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COATINGS AND ANTI CORROSION ENGINEERING REVIEW

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Increasing demand for energy-efficient solutions a primary driver for the growth in demand for insulation coatings

Interview

Mr Venkatesan Babu

Country Representative – Coatings & Adhesives, India and Head of Sales FOM (Fibre Optic Materials) India & EMEA (Europe, Middle East and Africa)

Technical Feature

Paint coating selection process

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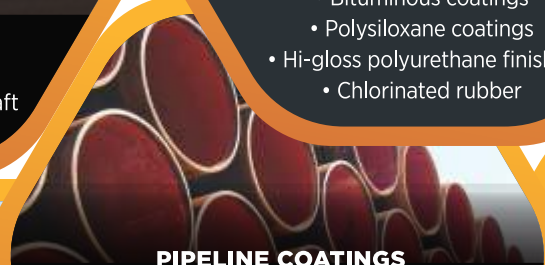

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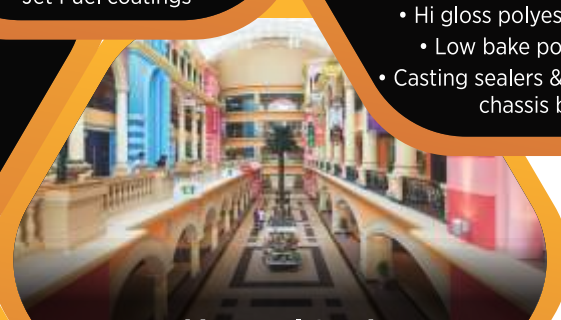

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COVER PHOTO:123RF

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The entire world has been going through some difficult times lately. The armed conflicts in various parts of the globe, and a major tragedy back home in India – the disastrous crash of Air India flight AI-171 in Ahmedabad a couple of weeks ago. At the outset, we offer our sincere prayers and condolences to all the devastated families who have lost their loved ones in the unfortunate incident.

In this issue, we talk about insulation coatings and its growing use in industries operating in high-temperature environments, such as aerospace, metallurgy, and energy production. They increasingly seek advanced insulation coatings that can withstand extreme heat while maintaining structural integrity and performance.

In addition to the growing focus on energy efficiency, global market growth is also spurred by rising awareness of environmental impacts and the increasing regulatory emphasis on sustainability. Manufacturers and industrial players are now more aware of the cost-saving potential of insulation coatings, which help extend the lifespan of equipment while reducing energy consumption and associated operational costs. The trend toward smart building solutions, energy-efficient systems, and green construction further supports the adoption of these coatings across sectors. Moreover, as businesses continue to face fluctuating energy prices and stricter environmental regulations, insulation coatings are being recognized for their significant contribution to energy conservation and environmental protection.

Rising construction activities in emerging economies also boost demand for thermal insulation coatings for buildings. In March 2025, an initiative in Gujarat involved painting roofs in slum areas with a reflective white coating to combat extreme heat. This project encompassed 400 households in Ahmedabad and is part of a global scientific trial studying the impact of indoor heat on health and economic outcomes in developing countries. Residents reported benefits such as cooler homes, improved sleep, and reduced electricity bills. Insulation coatings play a significant role in mitigating global warming by reducing energy consumption and carbon emissions associated with heating and cooling buildings.

In the meanwhile we look forward to meeting you at the CII Surface & Coatings Expo, Chennai; the ICENDE 2025 / ICECORR 2025, Kochi, and the launch of AMPP India's Kerala Chapter, also in Kochi, very soon!

Jolly Lonappan
Editor-in-Chief

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The time has arrived for ceramics to finally take centre stage. Jyoti Ceramic Industries has specially developed ceramic filled polymer based coating compounds, "**Aluma Coat®-BR**" brushable / sprayable and "**Aluma Coat®-TW**" trowelable.

VERSATILE INDUSTRIAL APPLICATIONS

Motor Shaft Coated with Aluma Coat - BR

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VERSATILE INDUSTRIAL APPLICATIONS

Mineral Crusher Coated with Aluma Coat - TW

Inner Base of Dust Collector Coated with Aluma Coat - TW

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PPG introduces PPG EnviroLuxe Plus powder coatings with recycled plastic content

PPG has announced the launch of PPG EnviroLuxe™ Plus powder coatings, which include up to 18% post-industrial recycled plastic (rPET) and are made without per- and polyfluoroalkyl substances (PFAS). This product combines the benefits of post-industrial recycled plastic (rPET) in a formulation that is made without PFAS, providing a versatile solution that meets diverse application needs, notes a press release from PPG.

PHOTO: PPG

PPG EnviroLuxe Plus powder coatings achieve up to a 30% reduction in carbon footprint compared to standard durable powders, due to the elimination of polytetrafluoroethylene (PTFE) fluoropolymer and the use of rPET, without compromising protective performance.

PPG EnviroLuxe Plus powder coatings achieve up to a 30% reduction in carbon footprint compared to standard durable powders, due to the elimination of polytetrafluoroethylene (PTFE) fluoropolymer and the use of rPET, without compromising protective performance. They offer the other sustainability benefits of powder coatings, including excellent transfer efficiency and reclaimable overspray – which minimizes waste – and low volatile organic compound (VOC) emissions.

"PPG EnviroLuxe Plus powder coatings not only enhance the durability and aesthetic appeal of products but also reflect our commitment to sustainability," said Shelley Verdun, PPG Business Manager, Powder Coatings, Industrial Coatings. "The advanced technology behind these coatings ensures superior performance, providing long-lasting protection while helping applicators minimize their carbon footprint and supporting their sustainability goals."

PPG EnviroLuxe Plus is part of the PPG EnviroLuxe powder coating family, a new suite of coatings designed to combine performance and aesthetics with sustainability benefits, making them a preferred choice for businesses looking to enhance their products while supporting their sustainability goals.

These coatings are engineered to enhance a wide range of end-use products, including metal office furniture, outdoor fencing and shelving and racking systems. They are available in a broad selection of standard and custom colors, including metallic options, allowing for aesthetic flexibility without sacrificing performance.

EvenMix introduces heavy duty drive to enhance mixing efficiency and reliability

EvenMix, a leader in innovative mixing solutions, proudly introduces the EvenMix Heavy Duty Drive. This advanced drive system showcases EvenMix's commitment to excellence and innovation, offering a powerful and efficient solution for industrial mixing challenges, notes a press release from the company.

PHOTO: EVENMIX

EvenMix Heavy Duty Drive is designed to work seamlessly with totes, drums, open containers, and tanks up to 10,000 gallons.

EvenMix serves various industries, including paint and coatings, chemicals, ink, etc. The EvenMix Heavy Duty Drive, with its variable speed settings, four control modes, and customizable on-off cycle, stands out as a versatile solution because it can handle viscous materials and large volumes with double the torque of standard drives. Despite its powerful capabilities, the drive is lightweight at only 15 pounds, making it easy to handle and install. This physical attribute enhances operational efficiency and reduces worker strain.

"Our new Heavy Duty Drive is a breakthrough in mixing technology," said the official spokesperson for EvenMix. "We've listened to our customers' needs and developed a drive that not only meets but exceeds their expectations for durability and efficiency."

The EvenMix Heavy Duty Drive for mixing is designed to drive mixing blades for industrial applications, providing the required torque and rotational power to thoroughly and effectively mix materials. This drive connects to mixing blades, powering them to rotate and blend materials with precision. Because it works well with thick and heavy materials, it is highly sought after for practical applications in industrial settings.

EvenMix Heavy Duty Drive is designed to work seamlessly with totes, drums, open containers, and tanks up to 10,000 gallons. Since it's made of stainless steel, it will last very long and still work as expected, setting new industry standards.

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Rhopoint Instruments introduces the Rhopoint Aesthetix IVS

Rhopoint Instruments, a recognized leader in the realm of appearance measurement, is delighted to announce the arrival of its most recent innovation, the Rhopoint Aesthetix IVS (Instrument Vision System). Deriving its name from "Aisthésis," the Greek word for "perception," the image-based device combines the high-tech prowess of dual camera technology while offering a new level of appearance measurement to describe how technical quality aspects are perceived by consumers. In a harmonious blend of traditional and state-of-the-art technology, the Rhopoint Aesthetix not only pioneers perception-based measurement but also offers backward compatibility with existing international standards. This compatibility ensures that users can transition seamlessly to advanced technology while maintaining continuity with their established processes and protocols.

PHOTO: RHOPOINT INSTRUMENTS

The Aesthetix combines the features of multiple single devices into one device, providing measurements for a comprehensive and complete understanding of surface appearances.

The Aesthetix's high-definition dual camera system enables a level of precision that captures the subtleties of surface characteristics below human visual resolution and merges them with human visual perception. Based on the latest academic research, Rhopoint has created a measurement framework that captures all the important quality aspects of a surface that affect perception, including gloss, haze, colour and texture, offering new ways to measure reflective contrast, sparkle and coarseness, surface waviness and topography. Measurements, surface maps and images are displayed and analysed in a comprehensive software package suitable for research and quality control applications.

The ultimate measurement toolset, the Aesthetix combines the features of multiple single devices into one device only, providing measurements for a comprehensive and complete understanding of surface appearances, elevating industry standards for material analysis while reducing maintenance costs.

"Integrating the new dimension of perception-based measurement while adhering to established international standards, the Rhopoint Aesthetix is a testament to our dedication to innovation and our respect for the tried and true," says Tony Burrows Managing Director at Rhopoint Instruments. "It's a powerful tool that provides our clients with a new understanding of surface appearance and a measure of the visual appeal of products to the consumer."

Dunn-Edwards unveils new porch and floor coating

Dunn-Edwards Corporation has announced an all-new offering, Porch & Floor Concrete and Wood – designed to give concrete and wood surfaces with chipped or faded paint a new life, notes a press communique. Continuing its 100-year commitment to formulating and manufacturing the industry's most innovative products, Porch & Floor delivers a smooth, flawless and durable finish.

PHOTO: DUNN-EDWARDS

Porch & Floor's 100% acrylic formula is engineered to protect exterior surfaces from water damage, scuffing, and the sun's harmful UV rays.

Porch & Floor's 100% acrylic formula is engineered to protect exterior surfaces from water damage, scuffing, and the sun's harmful UV rays. Ideal for use on concrete, wood porches, patios, basements, walkways, and stairs, Porch & Floor gives these surfaces a new life and unparalleled protection.

"Color makes an impact in any space – and flooring is no different; whether it's your back porch, front driveway, or anything in between, it's important to let your personality and style shine through every detail," said Lauren Hoferkamp, Color Marketing Manager at Dunn-Edwards. "The hues offered in Porch & Floor are expert-selected and timeless – sure to complement any project."

Tintable in eight transformative colors – from Bedrock Gray to Windswept Willow and more – its eggshell sheen will leave any surface with a beautiful finish. Unlike stains, Porch & Floor provides enhanced protection by forming a durable, protective layer on the surface. It offers enhanced resistance to wear and the elements with no noticeable brush marks or uneven blending.

"We are thrilled to bring quality and performance to our customers through the launch of Porch & Floor – from excellent adhesion, mar and scuff-resistance, and more, it's the perfect solution for projects where compromise is just not an option," said Tim Bosveld, VP of Product Management at Dunn-Edwards. "As we continue our long-standing legacy in the paint and coatings industry, this announcement solidifies our commitment to provide everything you need to apply a higher standard in your work."

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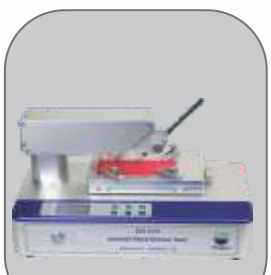

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Sherwin-Williams launches erosion-resistant coating system, Pipeclad™ Frac-Shun ERC

The new Pipeclad Frac-Shun ERC from Sherwin-Williams Protective & Marine establishes a new coatings category with a system that resists erosion inside pipes located near fracking wellheads, thereby reducing downtime maintenance costs and enhancing drilling productivity. This patent pending erosion-resistant coating (ERC) technology protects pipe interiors from the inherent sandblasting action of grit moving rapidly through the pipes, notes a press release from the company. The applied powder coating remains intact far longer than other options, protecting the steel pipes from the significant metal loss that otherwise leads to potential leaks and early pipe replacements in many operations.

PHOTO: SHERWIN-WILLIAMS

The new erosion-resistant coating system is able to withstand the impact of multiphase flows striking it without eroding or chipping away like most coatings.

The inner walls of pipes, especially elbows, located near wellheads can be eroded by fracking sandflows within six to 18 months, or sooner. Such erosion also occurs inside storage vessels and tanks where gritty, multiphase fluid flows strike interior surfaces. To date, no other coating category – whether liquid or powder – has been able to successfully mitigate this erosion. Instead, well operators are accustomed to frequent unexpected maintenance shutdowns following pipe wall thickness inspections.

"High velocity fluids containing sand, rocks and other debris moving through a coated fracking pipe create a sandblasting action that's akin to removing coatings when preparing a surface for a new application," says Kristin Leonard, Energy Segment Director, Sherwin-Williams Protective & Marine. "Once those coatings are gone, the steel will begin to erode instead. The new erosion-resistant coating system is able to withstand the impact of multiphase flows striking it without eroding or chipping away like most coatings. The ERC essentially spits the bullet back out after it's fired at the surface. With the coating intact, abrasive fluids have no chance at eroding the steel."

Pipeclad Frac-Shun ERC is applied to the inside of large- and small-diameter steel pipes to deliver maximum erosion protection. The applied system forms a molecular-level composite that provides an ultra-high erosion-resistant barrier that extends the service life of pipeline and elbow sections; minimizes lost production time by extending maintenance cycles; and reduces steel loss, damage, and leaking during energy extraction.

Walther Pilot's new 1030 Extrusion series for highly viscous materials

With the new 1030 Extrusion series, Walther Pilot has expanded their portfolio with a high-performance solution for the precise and efficient application of highly viscous materials such as grease, white glue, high-viscosity adhesives, potting compounds, or even chocolate. Thanks to its high flexibility and adaptability, it can be used in a wide range of industries.

PHOTO: WALTHER PILOT

Whether as an automatic or manual spray gun, the 1030 Extrusion ensures a consistent, efficient, and pinpoint application of beads or dots.

The new spray guns are available as both the GM 1030P Extrusion manual spray gun and the GA 1030 Extrusion automatic spray gun. With its freely configurable control system and the option to operate it with or without an adapter plate, the GA 1030 Extrusion can be perfectly adapted to individual production processes, notes a press release from the company.

For particularly precise applications, the spray guns feature a 100 mm extension.

Whether as an automatic or manual spray gun, the 1030 Extrusion ensures a consistent, efficient, and pinpoint application of beads or dots. This reduces material waste and enables clean processing with minimal rework.

With its well-thought-out design, robust construction, and versatile applications, the 1030 Extrusion provides the ideal solution for companies that prioritize maximum precision, efficiency, and flexibility in their production processes.

