful formation, nanoscale morphology, and homogeneous surface topology. These findings supported coating morphology studies by demonstrating the successful incorporation and dispersion of HCDs within the coating matrix. Water contact angle measurements confirmed progressive hydrophobic character, impact testing validated mechanical integrity, and electrochemical impedance spectroscopy (EIS) in 3.5 wt.% NaCl solution demonstrated superior long-term barrier performance. The outcomes demonstrate the strong potential of establishing this system as a promising multifunctional anti-corrosion coating platform for industrial metallic substrate protection.

Keywords:Hydrophobic Carbon Dots; PMMA-g-NR; Epoxy; Anti-corrosion; Nanocomposite Coatings;

ABSTRACTS

Graphene Oxide Reinforced Concrete Composites for Improved Corrosion Resistance in Aggressive Environments: Material for Sustainable Construction

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Graphene oxide (GO) is one of the most promising nanomaterials for reinforcing cementitious composites due to its excellent mechanical, thermal, and anti-corrosion properties. This study investigates the effect of incorporating graphene oxide at dosages ranging from 0.01% to 0.10% into Portland slag cement (PSC)-based concrete and evaluates its influence on strength and durability. The incorporation of GO enhances the microstructure of concrete by minimizing microcrack formation, improving flexibility, and increasing resistance to corrosion, thereby extending the service life of concrete structures. Despite its significant potential, limited studies have reported the use of GO in PSC-based concrete. To investigate its performance, comprehensive characterization techniques, including Micro-Raman spectroscopy, diffuse reflectance spectroscopy (DRS), Fourier transform infrared spectroscopy (FTIR), Brunauer–Emmett–Teller (BET) surface area analysis, scanning electron microscopy (SEM), transmission electron microscopy (TEM), and compressive strength testing, were employed. The results reveal that GO significantly enhances the compressive strength and durability of PSC concrete by refining the microstructure and improving resistance to aggressive environmental conditions. These findings demonstrate the potential of graphene oxide as an effective nano-additive for developing high-performance, durable, and sustainable concrete.

Keywords: Graphene oxide, Concrete, Construction industry, Compressive strength

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Arc Plasma Processing of Fused Tungsten Carbide Composite: A Candidate Material for Advanced Structural and Protective Applications

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Tungsten carbide (WC)-based composites have attracted considerable attention for advanced engineering applications owing to their exceptional hardness, wear resistance, thermal stability, and chemical inertness. In the present study, a dense WC–W_2C composite was synthesized using a thermal arc plasma process, which enables rapid melting, controlled phase transformation, and the formation of a low-porosity microstructure. Partial decarburization of WC during plasma processing resulted in the formation of the W_2C phase, producing a composite with enhanced mechanical integrity. The synthesized material was characterized by X-ray diffraction (XRD), field emission scanning electron microscopy (FESEM), energy-dispersive X-ray spectroscopy (EDS), and neutron absorption studies to establish the relationship between phase composition, microstructure, and performance. In addition to its superior tribological and anti-corrosion properties, the high tungsten content provides enhanced attenuation of ionizing radiation, while the composite offers moderate neutron interaction capability, making it a promising structural material or matrix for multifunctional radiation-shielding systems. The composites prepared by arc plasma melt-cast method are attractive for applications in nuclear reactors, spent fuel handling systems, aerospace components, defense equipment, and harsh industrial environments.