New nitrile glove with safe chemical protection and antistatic properties

New at Drefi Drehkopf & Fidi GmbH, Germany, the Northshield® Safe-Ex Chemical is a strong, powerful chemical protection glove specially developed for the production and painting areas, notes a write-up from the company. The 30cm nitrite glove, black in color, is available in sizes S to 2XL. The glove offers the special property of avoiding electrostatic charges due to its special material. Its contact resistance is tested according to EN 16350 and it meets the requirements for electrostatically dissipative gloves (ESD, antistatic properties) and therefore offers adequate protection against arcing. Thanks to its micro-textured fingertips, it offers excellent tactile sensitivity while maintaining good grip and slip resistance.

The Northshield® Safe-Ex Chemical is a strong, powerful chemical protection glove specially developed for the production and painting areas.

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AkzoNobel launches new wood coating with 20% bio-based content

Scientists at AkzoNobel have developed a new waterborne wood coating which features 20% bio-based content, helping to increase the use of renewable raw materials, without compromising on performance.

Adds Jim Kavanagh, Director of AkzoNobel's Industrial Coatings business: “We've successfully developed a product containing bio-based materials that matches the high-performance standards of equivalent coatings,

PHOTO: AKZONOBEL

The bio-based content used in the new product are renewable materials derived from plants.

Launched by the company's Sikkens Wood Coatings business, RUBBOL WF 3350 is a sprayable opaque coating which showcases AkzoNobel's innovative power and its commitment to developing more sustainable products that maintain the highest levels of quality and durability for customers, notes a press release from the company.

Developed and manufactured at the company's Malmö site in Sweden, RUBBOL WF 3350 is suitable for both interior and exterior use.

“By utilizing bio-based raw materials, we're not only helping to reduce our environmental impact, but also paving the way for a more circular economy in the wood coatings industry, while supporting our customers on their own sustainability journey,” says Tessa Slagter, Sustainable Innovation Manager at AkzoNobel.

ensuring that beauty and value endure, even in the harshest weather conditions. It represents a step forward in coatings technology which showcases our leading-edge R&D capability and aligns perfectly with the company's commitment to sustainable innovation.”

The bio-based content used in the new product are renewable materials derived from plants. As well as wood coatings, AkzoNobel is working hard to incorporate bio-based content into other areas of its portfolio. For example, the company already supplies bio-based paint to KIA Motors for the inside of its EV9 electric SUV, while in China, the Angel edition of the Dulux Anndru series has been launched. It's an innovative wall paint which helps to improve indoor air quality and is composed of 48% bio-based ingredients.

Advanced instruments for electrochemical research from Metrohm Autolab

Metrohm Autolab provides a comprehensive suite of instruments and accessories tailored to corrosion research. These solutions are designed to recreate real-world processes in the lab, ensuring reproducibility and accuracy.

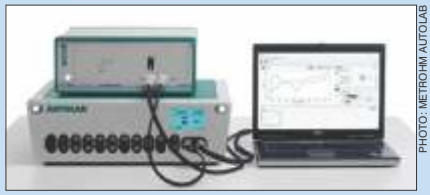

PHOTO : METROHM AUTOLAB

Designed for advanced and complex electrochemical experiments, the Metrohm Autolab's Corrosion Complete package provides unparalleled flexibility and precision.

Key capabilities include: Polarization resistance (Rp) - determined using Linear Sweep Voltammetry (LSV) and Electrochemical Impedance Spectroscopy (EIS); Corrosion rates - assessed with LSV and Electrochemical Frequency Modulation (EFM); Corrosion current (Icorr) and potential (Ecorr) - evaluated through linear and cyclic polarization; Coating properties - measured via EIS to understand breakdown and pitting potentials; Open circuit potential (OCP) - monitored with time-domain (chrono) measurements; Electrochemical noise (ECN) - captured using a Zero Resistance Ammeter (ZRA) configuration, analyzed in both time and frequency domains.

Ideal for laboratories with limited space or those looking to integrate electrochemical techniques into existing workflows, the Corrosion Compact package includes: Autolab PGSTAT204 - a robust instrument for core corrosion measurements; FRA32M Module - enables Electrochemical Impedance Spectroscopy (EIS); 1 L ASTM corrosion cell - fully compliant with ASTM standards, featuring a thermostatic jacket and a sample holder for precise measurements; NOVA software - a powerful platform for streamlined data acquisition and analysis.

Designed for advanced and complex electrochemical experiments, the Corrosion Complete package provides unparalleled flexibility and precision. It includes: Autolab PGSTAT302N - supports up to 8 modules, with space for additional configurations; Specialized Modules - FRA32M for EIS, low current amplifier module (ECD) for ultra-low current measurements, voltage and pH measurement module (pX1000) for simultaneous pH, voltage, and temperature analysis, electrochemical noise module (ECN) for detailed noise analysis in the frequency domain; 1 L ASTM Corrosion Cell - ensures compliance and accuracy; Pt 1000 Temperature Sensor - enhances temperature measurement accuracy; NOVA Software - seamlessly integrates data from multiple techniques into a unified interface.

This setup is ideal for researchers seeking high efficiency and versatility in executing diverse corrosion studies.

More details: www.khushbooscientific.com

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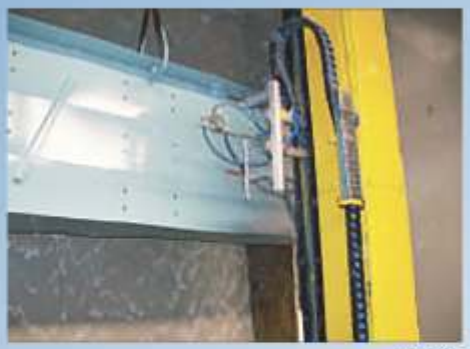

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An innovative electric polyurea and PU foam spray machine from Jaguar Equipments Pvt Ltd

The Polymatic-EF & Polymatic-ES PU foam spray machine has been designed and manufactured to meet the needs of polyurea applicators and spray foam specialists

The Polymatic-EF & Polymatic-ES PU foam spray machine has been designed and manufactured to meet the needs of polyurea applicators and spray foam specialists. Developed by Jaguar Equipments Pvt Ltd, the machine's precise proportioning capacity provides the applicators with a very well-proportioned mixture of two components. The electrically operated machine is equipped with all the necessary technical features to put users at ease during application.

Polyurea -based applications, which provide great advantages for the life of the buildings and the comfort of the users, should be applied with spray machines in a completely professional manner. In professional applications, contractors need high pressure polyurethane spray foam, also known as polyurethane spray machines or polyurea machines.

Designated as Model EF-799 the system has a maximum working pressure of 3,000 psi with a hose length up to 33 feet. Featuring two primary heaters each of 6KW, a 4HP motor with electric specifications 230V – 3-phase, the machine allows users to apply polyurea and spray foam in all seasons.

More accurately, the machine could be defined as a machine set. That is because this set consists of a high pressure polyurea spray machine, two transfer pumps used to transfer the raw material from the barrels, a hose specially designed to maintain the temperature of the heated raw material, and a spray gun, which is the point where the mixture is made.

The innovative electric Polyurea & PU foam system from Jaguar Equipments Pvt Ltd.

PHOTOS: JAGUAR EQUIPMENTS PVT LTD.

The electrically operated machine is equipped with all the necessary technical features to put users at ease during application.

The polyurea spray machine does the job of spraying the two-component polyurea raw material in viscous form by mixing it with a certain temperature and pressure. Polyurea, which is mixed and sprayed under certain heat and pressure, quickly adheres to the surface on which it is applied and solidifies.

As it works, first, the raw materials are transferred to the polyurea spray machine by means of two separate pumps; the polyurea spray machine preheaters and the pump ensure that the raw materials reach the appropriate consistency in terms of required heat and pressure.

Then, the liquid polyurea raw material, which has reached the required temperature, is delivered to the gun in high pressure through the specially designed heated hose. Both components are heated very quickly and when the set processing temperature for processing of the material is reached, the fluid heater switches off automatically. In this whole process, the two components of the polyurea are processed without mixing with each other. In the polyurea spray gun, which is the last point of the process, these two components are mixed and sprayed under high pressure.

“As a high-quality coating material, polyurea is becoming more and more important,” said Mr Paritosh Pradhan, Managing Director, Jaguar Equipments Pvt Ltd. “This is the latest product we have introduced and has been developed by our own

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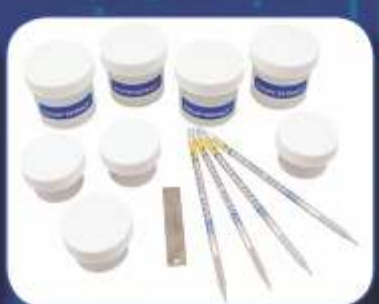



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R&D at our product design center based on feedback from the market." Applications include corrosion and wear protection, joint coating as well as sealing and repair of virtually all vertical and horizontal surfaces. Due to its fast processing time, high elasticity, extreme temperature resistance and excellent adhesion properties, polyurea is far superior to conventional coatings."

Polyurea is a very quality and durable waterproofing material. When applied correctly it is classified as the best material for waterproofing. Spray polyurea is a kind of synthetic polymer which is comprised as a result of the reaction between diamine and diisocyenate. After the reaction of these two components under desired heat and pressure the product takes its last shape in a very short time. It can adhere in any type of surfaces, apart from nylon, silicon and oily surfaces. Its elasticity and resistance to high pressure is very high. Its minimum life is about 25 - 50 years and is not affected from heat and cold so much. Because of being adhered to the surface as a whole, its isolation risk is very low. Moreover, It can be applied on surfaces both in outdoor and indoors.

To transfer material efficiently transfer pumps are required to move A and B materials to the Polymatic-E spray systems. The barrel transfer pump combines with mechanical air-motor and stainless steel pump lower. The barrel transfer pumps with quick connect technology, allows the user to quickly connect and disconnect the air motor from the pump lower. Designed especially for use with Polymatic-E, heated hoses are key component to the overall systems, allowing achieving accurate and uniform heating for the best application possible.

The control panel offers a comprehensive range of input and output options. The option to enlarge the size of the temperature display allows the user to easily monitor the actual temperature of both components even when working with very long hoses.

With large wheels and handles, the easily maneuverable machine is ideal for low and medium output foam application designed for construction, roofing and other plural component spray application.

Today, as the construction industry evolves into more and more different forms, polyurethane-based solutions are applied both in foam insulation for thermal insulation and polyurea applications in waterproofing. Within the construction sector, applications include use in waterproofing, tank lining, flooring, bridge, roof, cavity filling, fireproofing, etc. In the industrial coating segment, applications include truck beds, heavy machinery, pipe and pipeline coatings, packaging, thermal insulation, sound insulation, decks of ships and yachts. Specialized areas use includes space shuttle insulation, medical applications (mattress protectors), military and defense (insulated shelters, mobile bunkers, and storage units), etc.

Headquartered in Pune, Jaguar Equipments Pvt Ltd, offers a wide range of pneumatically operated airless spray machines, electric airless sprayers, internal and external customized pipe coating systems, diaphragm pumps, paint booths, high-pressure paint hoses, pneumatic paint agitator, pressure feed containers, air assisted guns and other accessories.

The ISO 9001 – 2015 and CE certified company has five manufacturing units, three of which are located in Pune, and the other two in Shrirampur near Ahilyanagar (earlier known as Ahmednagar) in Maharashtra.

Applications

Construction

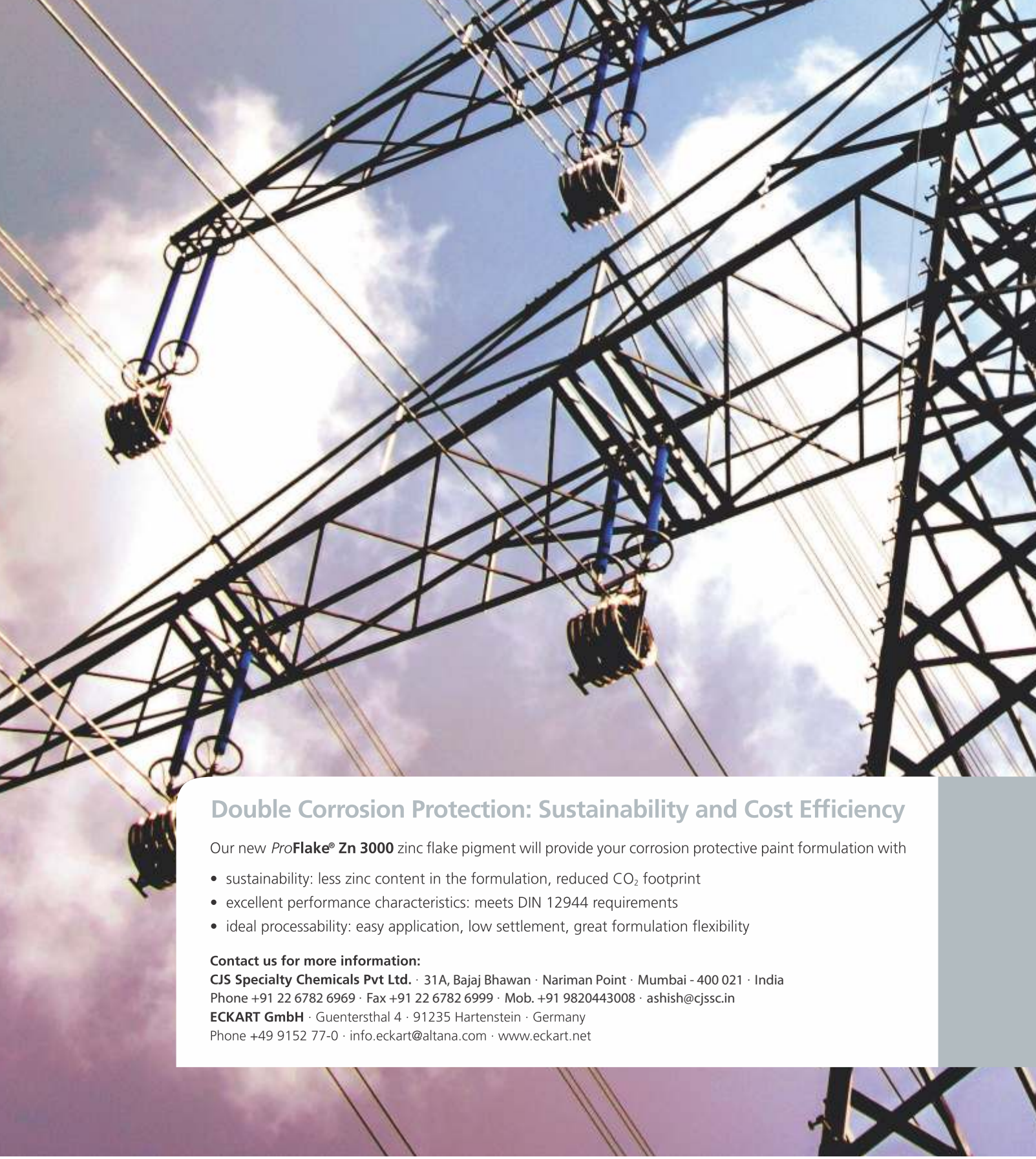
- Waterproofing
- Tank lining
- Flooring
- Bridge
- Roof
- Cavity filling
- Fireproofing

Industrial coating

- Decks of ship & yacht
- Truck beds
- Heavy machinery
- Pipe & pipeline coating
- Packaging
- Thermal insulation
- Sound insulation

Specialized areas

- Space shuttle (insulation)
- Medical application (Mattress protector)
- Military & defence (Insulated shelters, mobile bunkers, storage units)



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Covestro's strategy focuses on understanding local market needs and developing tailored solutions

For India specifically, we see tremendous potential for expansion given the country's growing infrastructure, automotive, and construction sectors, notes Mr Venkatesan Babu, Country Representative – Coatings & Adhesives, India and Head of Sales FOM India & EMEA, in a chat with C&ACER

Can you highlight the increasing demand for PU (with particular reference to paints and coatings) in various sectors like building and construction, automotive, and others and its reasons?

The demand for polyurethane in paints and coatings continues to grow across multiple sectors due to its exceptional performance characteristics. In building and construction, PU coatings provide superior durability, weather resistance, and corrosion protection for infrastructure projects. The automotive industry increasingly values PU coatings for their scratch resistance, chemical resistance, and aesthetic qualities that enhance vehicle longevity and appearance.

This growing demand is driven by several factors: increasing requirements for longer-lasting protective solutions, the need for materials that can withstand harsh environmental conditions, and the push for more sustainable yet high-performance coating options. PU coatings excel in these areas by offering excellent adhesion, flexibility, and resistance properties while increasingly incorporating sustainable innovations.

What are Covestro's strategies for expanding into emerging economies, say like India, China, etc?

Covestro has established a strong regional presence in emerging markets through strategic manufacturing facilities and innovation centres. In India specifically, we operate plants in Ankleshwar, Cuddalore, and Greater Noida, while in China we have facilities in Shanghai, Guangzhou, Kunshan, Qingdao, Shenzhen, and Shunde.

Our strategy focuses on understanding local market needs and developing tailored solutions. We invest in regional R&D capabilities to create products that address specific regional challenges while upholding global quality standards. For example, Covestro has established regional application development centers to cater to country-specific requirements — one such centre is located in Mumbai, India. This strong local presence helps ensure reliable supply chains, quicker response times, and solutions that effectively meet the unique needs of each market.

PHOTOS: COVESTRO

Mr Venkatesan Babu, Country Representative – Coatings & Adhesives, India and Head of Sales FOM (Fibre Optic Materials) India & EMEA (Europe, Middle East and Africa).

Overall, Covestro's expansion strategy includes:

☐ Local investment: Strengthening production and R&D infrastructure to meet increasing demand and minimize supply chain dependencies;

☐ Sustainability focus: Promoting circular economy solutions through its CQ (Circular Intelligence) product grades that help reduce environmental impact;

☐ Strategic partnerships: Collaborating with academic and industry stakeholders to foster innovation and support regional development goals;

☐ Customized solutions: Catering to high-growth sectors like automotive, construction, and electronics with products specifically designed for emerging market needs.

The Covestro facility in Greater Noida, one amongst the many in India.

How is Covestro leveraging innovation and technology

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Water, wind and waves – the rough, irrepressible power of the sea is a real challenge for any surface protection. Whether it's a ship or drilling rig, steel or concrete, BYK Additives for Protective and Marine Coatings prove how powerful they are under extreme conditions. They simplify the application of coatings, enable the coating layers to be reduced, provide long-lasting corrosion protection, and reduce maintenance intervals. Positive effects to be proud of both economically and ecologically!

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to develop new PU products, especially in the coatings sector?

Innovation is in Covestro's DNA, dating back to Otto Bayer's discovery of polyurethanes in 1937. Today, we operate ten innovation hubs across America, Asia, and Europe with approximately 1,340 employees dedicated to R&D, investing €392 million annually in research and development.

In the coatings sector specifically, we're pioneering several breakthrough technologies:

☐ Bio-based polyurethane dispersions: Containing up to 49% renewable carbon content, these are designed for applications such as automotive soft-touch coatings;

☐ CO_2 technology (Triturn®): This reduces fossil raw material usage by up to 20% in polyol production;

☐ Water-based coating solutions: Help in significantly reducing VOC emissions;

☐ Polyaspartic technologies: Improve coating performance while enhancing application efficiency;

☐ Direct coating technology: Simplifies automotive coating processes, reduces material waste, and improves surface quality, contributing to eco-efficiency goals;

☐ Automated coatings lab: A 24/7 automated laboratory enables rapid testing and optimization of PU formulations, significantly accelerating product development timelines.

What are the challenges faced by the industry, such as raw material costs and sustainability concerns?

The polyurethane industry faces several significant challenges:

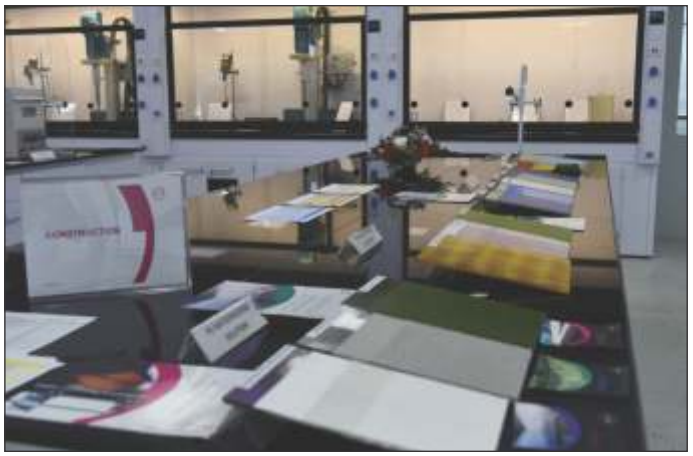
☐ Volatility in raw material costs and supply chain disruptions that impact production planning and pricing;

☐ Increasing regulatory requirements around chemical substances and emissions;

☐ Growing demand for sustainable solutions that reduce carbon footprint;

☐ Balancing sustainability improvements with maintaining high technical performance;

The automotive industry increasingly values PU coatings for their scratch resistance, chemical resistance, and aesthetic qualities that enhance vehicle longevity and appearance.



The regional application center, such as the one located in Mumbai, caters to country-specific requirements.

☐ Developing circular economy solutions for end-of-life products.

At Covestro, we're addressing these challenges through strategic initiatives like developing alternative raw material sources (including bio-based and CO_2-based feedstocks), improving manufacturing efficiency, and investing in recycling technologies like our participation in the pan-European PUReSmart research project.

What sets Covestro from other suppliers in the PU sector?

Covestro differentiates itself through several key factors:

☐ A comprehensive portfolio spanning both standard and specialty products;

☐ Industry-leading innovation capabilities with a proven track record of breakthrough technologies;

☐ Strong customer-centricity, offering tailored solutions for specific applications;

☐ A global manufacturing footprint backed by regional expertise;

☐ Commitment to sustainability as a core business driver, not just a compliance measure;

☐ Extensive technical expertise and application development support;

☐ Strong backward integration across the value chain, enhancing efficiency and reliability.

Additionally, Covestro is a leader in embedding circular economy principles into its PU product lines. It actively invests in renewable raw materials and low-VOC technologies, offering more sustainable and transparent solutions than many competitors.

Covestro's use of automated labs, machine learning for formulation optimization, and cloud-based platforms for environmental impact tracking sets it apart in terms of technological sophistication and speed to market.

This unique combination enables Covestro to be both a reliable supplier of high-applications.

What do you see as Covestro's key strengths?

Covestro's key strengths include:

☐ Technical expertise and deep understanding of polyurethane chemistry;

☐ Global production network with strong regional presence;

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☐ Robust innovation pipeline addressing market needs and sustainability challenges;

☐ Customer-centric approach with application-specific solutions;

☐ Strong safety culture prioritizing occupational, process, and product safety;

☐ Commitment to sustainability integrated into business strategy;

☐ Ability to balance standard product reliability with specialty innovation;

☐ Adaptability to changing market conditions and emerging trends.

These strengths position us as a trusted partner capable of helping customers navigate both current challenges and future opportunities.

Sustainability is a major topic in the industry. How does Covestro approach this issue?

Sustainability is central to Covestro's business strategy. We approach it holistically through our vision of becoming fully circular, considering the entire lifecycle of our products from raw materials to end-of-life.

Our approach includes:

☐ Developing products with renewable raw materials, such as our bio-based polyurethane dispersions;

☐ Pioneering CO_2 utilization technology to reduce fossil resource dependence;

☐ Improving energy efficiency in our manufacturing processes;

☐ Developing water-based coating solutions with reduced environmental impact;

☐ Researching recycling technologies for polyurethane materials;

☐ Collaborating with partners across the value chain on circular economy.

We evaluate sustainability across three dimensions: people, planet, and profit, ensuring our innovations deliver benefits in all areas.

What are your goals for the coming years, and where do you see Covestro in India say, five years down the line?

In the coming years, Covestro aims to accelerate our transition to circular economy principles while maintaining profitable growth. For India specifically, we see tremendous potential for expansion given the country's growing infrastructure, automotive, and construction sectors.

Over the next five years, we plan to:

☐ Strengthen our manufacturing presence in India to better serve local market needs;

☐ Expand our portfolio of sustainable solutions tailored to Indian market requirements;

☐ Deepen partnerships with local customers to co-develop innovative applications;

☐ Increase our technical service capabilities to support growing demand;

☐ Contribute to India's sustainability goals through our product innovations.

India represents a key growth market for Covestro, and we're committed to being a strong partner in the country's industrial development.

What do you feel about the market in India and what are your expansion plans here?

The Indian market presents exceptional opportunities due to its rapid industrialization, growing middle class, and increasing focus on sustainable development. We see particularly strong potential in sectors like construction, automotive, furniture, and infrastructure.

The growing demand for PU coatings is driven by the increasing requirements for longer-lasting protective solutions and the need for materials that can withstand harsh environmental conditions.

Our existing facilities in Ankleshwar, Cuddalore, and Greater Noida provide a solid foundation for our operations in India. Our expansion plans focus on:

☐ Increasing production capacity to meet growing local demand;

☐ Enhancing our technical service capabilities to support customers;

☐ Developing solutions specifically tailored to Indian market conditions;

☐ Building stronger partnerships with local customers and stakeholders;

☐ Contributing to skill development in the coatings and polyurethane sectors.

We're committed to growing alongside the Indian market and being a reliable partner for its continued development.

A brief history about Covestro....

Covestro's history begins with Otto Bayer's groundbreaking discovery of polyurethanes in 1937. For decades, our polyurethane technologies were developed as part of Bayer MaterialScience. In 2015, Covestro was carved out from Bayer as an independent company focused on high-performance polymer materials.

Since becoming independent, we've strengthened our position as a global leader in polyurethanes, polycarbonates, and specialty chemicals. In 2021, we unveiled our 'Sustainable Future' strategy with customer centricity and sustainable growth at its core, guided by our vision to become fully circular.

Today, Covestro operates as a global company with a presence in key markets worldwide. We're listed on the German stock exchange and included in the DAX index. Our organizational structure comprises two main segments: Performance Materials (focusing on standard products) and Solutions & Specialties (focusing on sophisticated products with high innovation rates).

Throughout our history, innovation has remained our driving force, enabling us to continuously develop new materials and solutions that address global challenges and improve people's lives.

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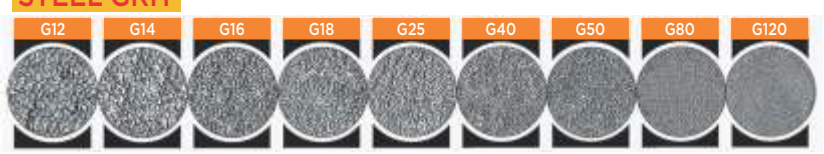

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Hexigone: Enhancing corrosion protection in the rail industry

Using Hexigone's Intelli-ion® AX1, Network Rail achieved significantly improved protection, adhesion, and durability, even in poorly prepared areas

PHOTOS: HEXIGONE

Project background

Holyhead station, a prominent railway station situated in Wales. Strategically located near a harbour and high street, it serves as a key transport hub, seamlessly connecting the region's rail and maritime networks.

As a result, the Grade II listed train station has endured persistent exposure to salty sea air, high humidity, heat from the trains and diesel fumes. This relentless environmental assault has resulted in significant corrosion of the structural steel canopies, causing progressive deterioration of the exposed steel. The extent of the damage has highlighted the need for a longer-lasting solution to preserve the station's structural integrity and historical value.

The challenge: Harsh environmental exposure

Network rail's current coatings manufacturer could not guarantee their product's effectiveness due to the harsh location. As a result, their coatings failed within just 18 months — significantly short of the intended 15-year maintenance cycle. This prompted the need to find an enhanced paint system that could outperform the existing specified paint system in order to:

- ☐ Maintain structural integrity
- ☐ Preserve the station's historical features
- ☐ Reduce maintenance and repair costs

The solution: Intelli-ion® AX1 for enhanced corrosion protection

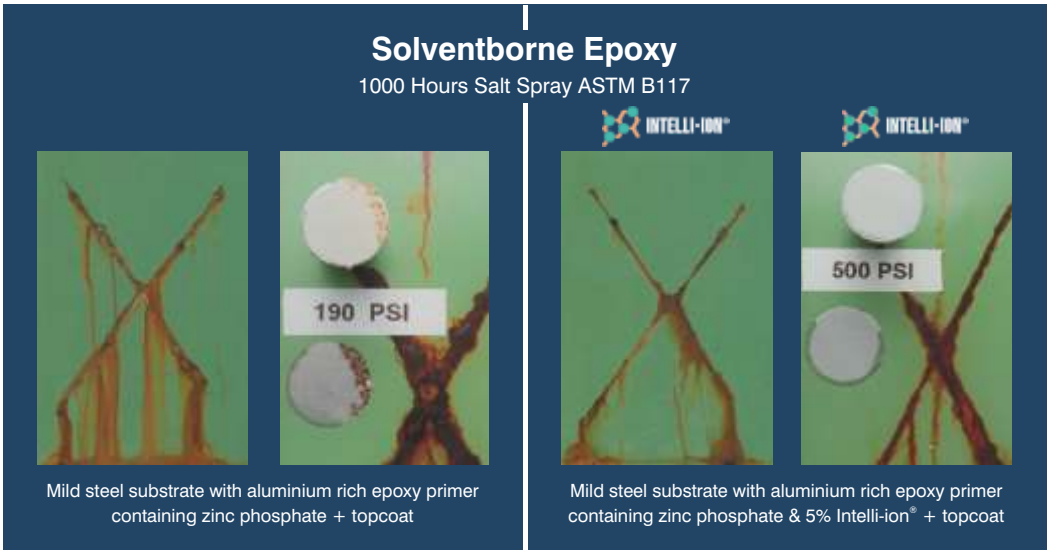
The solution implemented was Hexigone's "smart" corrosion inhibitor, Intelli-ion® AX1, chosen for its superior corrosion protection in harsh environments. Achieving C5-level corrosion resistance, AX1 effectively combats corrosion in highly aggressive environments, such as coastal areas, while delivering longer-lasting corrosion protection. Intelli-ion® AX1 has also endured 1,440 hours in salt spray testing (ASTM B117), and offers enhanced adhesion and colour retention in both laboratory and live testing.