Keywords: Tungsten carbide, Arc plasma technique, XRD, Microstructure

ABSTRACTS

Specialty Polymer Nanocomposite Emulsion for Hydrophobic Coatings

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Superhydrophobic surfaces have several interesting features. They have self-cleaning, anti-sticking, anti-icing, anti-fouling, and anti-bacterial properties. There are many examples of superhydrophobic surfaces (SH) in nature. For example, lotus leaves have superhydrophobic surface with a water contact angle (WCA) of >150◦. Material scientists are exploring different approaches to prepare the SH surface. In one of the approaches, the surface is grafted with suitable functional materials, like siloxane or fluoroalkyl moieties. In this study, we prepared a fluorine and siloxane-free hydrophobic surface by using specialty acrylic monomers having long alkyl and bicyclic alkyl functionality, as well as nano-carbon materials. In this case, different acrylate monomers, like having long alkyl chains like dodecyl as well as bicyclic alkyl functionalities, were polymerized via emulsion polymerization in the presence of suitable nano-carbon materials. The polymer nanocomposite emulsion was characterized by Dynamic Light Scattering (DLS) and Fourier Transform Infrared spectroscopy (FTIR). The hydrophobicity of the composite films was assessed to be 120-130◦ through Water Contact Angle (WCA) measurement using a Goniometer. This emulsion was found to be colloidally stable for several days, indicating its application in paints and coatings.

Keywords: Superhydrophobic surface; long alkyl chains; Emulsion polymerization; nan-carbon materials.

Specialty Polymer Nanocomposite Emulsion for Hydrophobic Coatings

Sunita Dhar[1], Sushree Subhadarshinee Mohapatra[2], Tapan Dash[3,*], Tapan Kumar Patnaik[2], Shubhra Bajpai[4], Tapan Kumar Rout[5], Surendra Kumar Biswal[3]

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Alumina (Al_2O_3) and alumina/graphene oxide (Al_2O_3/GO) composite coatings were successfully deposited on mild steel substrates using a robust and high-throughput non-transferred arc plasma torch technique. Raman spectroscopy confirmed the characteristic structural features of graphene oxide (GO), and its optical band gap was estimated to be 3.44 eV. X-ray diffraction (XRD) analysis verified the successful formation of crystalline Al_2O_3 and Al_2O_3/GO (0.5 wt%) coatings. The addition of 0.5 wt% GO significantly enhanced the mechanical performance of the coating, resulting in a 43.75% increase in microhardness compared with the uncoated mild steel substrate. Microstructural examination revealed a dense, homogeneous, and well-adhered coating with improved structural integrity and reduced defects. Electrochemical corrosion studies demonstrated a substantial improvement in corrosion resistance, as indicated by a positive shift in corrosion potential to values less negative than −0.05 V, reflecting the superior barrier properties of the Al_2O_3/GO composite coating. The synergistic combination of Al_2O_3 and GO effectively improved the hardness, microstructural quality, and corrosion resistance of mild steel, demonstrating the potential of plasma-sprayed Al_2O_3/GO composite coatings for advanced engineering applications requiring enhanced surface durability and long-term protection.

Keywords: Alumina (Al_2O_3) coating, Graphene oxide (GO), Al_2O_3/GO composite coating, Mild steel, Microhardness, Corrosion resistance

ABSTRACTS

Simulation and Artificial Intelligence-Assisted Design of Graphene-Reinforced Composite Coatings for Critical Aerospace Protection Components

Mohammed Siddique[1,*], Prakash Chandra Rout[2], Bipin Bihari Dash[3], Tapan Dash[4], Tapan Kumar Rout[5], Surendra Kumar Biswal[4]

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The development of advanced protective coatings is essential for enhancing the durability and service life of critical aerospace components exposed to extreme mechanical, thermal, and corrosive environments. Among emerging materials, graphene-reinforced ceramic composites, particularly Al_2O_3-graphene and Al_2O_3–graphene oxide (GO) coatings, have demonstrated significant potential due to their high hardness, excellent wear resistance, superior thermal stability, and effective barrier properties against oxidation and corrosion. This work presents a simulation- and artificial intelligence (AI)-assisted framework for the design and optimization of graphene-reinforced composite coatings for aerospace protection applications. Finite element simulations are employed to investigate the stress distribution, thermal response, and coating–substrate interfacial behavior under representative service conditions. AI-based predictive models are utilized to evaluate the influence of coating composition, graphene reinforcement, coating thickness, and processing parameters on the mechanical and functional performance of the coatings. The integrated approach enables rapid optimization of coating architectures while minimizing computational time and experimental efforts. The simulation results predict that graphene incorporation enhances coating toughness, crack resistance, thermal insulation, and adhesion characteristics, thereby improving the overall reliability and lifespan of coated aerospace components. The proposed simulation–AI methodology provides a cost-effective strategy for accelerating the development of next-generation multifunctional graphene-based composite coatings and supports data-driven materials design for aerospace protection systems.