Methodology:

To compare performance, two protection systems were applied simultaneously:

- ☐ 50% of the train station was painted with a standard system.
- ☐ The remaining 50% was painted with a system enhanced with Intelli-ion®

Note: The areas coated with the Intelli-ion® AX1 enhanced primer could not be fully



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NABL ACCREDITED LAB

Prof. A. S. Khanna
Director

As per the new requirements all labs under NABL, must have a Registered Entity. As a result SECC a proprietorship company needed to be changed to a Pvt. Ltd. company. With effect from New Financial Year starting from April 1, 2024, SECC is renamed as Khanna Paint Testing Laboratory (OPC) Pvt. Ltd. We have now 54 different paint standards approved by NABL. These 54 standards include IS, ASTM, DIN, ISO, NACE, and AWWA standards. Details can be see on our website which is now **www.kptllab.com** The lab has the most modern, fully calibrated equipment with well-educated and trained staff.

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ACCELERATED WEATHEROMETER (QUV)
ASTM G 154, ISO 16474

AUTOMATIC PULL OFF ADHESION
ASTM D 4541, ISO 4624

1. **Paint Characterizations, Specific gravity, % NVM, % Vol Solids, VOC, Viscosity & Drying time.**
2. **Flexibility Test, Pencil Hardness Test, Cross Hatch Adhesion Test, Shore Hardness A & D.**
3. **Chemical Immersion Test.**
4. **Water Vapor Permeability and % Water Absorption**
5. **Anti Carbonation Test .**
6. **Aluminium Composite Panels (ACP).**

Surface Engineering & Coating Consultant

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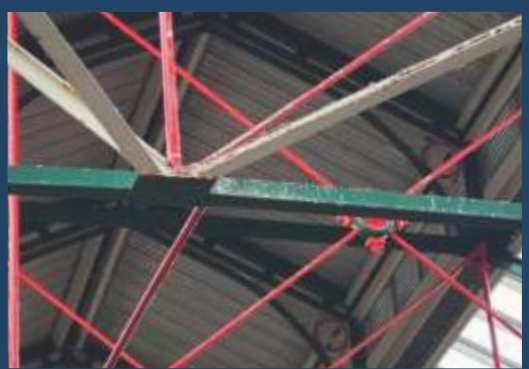
Solventborne Epoxy

3 Years After Application



Mild steel substrate with aluminium rich epoxy primer containing zinc phosphate + topcoat

INTELLI-ION®

Mild steel substrate with aluminium rich epoxy primer containing zinc phosphate & 5% Intelli-ion® + topcoat

Solventborne Epoxy

3 Years After Application

Standard primer with zinc phosphate before Intelli-ion® AX1

INTELLI-ION®

Mild steel substrate with aluminium rich epoxy primer containing zinc phosphate & 5% Intelli-ion® AX1 + topcoat

prepared; it could not be washed to remove surface salts due to location and proximity to existing live electrical wiring, had poor surface preparation, and the paint company used (a large tier 1 supplier) did not guarantee their system in these areas.

Laboratory test results: 1,000 hours salt spray ASTM B117

Panels with both standard paint and paint enhanced with Intelli-ion® AX1, were tested side by side. The addition of AX1 improved corrosion resistance, significantly increased adhesion levels and the bonding of the aluminum primer to the metal surface.

Real-world results: Increased protection, improved adhesion & cost savings

The addition of Intelli-ion® AX1 significantly enhanced the 50% repainting process of the mile-long station's surface, comprised of tool-prepared Victorian cast iron.

Contractors observed the following improved application properties; “the paint applied more easily, spread more evenly, and provided more coverage.”

By enhancing surface tolerance, AX1 improved adhesion by 163.16%, resulting in increased performance. This improvement led to reduced maintenance requirements, delivering a highly efficient, cost-effective solution with enhanced long-term asset protection.

Three years after application

Intelli-ion® AX1 demonstrated superior performance compared to the standard system - designed to provide 15 years of corrosion protection.

Feature courtesy: Hexigone Inhibitors Ltd, United Kingdom

Maheshkumar Aradhye joins as Senior Director at Nippon Paint India Pvt Ltd.

Mr Maheshkumar Aradhye, has recently joined Nippon Paint India Pvt Ltd, as Senior Director (Protective Coatings & General Industrial Use). He will be reporting to Subash Gaijes Selvaraj – President IU & Head – CO Management.

With over 29 years of experience in protective coatings, marine coatings, and corrosion management, Mr Aradhye has a proven track record in product development, process optimization, and strategic growth in the B2B industry. He has extensive experience in zinc primers, ultra-high build epoxies, pipeline coatings, and PFP within the protective and marine coatings segments.

Mr Aradhye is a protective coatings specialist and CIP instructor, mentoring professionals with AMPP (formerly NACE), as well as a visiting faculty at IIT Bombay, and ICT Mumbai, and an ASK Foundation award winner for Best R&D in Industry. He has also conducted AMPP and SSPC training across the United States, Malaysia, Egypt, Australia, Turkey, UAE and Saudi Arabia.

His qualifications include Sr Management Program – IIM Visakhapatnam, (2024-2025); MBA Marketing, IBMR Bangalore; Certified Protective Coating Specialist (SSPC and NACE International); Diploma in STEM Corrosion – Corr Magnet Consulting, Canada.

PHOTO: MR MAHESHKUMAR ARADHYE

Mr Maheshkumar Aradhye.

Mr Aradhye has played a key role in developing industry-leading coatings for major projects like ONGC, HPCL, BPCL, Tata Steel, and Reliance.

Er Samir Surlaker conferred with CIDC Chairman's Commendation Award

Er Samir Surlaker, Director, Asses Build Chem Pvt Ltd., was conferred the prestigious CIDE Chairman's Commendation Award at the mega event Construction Industry – Vision 2047, organized by the Construction Industry Development Council (CIDC) in New Delhi recently. The award was conferred on Er Surlaker, as token of contribution for being proactively involved with several CIDC Initiatives and for his commitment and drive to create a vibrant work environment for construction fraternity, in addition to his active role in skill development initiatives through CIDC-IITD Certifications.

Er Samir Surlaker is the Founder and Director of Assess Build Chem Pvt Ltd a leading manufacturer of high performance, hi-tech, construction chemicals. He is also Founder and Director of Institute for International Talent Development (IITD), a skill development and training firm under certification from Construction Industry Development Council (CIDC).

PHOTO: ASSESS BUILDCHEM PVT. LTD.

Er Samir Surlaker, Director, Asses Build Chem Pvt Ltd., receiving the CIDE Chairman's Commendation Award at Construction Industry – Vision 2047 in New Delhi recently.

Increasing demand for energy-efficient solutions a primary driver for the growth in demand for insulation coatings

Global insulation coatings market is expected to reach $19.1 bn by 2034

Insulation coatings are liquids or semi-liquids that, when dried or cured, form a protective finish on surfaces while also providing resistance to heat flow. They are designed to reduce heat transfer, enhance energy efficiency, and protect equipment or structures.

Industrial sectors such as manufacturing plants, power stations, and oil refineries are increasingly adopting insulation coatings to enhance energy efficiency, protect equipment, and reduce operational costs. These coatings are crucial for maintaining peak performance while addressing environmental concerns related to energy consumption and sustainability.

In addition to the growing focus on energy efficiency, global market growth is also spurred by rising awareness of environmental impacts and the increasing regulatory emphasis on sustainability. Manufacturers and industrial players are now more aware of the cost-saving potential of insulation coatings, which help extend the lifespan of equipment while reducing energy consumption and associated operational costs. The trend toward smart building solutions, energy-efficient systems, and green construction further supports the adoption of these coatings across sectors. Moreover, as businesses continue to face fluctuating energy prices and stricter environmental regulations, insulation coatings are being recognized for their significant contribution to energy conservation and environmental protection.

Growing demand

The Insulation coatings market is set to grow from its current market value of more than US$10.9 billion to over US$19.1 billion by 2034; as reported in the latest study by Global Market Insights, Inc.

The increasing demand for energy-efficient solutions is a primary driver of this growth. As the world continues to urbanize, the need for advanced construction and infrastructure projects is rising rapidly. This is driving the expansion of the insulation coatings market.

PHOTO: 123RF

Industrial sectors such as manufacturing plants, power stations, and oil refineries are increasingly adopting insulation coatings to enhance energy efficiency, protect equipment, and reduce operational costs.

In the aerospace industry, high-temperature insulation coatings are critical for protecting aircraft and spacecraft components from extreme thermal fluctuations.

The market is segmented by product types, including epoxy, polyurethane, acrylic, yttria-stabilized zirconia, and others. When it comes to end-user industries, the insulation coatings market is divided into oil and gas, aerospace, marine, building and construction, automotive, and others. The oil and gas sector holds a 30% market share, with insulation coatings playing a vital role in offering temperature control, corrosion resistance, and safeguarding pipelines and equipment.

These coatings help minimize heat loss, increase energy efficiency, and protect assets from harsh environmental conditions. With an increasing focus on safety, sustainability, and operational efficiency, demand for high-performance insulation coatings is rising steadily across this industry.

In the U.S., the insulation coatings market reached US$ 1.5 billion in 2024, with significant growth anticipated in the coming years. This surge is driven by the growing demand for energy-efficient solutions across various industries, such as construction, manufacturing, and oil and gas. The adoption of stricter energy efficiency regulations, combined with sustainability initiatives, has led to the widespread use of advanced insulation coatings.

Industries operating in high-temperature environments, such as aerospace, metallurgy, and energy production, are increasingly seeking advanced insulation coatings that can withstand extreme heat while maintaining structural integrity and performance. In the aero

space industry, high-temperature insulation coatings are critical for protecting aircraft and spacecraft components from extreme thermal fluctuations. These coatings prevent heat damage to engine parts, turbine blades, and exhaust systems while reducing overall weight compared to conventional insulation methods.

R&D in eco-friendly insulation coatings

The growing global emphasis on sustainability and environmental responsibility is pushing industries to invest in research and development (R&D) of eco-friendly insulation coatings. Manufacturers have prioritized developing insulation coatings with reduced environmental impact by incorporating low volatile organic compounds (VOCs) and bio-based ingredients.

Rising construction activities in emerging economies boost demand for thermal insulation coatings for buildings, notes a press release from Allied Market Research. In March 2025, an initiative in Gujarat involved painting roofs in slum areas with a reflective white coating to combat extreme heat. This project encompassed 400 households in Ahmedabad and is part of a global scientific trial studying the impact of indoor heat on health and economic outcomes in developing countries. Residents reported benefits such as cooler homes, improved sleep, and reduced electricity bills.

The CSIR-National Aerospace Laboratories in Bengaluru developed a paint coating technology aimed at providing thermal insulation for aircraft surfaces. This innovation addresses heating issues caused by engine exhaust plumes impacting aircraft structures. The coating offers a temperature reduction of approximately 25ºC when exposed to 150ºC and demonstrates excellent adhesion to both metals and composites.

Moreover, in November 2023, Scientists at the Jawaharlal Nehru Centre for Advanced Scientific Research introduced an affordable, eco-friendly radiative cooling paint made from a magnesium oxide-polyvinylidene fluoride nanocomposite. This paint demonstrates high solar reflectivity and thermal emissivity, leading to a surface temperature reduction of approximately 10ºC under intense sunlight. Its water-resistant properties make it suitable for various applications, offering a cost-effective and environmentally sustainable solution for passive cooling. Insulation coatings play a significant role in mitigating global warming by reducing energy consumption and carbon emissions associated with heating and cooling buildings; more so in the Middle East regions and other high temperature zones.

Expansion of cold chain logistics

The rapid growth of cold chain logistics, driven by increasing demand for temperature-sensitive goods such as pharmaceuticals, perishable foods, and biotech products, is also creating a strong need for efficient insulation coatings. In the pharmaceutical sector, the rise of biologic drugs, vaccines, and temperature-sensitive medications has intensified the need for reliable cold chain infrastructure. Insulation coatings help maintain the required temperature levels by minimizing heat transfer and preventing condensation, which can compromise product integrity. The global distribution of vaccines, during the COVID-19 pandemic, made the importance of advanced thermal insulation solutions in ensuring safe and effective delivery has become more evident than ever.

Emerging Smart Cities in Asia-Pacific countries provides opportunities for insulation coating

The smart city movement in Asia-Pacific countries is accelerating due to government initiatives, rapid urbanization, and sustainability goals. Insulation coatings play a crucial role in smart infrastructure by enhancing energy efficiency, reducing heat loss, and improving durability in buildings and transportation systems. India plans to invest about US$1.716 trillion (Rs 143 lakh crore) in smart infrastructure between fiscal years 2024 and 2030, with approximately US$422.92 billion (Rs 36.6 lakh crore) directed towards green projects. This marks a five-fold increase in the share of green infrastructure in India. Sectors such as roads, power transmission, renewable energy, and ports have seen rapid reforms and developments, creating opportunities for stakeholders to accelerate investments across infrastructure sectors.

Manufacturers are adapting themselves and introducing new products to keep pace with growing regulations and demands.

The application of these coatings require specialized equipment, a feature on which we hope to do in the near future.

PPG launches PPG PITT-THERM 909 spray on insulation coating for oil and gas, infrastructure industries

PPG recently launched the PPG PITT-THERM® 909 spray-on insulation (SOI) silicone-based coating designed for high-heat environments in the oil and gas, chemical, petrochemical and other critical infrastructure industries. It provides improved safety, asset protection and operational efficiency compared to traditional thermal insulative materials.

Conventional waterborne acrylic or epoxy-based SOI coatings cannot be used on equipment operating above 350ºF (177ºC). Silicone-based PPG Pitt-Therm 909 coating offers much greater temperature resistance; thermal testing shows that it endures continuous and

PHOTO: BUSINESS WIRE

PPG announces PPG PITT-THERM® 909 spray-on insulation coating, designed for high-heat environments in the oil and gas, chemical, petrochemical and other critical infrastructure industries.

cyclic temperatures as high as 500ºF, and by reducing heat transfer, external surfaces remain safe to touch at up to 310ºF, significantly reducing the risk of burns.

Application testing of PPG Pitt-Therm 909 coating has also shown that fewer coats are necessary compared to traditional SOI coatings, providing operational efficiency benefits for customers. It can be applied in thicknesses of up to 250 mils (6.35 mm) per coat and depending on the specific application requirements, only one or two coats are needed, substantially cutting down the time and cost of the insulation process. Despite the reduced number of layers, it can achieve a higher total coating thickness of up to 500 mils and cure times are comparable to competing products.

Application to both hot and cold substrates is also viable, allowing assets to remain in service during application – a significant advantage over traditional methods that require operational shutdowns.

“PPG Pitt-Therm 909 coating represents our team's ongoing commitment to advancing industry standards through innovation,” said Bill Pernice, PPG global segment director, oil and gas, Protective and Marine Coatings. “This solution tackles the industry's long-standing challenges by delivering high heat resistance and water-repelling properties, elevating safety and performance in demanding environments.”

PPG Pitt-Therm 909 coating also addresses critical challenges of traditional mechanical insulation systems, notably their susceptibility to moisture absorption and corrosion under insulation (CUI). Water-repellent PPG Pitt-Therm 909 has demonstrated exceptional corrosion resistance in rigorous testing. Results show that it is an optimal solution for CUI prevention for reduced maintenance costs, operational shutdowns and safety incidents.

Hempel introduces Hempatherm IC, provides both thermal insulation and mitigation of CUI

As the need to control maintenance costs and manage Corrosion Under Insulation (CUI) increases, leading coatings manufacturer, Hempel A/S, introduces the Hempatherm IC. The seamless coatings system, with one of the market's highest film build capabilities, offers superior protection and mitigation of CUI by significantly reducing the risk of water ingress and retention.

Made up of Hempatherm IC 170 and Hempatherm IC 175, the system is designed to replace many conventional insulation systems in the critical CUI temperature range. It provides both thermal insulation and mitigation of CUI, thereby maximizing the service life of industrial equipment and assets.

“Process industry operators are constantly looking for solutions that reduce the risk of CUI, while managing their personnel safety and energy consumption in a responsible way. They want robust solutions to minimize disruption and deliver long-term value,” says Zechariah Lim, Product Manager CUI/High Heat & Insulation at Hempel. Zechariah continues: “The Hempatherm IC system offers just that. It is designed with our customers' need for energy conservation in mind, without the risk of associated CUI. Coatings provide a simple and elegant alternative to meet this requirement, while promoting cost competitiveness, productivity, and sustainability over its service life for all stakeholders across the value chain.”

David Hunter, Segment Development Manager, CUI/High Heat & Insulation at Hempel adds: “Hempel is excited to be part of the market shift from mechanical insulation to an advanced insulation coatings system. Insulation coatings have over 25 years of proven performance, but up until now, limitations on coating film thickness have limited thermal insulation coatings as a comparative alternative. Our Hempatherm system provides one of the market's highest film builds per coat, with a material engineered to maintain thermal performance over the service life, often in the range of 15 - 25 years.”

With the Hempatherm system, Hempel provides next level insulation solutions for process control and energy conservation, thereby empowering industries to achieve optimal operational performance.

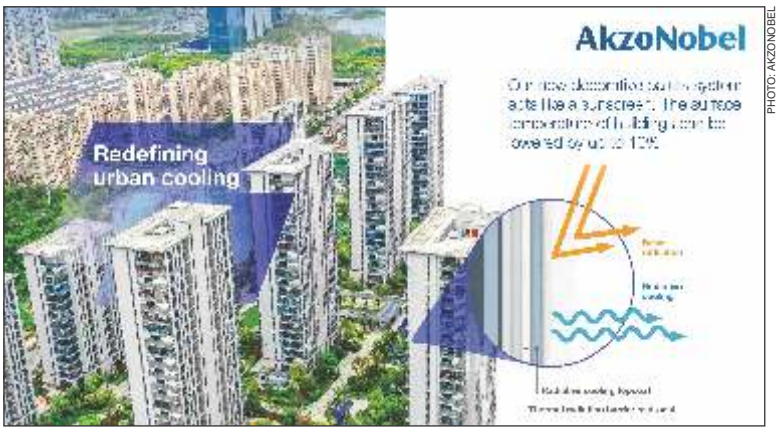


PHOTO: AKZONOBEL

Featuring a radiative cooling topcoat and a thermal radiation barrier mid-coat, the innovative technology from AkzoNobel can lower the surface temperature of buildings up to 10% during hot summer months, compared with using conventional coatings.

AkzoNobel launches “sunscreen” coating system to redefine urban cooling

A new thermal insulation coating system which can cool down buildings and make them more energy efficient has been launched by AkzoNobel.

Featuring a radiative cooling topcoat and a thermal radiation barrier mid-coat, the innovative technology from the company's Decorative Paints business acts like a sunscreen, notes a press communique. It means the surface temperature of buildings can be lowered by up to 10% during hot summer months, compared with using conventional coatings.

It's expected to significantly enhance energy-saving performance – particularly when renovating existing buildings – and has been successfully tested on several buildings in the Lingang section of the Shanghai Pilot Free Trade Zone.

“This is a significant breakthrough in architectural coatings and opens up new avenues for energy-efficient building renovations,” says Karen Yin, Director of the company's Decorative Paints China North Asia business and President of AkzoNobel China. The mid-coat uses

advanced aerogel insulation materials, which have extremely low thermal conductivity, helping to effectively block the transmission and penetration of heat. The topcoat is an upgraded version of heat-reflective coatings, offering higher reflectivity to further reduce solar heat absorption. It also has high thermal emittance, allowing it to directly emit heat back into the atmosphere, mitigating urban heat island effects. Both of these coatings are low-VOC and fully water-based.

Adds Yin: “The science behind these 'cool coatings' might be complex, but the effect is easily explained. A 'normal' exterior coating will heat up in the sun, because it still absorbs some sunlight. A heat-reflective coating will heat up less, because it absorbs less sunlight. Our new cool coatings don't heat up at all, because they barely absorb any sunlight and efficiently radiate the heat away.”

With the built environment estimated to be responsible for around 40% of annual global carbon emissions, the technology has the potential to redefine urban cooling in hot climates and help drive the creation of more sustainable buildings.

TEGO® Therm makes insulation coatings more efficient

Evonik has developed a line of tailor-made feedstocks, TEGO® Therm, that substantially improve the performance of thermal insulation coatings (TICs). The new product range includes two microporous silica-based granules, TEGO® Therm HPG 4000 and TEGO® Therm HPG 6806, as well as a heat-resistant, silicone-based binder, TEGO® Therm L 300.

The three products from Evonik's Business Line Coating Additives are characterized by excellent insulation properties & heat resistance, even at temperatures of up to 250ºC. This provides the following performance and sustainability benefits: insulation coatings based on TEGO® Therm products substantially reduce energy loss, and they also aid occupational health and safety, because they can significantly reduce the temperature of hot surfaces (safe touch). Insulation coatings also provide protection against moisture penetration and therefore corrosion under insulation (CUI). This significantly increases the service lives of coated items.

One target application for this new generation of feedstocks is the technical insulation of pipelines, tanks or various other components in industrial plants. A first product based on TEGO® Therm granules is already commercially available and can be applied for safe touch and corrosion prevention purposes. Evonik wants to use this product range in the future to provide thermal insulation solutions to its customers in the construction and vehicle manufacturing sectors.

Another benefit of TEGO® Therm-based insulation coatings is that they are easy to apply. “Conventional insulation systems, such as mineral wool, are often difficult and time-consuming to apply - appliances and components with complex geometries in particular are often inadequately insulated,” says Dr Niko Haberkorn, Head of Thermal Managing Coatings at Evonik Coating Additives. As a result, non-insulated, hot surfaces increase energy loss and they also need to be protected against accidental contact. In contrast, coatings incorporating products from the TEGO® Therm line can be easily applied just by spraying. “That is even feasible to some extent during ongoing operations. This avoids equipment downtimes and saves time and money,” says Haberkorn.

The TEGO® Therm HPG 4000 granules, featuring larger particles of around 300 micrometers, is characterized by particularly low thermal conductivity at high temperatures. TEGO® Therm HPG 6806, on the other hand, features finer particles (around 30 micrometers) and enables higher fill levels and ensures that coatings have smooth surfaces. Both granules are highly insulation-effective, offer mechanical stability and are hydrophobic. Their inorganic structure also makes them non- combustible.

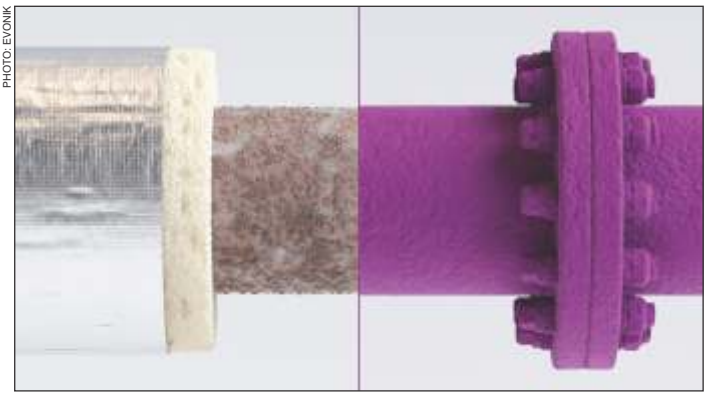
The water-based binder TEGO® Therm L 300 can withstand temperatures of up to 250ºC, while standard binders for TICs can only withstand temperatures no higher than 160 degrees. Given its excellent adhesion to various substrates, TEGO® Therm L 300 ensures particularly resilient coatings.

Products from the TEGO® Therm line can be combined with one another and with other product lines, depending on the specific application.

Evonik's coating experts provide their customers with sample formulations incorporating the two granulates for different applications. “We recommend combining the granulates with the heat-resistant binder from the TEGO® Therm line, especially for applications involving very high temperatures,” says Markus Hallack, Head of Applied Research for Thermal Managing Coatings.

Evonik targets its high-performance TEGO® Therm product line at formulators, who wish to change their systems, in order to enhance their products and improve the long-term reliability of their coatings. Customers from the coating industry that want to enter the thermal insulation market for the first time also benefit because TEGO® Therm enables them to work sustainably, safely and efficiently right from the word go. The products from this line are available worldwide, effective immediately.

PHOTO: EVONIK



Non-insulated, hot surfaces increase energy loss and they also need to be protected against accidental contact.

References:
☐ *Global Market Insights, Inc.*
☐ *Allied Market Research*

Paint coating selection process

Coatings designed for corrosion protection require additional properties, which are achieved through various ingredients mixed into the resin and solvent solution

Prof. A S Khanna, Retd. IIT Bombay, Chairman SSPC India

A paint coating, in simplified terms, is defined as a solution of resin dissolved in a suitable solvent. There are many types of coatings available that protect wooden surfaces from damage caused by water and moisture. However, coatings designed for corrosion protection require additional properties, which are achieved through various ingredients mixed into the resin and solvent solution.

Pigments are added to provide color to the coating; for instance, compounds such as zinc oxide (ZnO), titanium dioxide (TiO_2), and barium sulfate ($BaSO_4$) create a white color. Corrosion-resistant pigments like zinc phosphate and zinc chromate enhance the coating's ability to withstand corrosion. Additionally, reinforcing pigments such as carbon fibers and glass flakes can be added to improve the coating's strength. There are also various additives, used in small quantities, that help control micro-properties of the coating, such as fast drying, proper pigment dispersion, and antimicrobial properties.

PHOTOS: 123RF

Paint coating selection is the most important first step requirement for the long durability of the structure.

Another important consideration for organic coatings is their mechanism of protection, which primarily involves

Table 1 - Description of typical atmospheric environments related to the estimation of corrosivity categories (EN 14713-1 : 2009)

Corrosivity category C Corrosion rate for zinc (based upon one year exposures), r_{corr} (µm-a^{-1}) and corrosion level	Typical environments (examples)	
	Indoor	**Outdoor**
C1 $r_{corr} \leq 0.1$ Very low	Heated spaces with low relative humidity and insignificant pollution, e.g. offices, schools, museums	Dry or cold zone, atmospheric environment with very low pollution and time of wetness, e.g. certain deserts, central Arctic / Antartica
C2 $0.1 < r_{corr} \leq 0.7$ Low	Uninhabited spaces with varying temperature and relative humidity. Low frequency of condensation and low pollution, e.g. storage, sport halls	Temperate zone, atmospheric environment with low pollution (SO_2 <5 µg/m^3), e.g.: rural areas, small towns. Dry or cold zone, atmospheric environment with short time of wetness, e.g, deserts, sub-arctic areas.
C3 $0.7 < r_{corr} \leq 2$ Medium	Spaces with moderate frequency of condensation and moderate pollution from production processes, e.g. food-processing plants, laundries, breweries, dairies	Temperate zone, atmospheric environment with medium pollution (SO_2: <5 µg/m^3 to 30 µg/m^3) or some effect of chlorides, e.g. urban areas, coastal areas with low deposition of chlorides, subtropical and tropical zones with atmosphere with low pollution
C4 $2 < r_{corr} \leq 4$ High	Spaces with high frequency of condensation and high pollution from production processes, e.g. industrial processing plants, swimming pools	Temperate zone, atmospheric environment with high pollution (SO_2: 30 µg/m^3 to 90 µg/m^3) or substantial effect of chlorides, e.g. urban areas, coastal areas without spray of salt water, exposure to strong effect of de-icing salts, subtropical and tropical zones with atmosphere with medium pollution
C5 $4 < r_{corr} \leq 8$ Very high	Spaces with very high frequency of condensation and/or with high pollution from production processes, e.g. mines, caverns for industrial purposes, unventilated sheds in subtropical and tropical zones	Temperature and subtropical zones, atmospheric environment with high pollution (SO_2: 90µg/m^3 to 250µg/m^3) and/or important effect of chlorides, e.g. industrial areas, coastal areas, sheltered positions on coastline
CX $8 < r_{corr} \leq 25$ Extreme	Spaces with almost permanent condensation or extensive periods of exposure to extreme humidity effects and/or with high pollution from production process, e.g. unventilated sheds in humid tropical zones with penetration of outdoor pollution including airborne chlorides and corrosion-stimulating particulate matter	Subtropical and tropical zones (very high time of wetness), atmospheric environment with very high pollution (SO_2 higher than 250 µg/m^3), including accompanying and production pollution and/or strong effect of chlorides, e.g. extreme industrial areas, coastal and offshore areas with occasional contact with salt spray

Polyester coatings, particularly those with glass flakes, excel in harsh environments such as splash zones of offshore structures.

creating a barrier for the substrate. However, this method has significant limitations; if the coating is damaged due to scratches or impacts, the affected area can start to corrode immediately. To ensure a longer lifespan for the paint coating, particularly in outdoor environments, an additional corrosion protection mechanism is necessary. Zinc-based primers have been a prominent choice; most outdoor steel structures are protected with either an organic-rich epoxy primer or an inorganic zinc-rich primer as the first layer. Many corrosion-resistant coatings, such as epoxy-based systems, are adversely affected by sunlight, so an extra layer of acrylic or aliphatic polyurethane is often applied to shield the epoxy from UV damage.