Keywords: Graphene-reinforced coatings, Al_2O_3–graphene oxide, Artificial intelligence, Aerospace coatings, Protective coatings

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Amphiphilic Polystyrene–Block–Poly(acrylic acid) Diblock Copolymers: Synthesis, Self-Assembly, and Advanced Applications

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Amphiphilic polystyrene–block–poly(acrylic acid) (PS–b–PAA) copolymers were synthesized via different polymerization techniques such as radical polymerization and emulsion polymerization. PS–b–PAA was synthesized with different ratios to obtain polymers for advanced applications. The structures were confirmed by ^{1}H NMR and ^{13}C NMR and FTIR spectroscopy. The resulting amphiphilic copolymers exhibited pronounced self-assembly behavior in aqueous and mixed-solvent systems, forming micelles, worm-like aggregates, and vesicular structures depending on the PAA fraction and solvent composition. PS–b–PAA sdiblocks functioned as efficient stabilizers in emulsion and dispersion polymerizations, enabling the production of stable latexes and well-defined nano-objects at low block-copolymer-to-monomer ratios. Furthermore, these copolymers were explored as functional matrices for encapsulating enzymes and metal nanoparticles, demonstrating potential applications in enzymatic nanoreactors, catalysis, corrosion-inhibiting coatings, and advanced composite materials. Despite the use of a conventional AIBN radical initiator, optimized reaction conditions and controlled conversions allowed the preparation of PS–PAA diblocks with sufficient structural control and tunable amphiphilicity for a broad range of advanced materials applications.

Key words: Di-block, Copolymer, polystyrene–block–poly(acrylic acid).

ABSTRACTS

Protection of Aquatic Environments Using TiO_2–Fe_2O_3–Graphene Oxide Hybrid Catalysts

Jyoti Prakash Dhal

Department of Chemistry, School of Basic Sciences and Humanities, Odisha University of Technology and Research, Bhubaneswar.

The simultaneous occurrence of pharmaceutical residues and heavy metals in wastewater poses a significant threat to environmental and public health, necessitating the development of efficient multifunctional treatment technologies. This study reports the design and evaluation of a TiO_2–Fe_2O_3–graphene oxide (GO) hybrid catalyst for the dual removal of pharmaceutical pollutants and toxic heavy metals from aqueous systems. The catalyst was synthesized using a hydrothermal method followed by calcination to enhance crystallinity and catalytic stability. Structural and morphological properties were characterized using XRD, SEM, and BET analyses. The photocatalytic degradation of pharmaceuticals and adsorption of heavy metals were investigated under varying pH, temperature, catalyst dosage, and pollutant concentrations. Pollutant removal was quantified using HPLC and ICP-MS. The optimized hybrid catalyst exhibited removal efficiencies exceeding 90%, attributed to the synergistic effects of photocatalysis, adsorption, and redox reactions. Graphene oxide significantly improved the surface area, charge separation, and catalytic activity, resulting in enhanced degradation kinetics and adsorption capacity. The catalyst also demonstrated excellent stability, reusability, and minimal heavy-metal leaching during repeated treatment cycles. These findings highlight the potential of TiO_2–Fe_2O_3–GO hybrid catalysts as sustainable, cost-effective, and high-performance materials for advanced wastewater treatment and environmental remediation.

Keywords: Hybrid catalyst; Photocatalysis; Heavy metal removal; Pharmaceutical pollutants; Graphene oxide; Wastewater treatment.

Development of Aluminium Hybrid Nanocomposites Reinforced with Graphene and Silicon Carbide for Harsh-Service Engineering Applications

Deepanjali Swain[1], Nibedita Nayak[1], Tapan Dash[1,2,#], Shubhra Bajpai[3], B.B. Palei[3], Tapan Kumar Rout[4], and Surendra Kumar Biswal[2]

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We developed novel nano hybrid composites of Al-SiC (5, 7 & 9 wt.%)-graphene (0.5 wt.%) by powder metallurgy route. Pure Al and Al-SiC (5, 7 & 9 wt.%)-graphene (0.5 wt.%) nanocomposites were prepared by planetary ball milling of 3 h followed by compaction (200 MPa) and sintering (600 ^{0}C, 5 h) under argon atmosphere. The characteristics of the materials have been evaluated to improve microstructure and microhardness of composites. The graphene behaviour was studied via micro Raman, UV-DRS, TEM and FTIR analyses. Graphene has few layers of sheets with the energy band gap of 1.7 eV. Micro Raman shows three characteristic peaks of graphene i.e. D, G and 2D. The rGO retains structural quality before and after making composites samples. The purity of composite samples was confirmed by EDS analysis Al/SiC/graphene nano composites formation were evaluated by various techniques. Micro Raman analysis represents characteristic peaks of SiC and graphene. It has been observed that that microstructural and microhardness behaviour of Al is significantly improved upon reinforcement of SiC and graphene. Pure Al shows microhardness of about 42 VHN and Al-SiC (5 wt.%)-graphene (0.5 wt.%) composites shows about 230% times more values of microhardness in compared to pure Al. When the Si amount further increased to 9 wt.% in Al-SiC (9 wt.%)-graphene (0.5 wt.%) composites, there is no significant improvement of microstructural and microhardness properties of the composites.

Keywords: Aluminium matrix, Silicon carbide, Graphene, Hybrid nanocomposite

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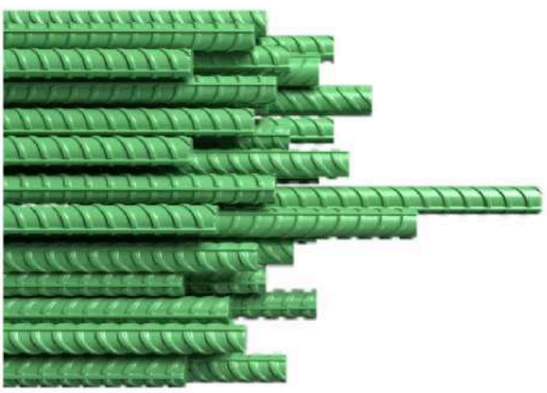

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- **Length:** 12 meters & as per Requirement
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We help industries transition to safer, sustainable, high-performance coating systems

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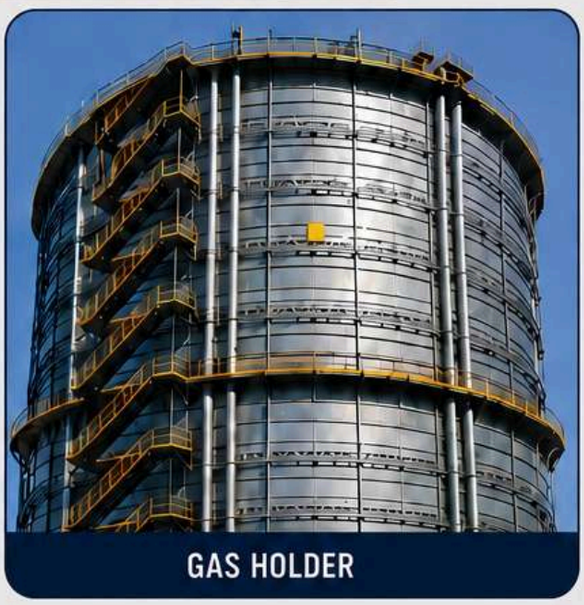

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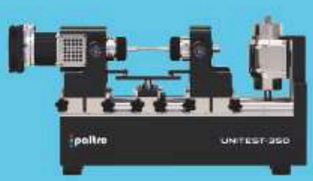