The durability of a coating is highly dependent on how well the substrate surface is prepared. The best surface preparation involves achieving a blast-cleaned surface with a Sa2½ finish, accompanied by a suitable anchor profile. Proper application of the coating is essential to achieve the desired thickness and appropriate drying time before applying subsequent coats. Inadequate drying can lead to various defects in the coating.

Selection process

The first step in the paint coating selection process is to identify the corrosiveness of the environment, categorized according to ISO standard 12944 (C1, C2, C3, etc.). Three important parameters for characterization include relative humidity, chloride levels, and sulfur dioxide concentrations. Based on this classification, different sites can be evaluated as described in the corresponding Table 1. Once a site has been classified, the appropriate coating can be selected based on the resin chemistry, which can be alkyd, acrylic, polyester, epoxy, or polyurethane. For dry environments (C1 and C2), alkyd coatings are sufficient. However, for more polluted environments, such as those near the sea, harsher coatings with epoxy or polyester chemistry are necessary. Epoxies are suitable for environments categorized from C3 to C5. Polyester coatings, particularly those with glass flakes, excel in harsh environments, such as the splash zones of offshore structures.

For C3 environments, standard epoxy coatings are adequate; however, in C4 and C5 environments, these epoxies can be modified with micaceous iron (MIO), carbon fiber, or glass flakes to enhance strength and reduce permeability to moisture and pollutants. Polyurethanes are also effective in demanding environments, with aliphatic

Case 1: Open to environment – New surface with blast cleaning Sa2½, or old surface with St2/St3 temperature ambient to 120°C

Corrosion category	Surface preparation	Duration required	Paint system selected	DFT (µm)	Number of coats
C1-C2	Sa2½	Medium durability 6 months to 2 years	**Primer:** MiO alkyd **Top coat:** Modified alkyd	**50** **50**	1 1
C1-C2	Sa2½	Long durability 3 - 6 years	**Primer:** Zn rich **Top coat:** Modified alkyd with urethane	**50** **100**	1 2
C1-C2	St2/St3	Long durability 2 - 4 years	**Primer:** Surface tolerant **Top coat:** Modified alkyd with urethane	**80** **100**	1 2
C3	Sa2½	Medium durability 6 months to 2 years	**Primer:** Epoxy zinc rich **Middle coat:** Epoxy **Top coat:** Aliphatic PU	**50** **50** **50**	1 1 1
C3	Sa2½	Long durability 3 - 7 years	**Primer:** Inorganic zinc rich primer (IOZ) **Middle coat:** Epoxy **Top coat:** Aliphatic PU	**75** **100** **50**	1 2 1
C3	St2/St3	Long durability 2 - 5 years	**Primer:** Surface tolerant **Middle coat:** Epoxy **Top coat:** Aliphatic PU	**80** **100** **50**	1 2 1
C4	Sa2½	Long durability 3 - 7 years	**Primer:** IOZ **Middle coat:** Epoxy **Top coat:** Aliphatic PU	**75** **150** **50**	1 3 1
C5	Sa2½	Long durability 3 - 7 years	**Primer:** IOZ **Middle coat:** Epoxy (mio epoxy) **Top coat:** Aliphatic PU	**75** **250** **50**	1 3 1

Case 2: Open to environment – New surface with blast cleaning Sa2½, or old surface with St2/St3 temperature ambient to 200 – 550°C.

Corrosion category	Surface preparation	Temprature	Paint system selected	DFT (µm)	Number of coats
C3	Sa2½	200°C	**Primer:** IOZ **Top coat:** Aluminium paint	75 200	1 1
C3	Sa2½	400°C	**Primer:** IOZ **Top coat:** Alumino-silicon paint	75 100-200	1 1
C3	St2/St3	550°C	**Primer:** IOZ **Top coat:** Poly-siloxane paint	80 100	1 1

Case 3: Internal – Immersion service				
System	**Surface preparation**	**Coating type**	**DFT (µm)**	**Number of coats**
Tanks for fuel, oil, crude, chemicals and process water	**Sa2½**	Solvent-less epoxies	500	1
Sewage lines, water treatment facilities	**Sa2½**	Glass flake epoxies or a combination of glass flake and reinforced epoxies	1,000	1
Splash zone in sea water, underwater	**Sa2½**	Polyester glassflake, water repellent epoxies	1,000	1 or 2
Immersion service Water jetties, sea water	**Sa2½**	Glassflake epoxy or novolac epoxy	1,000	1

Case 4: Underground cross country pipelines (water/sewage/crude and gas)				
System	**Surface preparation**	**Coating type**	**DFT (µm)**	**Number of coats**
Potable water pipelines (internal)	**Sa2½**	Solvent-less epoxies (food grade)	500	1
Sewage lines	**Sa2½**	Glass flake epoxies	1,000	1
Crude and gas (internal)	**Sa2½**	Cathodic protection using inhibitors	-	-
Crude and gas (external)	**Sa2½**	Three layer PE 1. FBE coating 2. Tie coat 3. PE coat or FBE	 150-200 1,500-3,000 350-600	 1 1 1
Crude and gas pipe joint area	**Sa2½**	1. Epoxy coating 2. Heat shrink sleeves	100 1,000	1 1

polyurethanes particularly serving to protect underlying coatings from sunlight.

The second factor in selecting a coating depends on the surface preparation of the substrate. Approximately 90% of paint failures arise from inadequate surface preparation. For new objects, the general guideline is to achieve a minimum Sa2½ surface finish through blast cleaning for optimal durability. If blast cleaning is not feasible, partial cleaning with standard st2/st3 methods (using hand or electrically operated tools) can be an alternative. Another option is water jet cleaning, although it poses a risk of flash rusting. Different coatings are required based on the type of cleaned surface: a normal paint system suffices for blast-cleaned surfaces, while a surface-tolerant coating (STC) must be applied as a primer on partially cleaned surfaces. The primary role of STC is to ensure better wetting and spreading to cover uneven or partially cleaned areas. For surfaces affected by flash rusting from water jetting, special paints are available to mitigate this issue.

The third consideration in the selection process involves the choice of coating based on its viscosity and volume solids. Conventional paint coatings typically have a volume solid content ranging from 40% to 60%. These coatings usually provide a thickness of 40 to 50 microns per coat. Coatings with lower volume solids are effective when a total coating thickness of 200 to 300 microns is required, since multiple coats can create inter-coating stress issues. Therefore, when aiming for a coating thickness exceeding 250 to 300 microns, it is advisable to use high-build coatings capable of delivering 80 to 100 microns per coat.

The best surface preparation involves achieving a blast-cleaned surface with a Sa2½ finish, accompanied by a suitable anchor profile.

Case studies alongside describe the selection of coatings, number of coats and various systems such as external, internal, open to environment or immersed system, at normal temperature or at higher temperatures.

Conclusion

Paint coating selection is the most important first step requirement for the long durability of the structure. Basic knowledge of the chemistry of the resins, use of various pigments and additives helps you to select a suitable coating for a structure. Quality assurance, paint application skill is another important requirement. Thus, there is strong requirement of coating supervisors/coating inspector to help the coating process completed in best manner.

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Painting a sustainable future: How India's paint industry is aligning with SDGs

Part II

In the long term, the Indian paint industry has the potential to position itself as a global leader in sustainable coatings

Sanjay Chowdhury, Vice President & Business Head, Protective Coating Division, Berger Paints India Ltd.

The Sustainable Development Goals (SDGs), adopted by the United Nations in 2015, are a set of 17 global objectives aimed at eradicating poverty, protecting the planet, and ensuring prosperity for all by 2030. These goals provide a framework for nations, industries, and individuals to contribute toward a sustainable future. Covering aspects such as clean energy, responsible production, and climate action, the SDGs emphasize the importance of collaborative efforts to address pressing global challenges. Industries worldwide play a crucial role in meeting these objectives, as they influence resource consumption, environmental impact, and societal well-being. Among these, the paint industry, with its extensive use of chemicals, energy, and water, is particularly significant in the sustainability discourse. The industry faces the dual challenge of maintaining growth while reducing its environmental footprint, making SDG alignment not just a responsibility but a strategic priority.

India's paint industry, valued at over INR 70,000 crore and growing at a compound annual growth rate (CAGR) of 10-12%, is among the fastest-growing globally. This growth is fuelled by rapid urbanization, increased disposable incomes, and a booming infrastructure sector. However, the industry also faces criticism for its environmental and social impacts, including air and water pollution, carbon emissions, and hazardous waste generation. Aligning with SDGs offers the industry an opportunity to address these issues while driving innovation and gaining competitive advantage.

By prioritizing sustainability, the Indian paint industry can also ensure that its legacy is not only about vibrant colours and protective coatings but also about preserving the planet and empowering communities for generations to come.

PHOTOS: 123RF

India's paint industry, valued at over INR 70,000 crore and growing at a CAGR of 10.12% is among the fastest-growing globally.

Part I of this report consisting sections 1 - 3 was published in our April/May 2025 edition. Here's Part II beginning with section 4 to the end of the report.

By prioritizing sustainability, the Indian paint industry can ensure that its legacy is not only about vibrant colors and protective coatings but also about preserving the planet and empowering communities for generations to come.

4. Focus on Berger Paints India Limited

Berger Paints India Limited stands out as a pioneer in sustainable practices within the Indian paint industry. Over its nine-decade legacy, the company has consistently innovated and implemented strategies that align with the Sustainable Development Goals (SDGs). With a strong emphasis on reducing environmental impact, enhancing product performance, and fostering social welfare, Berger Paints continues to lead the way in creating a sustainable future. This section highlights the company's overarching sustainability framework, ground-breaking initiatives by its Protective Coating Division, community-driven CSR activities, and environmental management practices.

4.1 Corporate sustainability goals

Berger Paints India Limited has embraced a holistic sustainability model that integrates environmental stewardship, community upliftment, and ethical governance. Its corporate sustainability goals reflect a firm commitment to reducing environmental impact while contributing to societal development.

Reducing environmental impact

The company has prioritized sustainability across its product portfolio and manufacturing processes. By transitioning to low-VOC and water-based paints, Berger has significantly reduced emissions of volatile organic compounds, which are harmful to both human health and the environment. Manufacturing facilities have also adopted energy-efficient technologies and processes to minimize electricity consumption and reduce their carbon footprint. Additionally, waste management practices, such as recycling leftover paint and promoting circular economy principles, demonstrate the company's commitment to reducing its operational impact on the planet.

Enhancing product performance

Berger Paints is renowned for its durable and high-performance coatings, designed to address the challenges of diverse environmental conditions. Innovations such as weather-resistant and energy-efficient paints contribute to longer-lasting infrastructure and reduced lifecycle environmental impacts. By developing products that require less frequent maintenance, the company indirectly lowers resource consumption and waste generation.

Social and community welfare

Berger Paints' sustainability initiatives extend beyond its factories and products to include programs aimed at uplifting communities. By supporting skill development, education, and workforce diversity, the company actively contributes to social welfare. Its policies promote inclusivity, empowering women and marginalized groups, while fostering an equitable workplace environment.

Specialized coatings designed to protect industrial assets and infrastructure from corrosion extend their lifespan and reduce the need for frequent repainting.

4.2 Initiatives by the Protective Coating Division

Berger Paints' Protective Coating Division plays a pivotal role in driving sustainability within industrial and infrastructure sectors. By focusing on eco-friendly formulations, high-durability products, and innovative solutions, this division addresses both industry needs and environmental challenges.

The Protective Coating Division has developed an extensive range of environmentally friendly coatings. These include:

☐ High-durability products: Specialized coatings designed to protect industrial assets and infrastructure from corrosion, thereby extending their lifespan and reducing the need for frequent repainting. This not only conserves resources but also minimizes environmental impact.

☐ Low-VOC and water-based coatings: Products engineered to comply with global VOC regulations, ensuring improved indoor and outdoor air quality. By transitioning to these formulations, Berger has significantly reduced the environmental footprint of its protective coatings.

Innovative solutions for infrastructure

The division has introduced state-of-the-art coatings tailored for challenging environments, such as marine and coastal regions, where corrosion and weathering are prevalent. These solutions enhance infrastructure durability while lowering long-term maintenance costs, aligning with sustainable development goals.

4.3 Community and CSR initiatives

Berger Paints actively engages in community welfare through its Corporate Social Responsibility (CSR) programs. These initiatives reflect the company's commitment to improving lives while fostering sustainable development.

Education and skill development

☐ Skill development programs: Berger has collaborated with vocational training institutes to upskill painters and applicators, enabling them to adopt safer and more sustainable practices. These programs create employment opportunities and improve livelihoods, particularly in rural and underserved areas.

☐ Support for education: Through scholarships and investments in school infrastructure, Berger has positively impacted the lives of thousands of underprivileged students, ensuring better access to quality education.

Health and sanitation initiatives

The company has launched projects aimed at improving access to clean drinking water and sanitation facilities in rural communities. These efforts include installing water filtration systems, constructing toilets, and conducting hygiene awareness campaigns to promote better health outcomes.

4.4 Environmental management practices

Berger Paints has embedded sustainability into its operations through innovative environmental management

A key starting point for the Indian paint industry is to prioritize investments in R&D.

Training programs for employees, painters and contractors must focus on sustainable technologies and practices, ensuring that the knowledge of eco-friendly methods is disseminated across the industry.

practices, ranging from energy efficiency to supply chain optimization.

Energy efficiency and renewable energy

The company's manufacturing plants are equipped with energy-efficient technologies that significantly reduce electricity consumption. Renewable energy sources, such as solar power, are increasingly being integrated into production processes, further reducing reliance on fossil fuels. This transition supports global efforts to combat climate change and lower carbon emissions.

Water conservation and effluent treatment

Berger Paints has implemented rainwater harvesting systems at its facilities to reduce dependence on groundwater. Advanced effluent treatment plants (ETPs) ensure that wastewater generated during manufacturing is treated and reused, thereby minimizing pollution and conserving water resources.

Sustainable supply chain

The company is committed to building an environmentally sustainable supply chain by encouraging suppliers to use eco-friendly raw materials and packaging solutions. Transportation efficiency has also been enhanced through the adoption of fuel-efficient vehicles and route optimization, further reducing the environmental impact of logistics.

Through its comprehensive approach to sustainability, Berger Paints India Limited demonstrates how a business can balance profitability with environmental and social responsibility. From eco-friendly product innovations to impactful community initiatives, the company continues to set benchmarks for the Indian paint industry's contribution to sustainable development.