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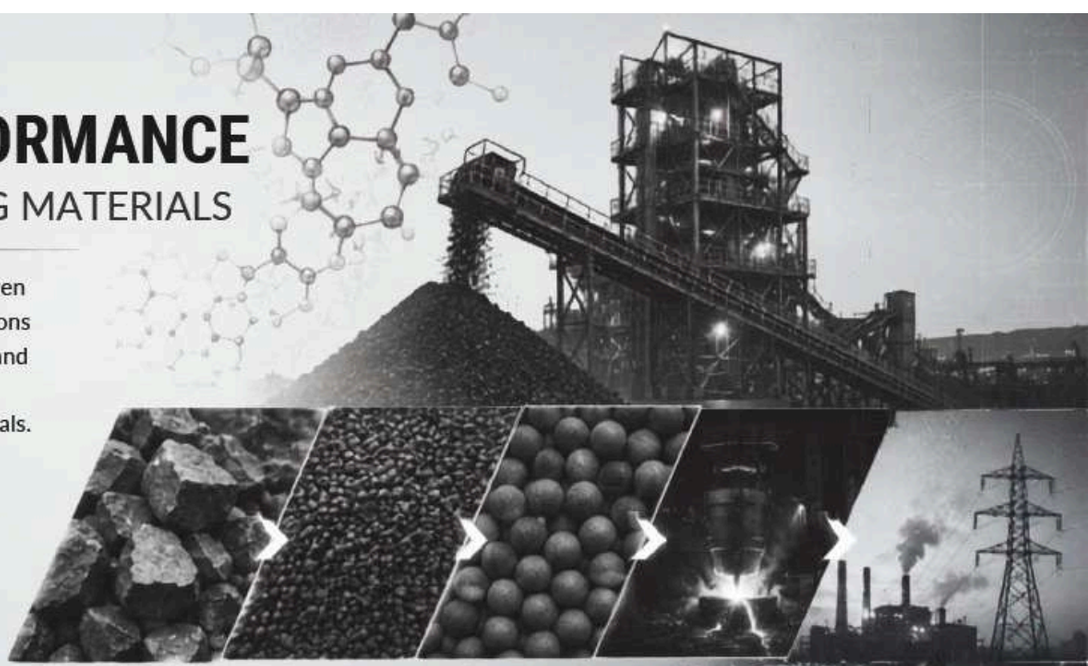

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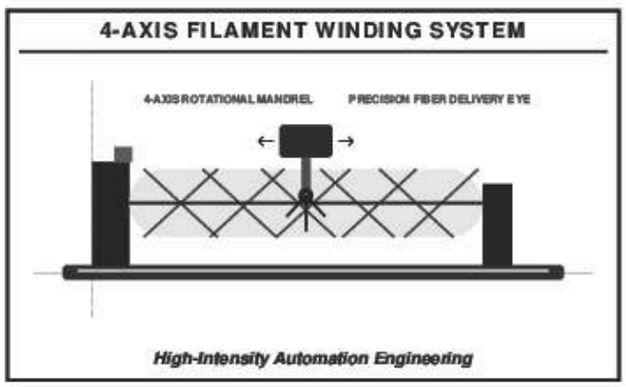

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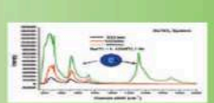