5. Challenges and opportunities for the Indian paint industry in achieving SDGs

The Indian paint industry is uniquely positioned to contribute to the achievement of Sustainable Development Goals (SDGs). While notable progress has been made, the sector faces complex challenges that require innovative solutions. At the same time, these challenges present opportunities to lead sustainable practices globally, foster innovation, and create long-term value.

5.1. Challenges

The reliance on petrochemical-based raw materials in paint manufacturing significantly contributes to greenhouse gas emissions and resource depletion. Moreover, the generation of hazardous waste, such as sludge and chemical effluents, poses environmental and disposal challenges, requiring robust waste management systems.

The prices of key raw materials like pigments, solvents, and resins are subject to global market fluctuations, making cost management difficult. Additionally, the dependence on imports for specialty chemicals increases vulnerability to supply chain disruptions, further hinder investment in sustainable practices.

Stringent environmental regulations, such as those governing VOC emissions and hazardous waste management, necessitate continuous investment in compliance measures. For small and medium-sized enterprises (SMEs), which form a large part of the unorganized sector, these costs are often prohibitive, limiting their ability to adopt sustainable practices.

While urban markets are increasingly aware of the benefits of eco-friendly paints, rural and price-sensitive consumers continue to prioritize affordability over sustainability. This lack of widespread demand hampers the industry's ability to scale up sustainable product lines.

SMEs often lack access to advanced technologies and resources required for sustainable production. This technological gap not only limits their competitiveness but also poses a barrier to industry-wide adoption of sustainable practices.

5.2. Opportunities

The growing preference for sustainable and high-performance coatings presents a wealth of opportunities for the Indian paint industry to innovate and lead in the transition toward environmentally conscious practices. One such area is the development of bio-based

paints, where renewable materials such as plant-based oils and natural pigments can replace traditional petrochemical components, reducing the industry's reliance on non-renewable resources. Smart coatings with advanced functionalities, including self-cleaning surfaces, heat-reflective properties, and anti-microbial capabilities, offer solutions to address urbanization and climate challenges. Additionally, expanding the portfolio of low-VOC alternatives to meet global indoor air quality standards provides both a competitive advantage and an avenue to cater to the rising consumer demand for healthier living environments.

The adoption of circular economy practices offers another promising path for sustainability. By recycling leftover paints into new formulations, companies can minimize waste and make better use of raw materials. The use of biodegradable and reusable packaging materials further reinforces these efforts. Collaborations across the value chain—working with suppliers to develop sustainable packaging solutions and with customers to establish systems for waste collection—can help create a closed-loop system that significantly reduces the environmental footprint of the industry.

Renewable energy integration within manufacturing processes presents a dual benefit: reducing carbon emissions while simultaneously lowering operational costs over the long term. Solar and wind energy are particularly viable options for many production facilities, offering a sustainable alternative to traditional energy sources. Furthermore, the implementation of digital technologies can enhance operational efficiency. AI-based systems enable real-time monitoring and optimization of energy use, while IoT-enabled sensors can track emissions and pinpoint inefficiencies in manufacturing processes, enabling swift corrective actions.

Collaboration and partnerships are essential for driving sustainable transformation in the paint industry. Research collaborations with academic institutions and technical organizations can accelerate the development of cutting-edge sustainable technologies. Government subsidies and incentives can provide financial support for companies adopting green practices, while industry associations can facilitate knowledge sharing and establish common sustainability goals.

The rising focus on green buildings, driven by the global movement toward sustainable construction, represents a significant market opportunity for the paint industry. Products such as heat-reflective coatings and low-VOC paints are increasingly becoming integral components of eco-friendly building projects. Positioning these offerings as essential elements for green certification programs can enhance their adoption in this growing market.

Lastly, the prioritization of sustainability by global markets provides an excellent opportunity for Indian paint manufacturers to expand internationally. Exporting eco-friendly products, supported by certifications such as GreenPro and Ecolabel, enhances their credibility and appeal in global markets. By leveraging these opportunities, the Indian paint industry can not only achieve substantial growth but also establish itself as a leader in sustainable practices on a global stage.

5.3. Bridging the gap between challenges and opportunities

Bridging the gap between the challenges and opportunities in achieving sustainability requires a multi-faceted approach that addresses both internal and external factors. A key starting point for the Indian paint industry is to prioritize investments in research and development (R&D). By focusing on cost-effective and scalable innovations, companies can accelerate the development of bio-based raw materials and sustainable formulations. Such innovations not only address the pressing need for eco-friendly solutions but also ensure that sustainability becomes economically viable across different market segments, including price-sensitive rural areas.

Collaboration and stakeholder engagement are equally critical in overcoming challenges and driving widespread adoption of sustainable practices. The industry must work closely with governments, non-governmental organizations (NGOs), and peer organizations to establish a framework of shared responsibility for sustainability. Public-private partnerships can pave the way for joint initiatives in sustainable technologies, while industry associations can facilitate the exchange of best practices and create collective strategies to meet national and global environmental goals.

Upskilling the workforce is another essential step toward bridging this gap. Training programs for employees, painters, and contractors must focus on sustainable technologies and practices, ensuring that the knowledge of eco-friendly methods is disseminated across the industry. Certification programs for professionals can further enhance their credibility and motivate adoption of sustainable practices at every level of the value chain.

By recycling leftover paint into new formulations, companies can minimize waste and make better use of raw materials.

Consumer awareness is a pivotal factor in driving demand for sustainable products. Companies should launch targeted awareness campaigns to educate consumers about the benefits of eco-friendly paints, emphasizing health, environmental, and long-term cost advantages. In rural and price-sensitive markets, where affordability is a primary concern, educating consumers about the value proposition of sustainable products can significantly boost their adoption and acceptance.

Finally, leveraging financial incentives is vital to overcome the initial cost barriers associated with sustainability initiatives. The industry must tap into government subsidies, green bonds, and other financial mechanisms designed to promote environmentally friendly practices. By aligning with these incentives, companies can fund investments in renewable energy, green technologies, and sustainable infrastructure, further accelerating the industry's transition to a greener future.

By integrating these strategies into a cohesive plan, the Indian paint industry can effectively bridge the gap between its challenges and opportunities, creating a sustainable roadmap that benefits businesses, consumers, and the environment alike.

6. Future roadmap and recommendations

To strengthen its alignment with the Sustainable Development Goals (SDGs) and achieve a sustainable future, the Indian paint industry must adopt a comprehensive and transformative approach. This requires a focus on product innovation, operational sustainability, community engagement, collaboration with stakeholders, leveraging technology, and transparent measurement of progress.

A crucial area is the development of sustainable products. The industry needs to prioritize green chemistry by investing in bio-based and renewable raw materials as alternatives to petrochemical derivatives. By adopting eco-friendly formulation practices, companies can significantly reduce their environmental footprint. Expanding the availability of low-VOC and water-based paints is equally important, especially as these products are healthier for consumers and better for the environment. However, their widespread adoption requires sustained efforts in consumer education to highlight their benefits. Additionally, there is an increasing demand for smart coatings with multifunctional properties such as self-cleaning surfaces, pollution absorption, and energy efficiency. To meet this demand, collaborations with research institutions and universities can expedite innovation and commercialization of advanced coating technologies.

Operational sustainability is another critical dimension. Transitioning to renewable energy sources like solar and wind power across manufacturing facilities will significantly reduce carbon emissions while lowering energy costs over time. At the same time, the industry must optimize its resource efficiency by integrating digital technologies such as IoT-enabled sensors to monitor and manage energy and water consumption effectively. Circular economy practices should be embraced, including recycling leftover paints and reusing raw materials. Supply chains also need to be greener, with a focus on procuring sustainable materials, reducing packaging waste, and adopting eco-friendly logistics systems.

Products engineered to comply with global VOC regulations, ensure improved indoor and outdoor air quality.

Community engagement forms a key pillar in aligning with the SDGs. The industry must expand its efforts to upskill workers, especially in rural areas, by offering training programs in sustainable painting techniques and safety practices. Certification initiatives can enhance the employability of painters and contractors, creating economic opportunities while promoting sustainable practices. Corporate Social Responsibility (CSR) programs should continue to focus on improving education, healthcare, and sanitation in underserved communities. Special efforts should also be made to empower women-led enterprises and ensure diversity in the workforce. Alongside these efforts, consumer awareness campaigns are essential to educate the public about the advantages of sustainable paints and coatings, leveraging digital platforms to reach environmentally conscious demographics.

Collaboration with policymakers and other stakeholders is vital to advancing sustainability goals. The paint industry must advocate for supportive government policies, such as tax incentives for adopting green technologies and stricter environmental regulations to ensure compliance. Public-private partnerships can be instrumental in funding large-scale sustainability projects. Industry associations like the Indian Paint Association (IPA) should take the lead in establishing unified goals and sharing best practices, while partnerships with global organizations can help align the industry with international standards and open up export opportunities. Additionally, collaborating with academia and research institutions will foster innovation in sustainable products and processes, creating a pipeline of new ideas and technologies.

Digital tools such as artificial intelligence (AI) and machine learning can optimize production, inventory management, and supply chain operations.

Technology will play a transformative role in driving sustainability. Digital tools such as artificial intelligence (AI) and machine learning can optimize production, inventory management, and supply chain operations, leading to significant reductions in waste and resource use. Block chain technology can ensure transparency and traceability in sourcing materials, bolstering the industry's sustainability credentials. Automation and smart manufacturing systems can further enhance operational efficiency by integrating energy-saving machinery and digital twins to simulate resource use and identify inefficiencies before implementation.

To ensure accountability and continuous improvement, the industry must set clear and measurable sustainability goals. These targets should align with global frameworks such as the UN SDGs and the Paris Agreement. Transparent reporting through annual sustainability reports is essential to demonstrate progress and build consumer trust. Certifications such as GreenPro, Ecolabel, and ISO 14001 can further validate these efforts. Engaging independent auditors to evaluate sustainability initiatives will also provide critical feedback to refine and improve strategies.

In the long term, the Indian paint industry has the potential to position itself as a global leader in sustainable coatings. By investing in research and development to address challenges such as urbanization and climate change, the industry can create innovative products that meet international standards. Exporting eco-friendly paints to global markets will enhance India's reputation as a sustainability pioneer. Simultaneously, supporting the unorganized sector with resources and training will ensure a unified approach across the industry, fostering an environment of shared growth and sustainability.

By adopting this comprehensive roadmap, the Indian paint industry can effectively bridge its challenges and opportunities, making significant contributions to the SDGs while achieving economic, environmental, and social value. This transformation will not only strengthen the industry's future resilience but also set a benchmark for other industries to follow.

7. Conclusion

The Indian paint industry has taken significant strides in aligning its operations and products with the United Nations Sustainable Development Goals (SDGs). From reducing environmental impact to enhancing community welfare, leading companies like Berger Paints India Limited have embraced sustainability as a core business strategy. However, the journey toward achieving holistic and long-term sustainability remains ongoing, marked by challenges such as regulatory compliance, volatile raw material costs, and the need for greater consumer awareness.

The paint industry has immense potential to contribute to the SDGs by focusing on innovation, operational efficiency, and social impact. The transition to low-VOC and eco-friendly coatings, adoption of renewable energy, and integration of circular economy practices are some of the crucial steps that companies have already taken. Moreover, the rise of digital technologies and collaboration with stakeholders offers an unprecedented opportunity to accelerate the pace of transformation.

Berger Paints India Limited stands out as a pioneer in the industry with its Protective Coating Division leading sustainable innovations. Through initiatives like high-durability eco-friendly coatings, community engagement programs, and investments in renewable energy, the company exemplifies how businesses can simultaneously achieve profitability and social responsibility. Berger's efforts demonstrate how sustainability is no longer an option but a necessity for businesses to thrive in the modern era.

Looking ahead, the industry must adopt a forward-thinking approach, focusing on the roadmap outlined in this article. By setting ambitious sustainability goals, fostering collaboration, and leveraging technology, the paint industry can overcome existing challenges and seize opportunities for growth. Moreover, as consumer preferences continue to shift toward eco-friendly solutions, companies that lead the charge in sustainability will gain a competitive edge in both domestic and international markets.

The paint industry's contribution to SDGs is not only a testament to its resilience and innovation but also a call to action for other sectors to adopt sustainable practices. As India continues its journey toward becoming a global economic powerhouse, the paint industry's efforts in sustainability can serve as a model for achieving inclusive and responsible growth.

By prioritizing sustainability, the Indian paint industry can ensure that its legacy is not only about vibrant colours and protective coatings but also about preserving the planet and empowering communities for generations to come.

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New report reveals the consequences of poor biofouling management

Jotun, the global leader in marine coatings, has published a new report based on a survey among 1,000 ship owners and operators, uncovering trends in biofouling management strategies exploring the impacts of biofouling in shipping. The report reveals that many owners and operators have faced the consequences of inadequate biofouling management through regulatory penalties or refused port access.

The Biofouling in Shipping report, which surveyed 1,000 ship owners and operators across 11 countries, reveals that even though the topic on biofouling seemingly has more awareness today than compared to a few years ago, there is still knowledge gaps in the industry.

“How biofouling management plays a key role in the shipping industry's aim to cut carbon emissions and protect biodiversity has received an increasingly more acceptance amongst port authorities and regulatory stakeholders, as well as ship owners and operators. However, although 79% of respondents considers hull performance a top priority for their company, only 31% believe importance of continuing to increase the awareness and understanding, as the environmental and economic effects are significant,” said Morten Sten Johansen, Global Category Director Hull Performance in Jotun.

The report highlights the hidden costs of the lack of proper biofouling management.

- ☐ 41% have faced regulatory penalties due to biofouling related issues
- ☐ 38% have been denied port access due to non-compliance issues related to biofouling

“Perhaps even more telling, today half (49%) of those surveyed avoid ports with stringent biofouling regulations, a strategy that becomes increasingly unsustainable as global standards continue to tighten,” said Petter Korslund, Regulatory Affairs Manager Hull Performance in Jotun. “We have arrived at a crossroads where regulations so far have had a regional or local focus, which can make it difficult for ship owners and operators to navigate in the regulatory landscape. We are now seeing a shift towards a more global framework that we believe, and hope, will make it easier to manage for those who live with day-to-day operations. With that said, it remains and is all more important, to have a good biofouling management plan.”

Beyond regulatory impacts, the research reveals substantial operational consequences. More than half (50.4%) of ship owners report experiencing fuel inefficiencies as a result of biofouling, representing missed opportunities for both cost savings and meaningful progress toward decarbonisation goals.

PHOTO: JOTUN

The Biofouling in Shipping report, which surveyed 1,000 ship owners and operators across 11 countries, reveals that even though the topic on biofouling seemingly has more awareness today than compared to a few years ago, there is still knowledge gaps in the industry.

Morten Sten Johansen, Global Category Director, and Petter Korslund, Regulatory Affairs Manager Hull Performance, Jotun.

Still, as many as 1 in 5 ship owners and operators are aware that they are not using the most effective antifouling coating for each vessel in their fleet today.