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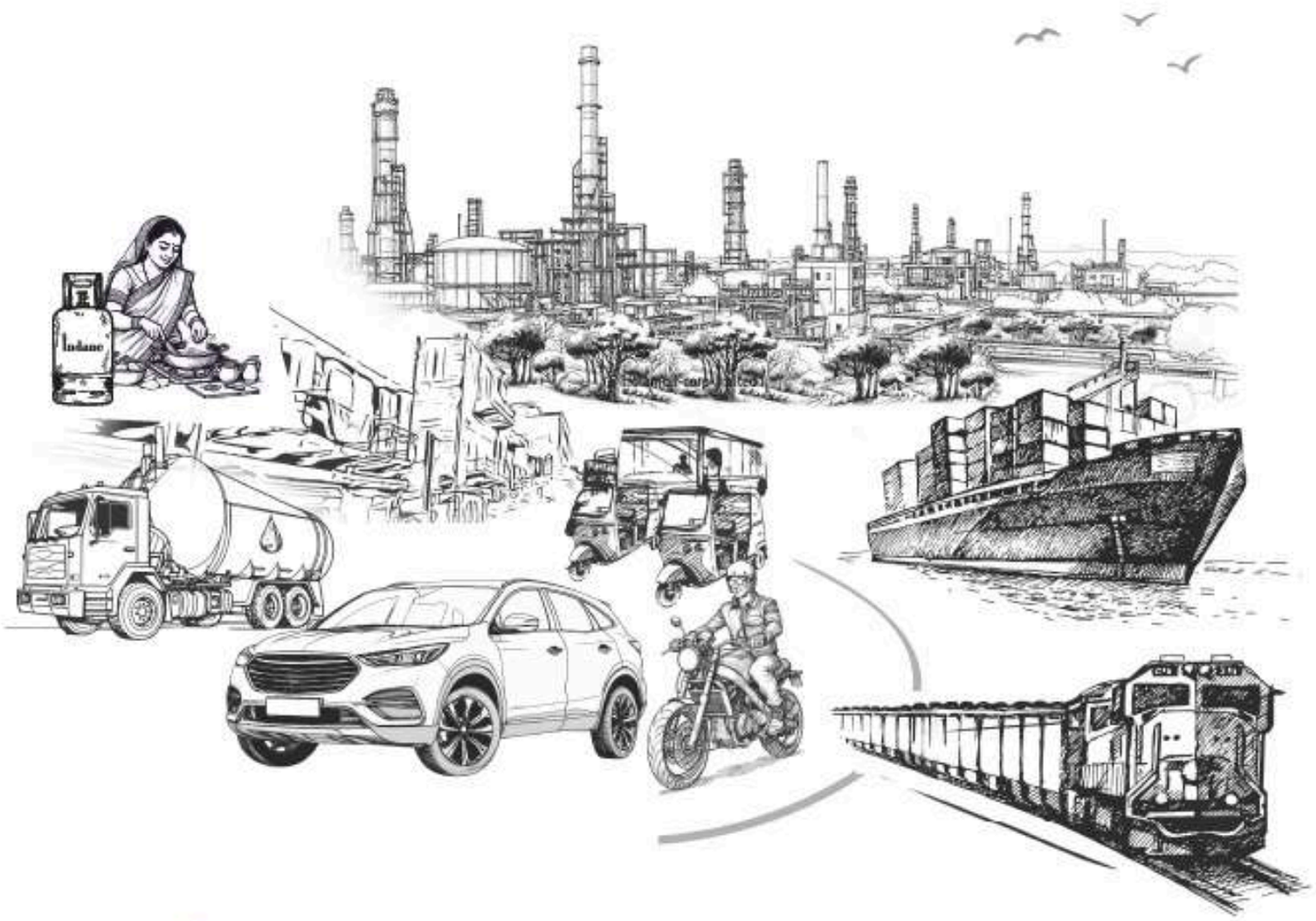

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- Pipelines throughput of over 100 Million Metric Tonnes per annum
- Operates over 14,000 Electric Vehicle Charging Stations
- Product sales of over 100 Million Metric Tonnes per annum
- Fuelling journeys across the nation with over 40,000 Retail Outlets
- Over 15 Crore kitchens across India trust Indane LPG

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Can Your Materials Survive the Real World ? - When Hydrogen Strikes and Oxygen Bites !

▶ A Testing Solution for Paint and Coating Industries

Greenewelty Private Limited is a technology-driven startup focused on innovation in new age materials. We are committed to developing solutions to address the generation, storage, and transport of hydrogen. In addition, we provide testing and consultancy support for a wide range of industries, including paint & coating, steel, aluminium, energy, oil & gas, and fuel cell technologies.

Greenewelty is pioneering a better way of testing in the hydrogen value chain, and our solution is the first of its kind in India.

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