“Although our findings underscore a growing recognition of the link between effective biofouling management and operational efficiency, there is still room for improvement. Ship owners that proactively seek and embrace a tailored biofouling management plan, including hull performance solutions tailored to trade, will gain a competitive edge within the market, maximising effectiveness while reducing unnecessary costs and environmental impacts,” said Johansen in Jotun, and added: “In an environment where profit margins are increasingly tight, it is more important than ever to minimize hidden costs. With more regulations on the horizon, including a legally binding biofouling framework on biofouling, our survey results are a stark reminder of the cost of being unprepared.”

Jotun's report was presented during Nor-Shipping as a part of Jotun's ongoing Clean shipping commitment and sets out a roadmap for rethinking biofouling as a strategic priority for the shipping industry, against a backdrop of increased regulations and efficiency obligations.

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Borchers coating additive technical service laboratory in Pune boosts regional support

Borchers, a Milliken & Company brand and global leader in advanced coating additives, has introduced enhanced technical lab capabilities in Pune, India.

The Pune laboratory is part of the global network of Borchers' technology centers, reinforcing the brand's commitment to regional collaboration, technical excellence, and customer-driven innovation.

The facility supports a wide range of Borchers' high-performance coating technologies including: Cobalt-free driers; tin-free catalysts; dispersing agents; rheology modifiers; flow and leveling agents; and, defoamers.

These solutions are designed to enhance the performance of both waterborne and solvent borne coatings – empowering formulators to meet increasingly demanding market requirements.

"Our technical service laboratory in Pune is instrumental in delivering tailored solutions to our regional customers," said Jeff Losch, Vice President & Business Manager, Coating Additives at Milliken. "The facility emphasizes our commitment to fostering innovation and addressing the unique needs of the market."

Serving various sectors including architectural, wood, industrial, and automotive coatings, the Borchers Coating Additives Technical Service Laboratory in Pune is key to driving customer satisfaction and supporting the development of next-generation coating solutions that meet the specific needs of the regional market.

PHOTO: BORCHERS

The Pune laboratory is part of the global network of Borchers' technology centers, reinforcing the brand's commitment to regional collaboration, technical excellence, and customer-driven innovation.

NETL develops simulation to study how corrosion occurs on gas turbines' barrier coatings

The National Energy Technology Laboratory (NETL) researchers are reporting a breakthrough in efforts to extend the life and improve the efficiency of energy-producing gas turbines by refining a process that can simulate how corrosion-causing thermally grown oxide (TGO) develops and causes cracking in the environmental barrier coatings (EBCs), notes a press communique from the organization. This development is crucial for protecting next-generation turbine blades from thermal cycling damage.

Better coatings can lead to more effective and longer-lasting gas turbines.

The researchers reported their success in a paper published in the journal *Acta Materials*, titled "Phase-Field Modeling of Thermally Grown Oxide and Damage Evolution in Environmental Barrier Coatings."

A gas turbine is a combustion engine at the heart of many power plants that can convert natural gas or other liquid fuels to mechanical energy. This energy then drives a generator that produces the electrical energy that moves along power lines to homes and businesses.

Gas turbines also power aircraft, trains, ships, pumps, gas compressors and tanks.

NETL researchers Tianle Cheng, Fei Xue, Yinkai Lei, Richard Oleksak, Ömer Doğan and Youhai Wen, who all are based at the laboratory's Albany, Oregon, site, authored the paper.

According to the paper, "The pressing demand for improving the energy efficiency in gas turbines necessitates materials that can endure increasingly higher temperatures within oxidizing atmospheres. Current state-of-the-art structural materials in the hot sections of gas turbines are mainly nickel-based superalloys, complemented by thermal barrier coatings. For next-generation gas turbine engines, ceramic matrix composites protected by environmental barrier coatings is one promising material solution. Although some success has been achieved with current generation EBCs, development of more effective and durable EBCs remains of significant technological importance."

Current state-of-the-art EBCs typically consist of a rare earth silicate topcoat and a metallic silicon bond coat that attaches the topcoat to the substrate. However, at high temperatures, oxygen penetrates the topcoat and reacts with the bond coat to form a TGO layer.

Wen explained that more robust and efficient EBCs are needed to accommodate high-temperature oxidative environments.

"TGO layers spontaneously form in the EBC systems," he said. "Those TGOs are critical factors in the degradation and failure of environmental barrier coatings, yet the detailed mechanisms of TGO growth remains unclear. NETL developed a comprehensive model that can simulate growth of TGO layers in environmental barrier coatings."

In the NETL approach, researchers performed large-scale three-dimensional simulations to model the formation of interconnecting vertical/channel cracks, often called "mud cracks." The simulations provide insights into the cracking of EBCs and its dependence on the coating system's structure and properties.

"These results highlight the potential of the damage model as a useful tool for designing more durable EBCs, which are critical for next-generation gas turbines, especially those powered by sustainable fuels like hydrogen," Wen said.

NETL is a U.S. Department of Energy national laboratory that drives innovation to deliver solutions for a secure energy future. Through its expertise and research facilities, NETL is advancing technologies to unleash America's affordable, reliable, and secure domestic energy and natural resources.

PHOTO: NETL

Better coatings can lead to more effective and longer-lasting gas turbines.

Novel image-based model enhances the detection of surface defects in low-light industrial settings

Quality control (QC) is a critical component of industrial processes that ensures product reliability, quality, and safety. Anomaly detection (AD), which refers to the process of identifying outliers or rare/unusual events compared to the majority, is crucial for identifying defects during product inspection and QC. The increasing stringency in industrial regulations and rising demand for various products call for automated, robust, and efficient AD systems that can accurately detect anomalies. However, AD becomes particularly challenging using traditional methods, given the obscure and diverse environments in industrial settings, including low-light conditions. Moreover, AD models that rely on low-light image enhancement may be limited by artefacts and noisy images that do not accurately reflect subtle defects on industrial surfaces. Additionally, deep learning-based AD systems require extensive data processing and computational resources, which limit their widespread practical application.

To overcome this challenge, Dr Phan Xuan Tan, an Associate Professor at the Innovative Global Program, College of Engineering, Shibaura Institute of Technology, Japan, along with Dr Dinh-Cuong Hoang and other researchers from FPT University, Vietnam, have designed DarkAD—a novel end-to-end framework that can enhance AD in low-light industrial environments. The researchers have introduced a Dark-Aware Feature Adapter (DAFA) that integrates noise reduction and low-light image processing.

Giving further insight into their work, Dr Tan explains, "Unlike existing methods that rely on computationally expensive low-light image enhancement, DarkAD introduces DAFA, which enhances feature extraction through Frequency-Based Feature Enhancement (FFE) to suppress noise and Illumination-Aware Feature Enhancement (IFE) to amplify critical features in poorly lit areas. The proposed feature enhancement approach allows for real-time AD, reducing inspection errors and operational costs."

Their work has been published in Volume 25 on March 1, 2025 in the *Results in Engineering*.

SimpleNet is a hybrid approach that combines feature-embedding and synthesizing-based strategies, allowing abstract and flexible anomaly generation and computationally efficient AD. Nonetheless, low-light detection continues to remain a concern. The researchers sought to adapt the SimpleNet model to improve AD in low-light and noisy conditions.

In the current framework, the FFE module enhances low-frequency structural features while reducing high-frequency noise, thereby enabling robust AD even in low-light conditions. The IFE module estimates illumination across the image and enhances regions that are poorly lit, thus mitigating challenges that result from uneven illumination. Notably, the DarkAD model does not require pre-processing or enhancement of the input image. Further, dynamic adaptation by the model selectively amplifies features from well-lit regions, while preserving crucial features from low-lit regions, thus improving its detection accuracy.

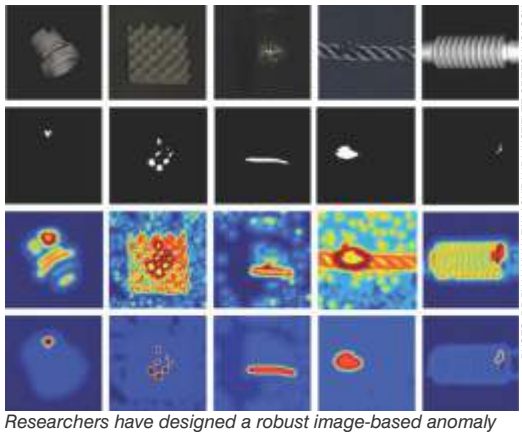

PHOTO: DR PHAN XUAN TAN / SHIBAURA INSTITUTE OF TECHNOLOGY

Researchers have designed a robust image-based anomaly detection (AD) framework with illumination enhancement and noise suppression features that can enhance the detection of subtle defects in low-light industrial settings.

In addition to designing the AD model, the researchers also assembled an anomaly training dataset using images of industrial objects with diverse shapes, sizes, colors, and materials acquired in low-light settings. They carefully selected objects that would represent commonly encountered industrial items, increasing the real-world applicability of the model. Their dataset included defect-free and defective objects that reflect common anomalies, including scratches, dents, discolorations, missing parts, and surface deformations. Finally, they combined the newly acquired data with existing datasets to enhance the robustness and scope of the model across diverse industrial settings.

The DarkAD model designed in this study significantly outperformed the SimpleNet model by accurately detecting subtle anomalies, even in objects with complex textures in poorly illuminated conditions. The model also achieved high detection speed, consistency, and localization accuracy compared to other state-of-the-art models. Overall, the DarkAD framework is a robust, high-performing, adaptive, and industrially scalable AD model that can be applied in diverse real-world industrial settings. Its accuracy in detecting anomalies of varying sizes and shapes across diverse materials and complex lighting conditions makes it a valuable QC tool for automated industrial manufacturing, infrastructure monitoring, and detection of instrument malfunctioning and other industrial hazards.

Highlighting the diverse applications of their model, Dr Tan says, "DarkAD can be potentially applied in various applications, for example, manufacturing QC for detecting defects in automotive parts like clutches and tires, industrial components including cable glands and insulators, and textiles under poor lighting. It can also enable automated 24/7 monitoring and close visual inspection for detecting subtle anomalies in low-light factories, warehouses, high-risk settings like power grid systems, and complex underwater environments, thus reducing reliance on human inspectors."

High-performance elastomers and plasma polymer coatings to replace fluoropolymers in technical applications: new Fraunhofer project

Users of poly- and perfluorinated alkyl compounds (PFAS), also known as “forever chemicals,” are under pressure due to regulatory proposals from the European Chemicals Agency (ECHA). This also affects the use of fluoroelastomers, whose economic significance is enormous. Fraunhofer experts initiated the “HATE-FLUOR” project at the beginning of February. Together, they want to develop high-performance elastomer compounds to replace fluoropolymers in certain technical applications. Various industries can benefit from this, including manufacturers of semi-finished and finished parts as well as companies in mechanical engineering industry, medical engineering, clean room and semiconductor technology, chemical process technology and electrical applications.

Many companies are looking for alternatives to poly- and perfluorinated alkyl compounds (PFAS), as their possible uses in the future are uncertain and voluntary commitments are expected. PFAS are found in everyday products such as coated pans, pizza boxes and outdoor jackets, as well as in medical engineering, heat pumps and batteries. While there are already fluorine-free substitutes for some everyday applications, there is a great need for new individual solutions to replace fluoropolymers for technical applications that have to withstand extreme conditions.

PFAS replacement: coated elastomers and customizable modular solutions

In the newly initiated “HATE-FLUOR” project, teams of experts at the Fraunhofer Institute for Structural Durability and System Reliability LBF and the Fraunhofer Institute for Manufacturing Technology and Advanced Materials IFAM will develop fluorine-free coated elastomers and offer customizable modular solutions to meet the growing market demand. The solution comprises three main steps: improving the thermal stability of fluorine-free elastomers with novel antioxidants, producing customized elastomer formulations and developing a coating system to protect the elastomer from oxidative and chemical attack.

The modular structure of this system, consisting of paint and plasma coatings, is intended to cover a broad spectrum in the section of fluorine alternative seals. The target properties are determined by the areas of application of the fluoroelastomers that are being replaced in the project.

Bundled Fraunhofer expertise

In the “HATE-FLUOR” project, the Fraunhofer Institute for Structural Durability and System Reliability LBF is concentrating on the development of high-performance elastomers as a replacement for fluoropolymers in technical applications. One focus is on improving the thermal and thermo-oxidative stability of fluorine-free elastomers using innovative antioxidants. In addition, application-optimized elastomer formulations are being developed to ensure maximum resistance and optimum adhesion. This is complemented by the formulation of a coating system for the elastomers. The latter is being developed at the Fraunhofer Institute for Manufacturing Technology and Advanced Materials IFAM to protect the material from oxidative attack and chemical degradation.

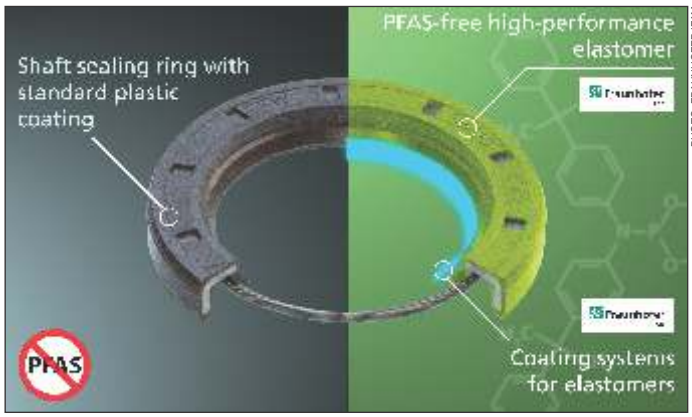

PHOTO: FRAUNHOFER IFAM

In the future, a commercially available fluorine elastomer sealing ring could consist of a fluorine- free high-performance elastomer with adapted antioxidants, formulations and a specially developed coating.

Fraunhofer IFAM is also working within the project on coatings for these elastomers to improve their friction reduction and barrier properties. A particular focus is on the development of polyimide coatings in combination with layered silicates that prevent the permeation of harmful gases and moisture. These coatings are used in particular for high-performance electronics and other demanding applications. In addition, the modification of the layered silicates is being investigated to reduce the permeation of water vapor and oxygen through the coating by up to 99%. The application of these coatings shows significantly reduced ageing and prevents dendrite growth as a result of exposure to harmful gases.

The Fraunhofer institutes LBF and IFAM are combining their expertise to develop new solutions and application-ready technologies. Both institutes already have extensive expertise in PFAS substitution thanks to many years of development and project work. The “HATE-FLUOR” project is funded by the Fraunhofer-Gesellschaft as part of the PREPARE program and will run for three years.

Experts in NDT, welding, and corrosion to converge at ICENDE 2025 in Kochi

ICENDE 2025 – the International Conference and Exhibition on Nondestructive Evaluation – is scheduled August 20 – 22, 2025, at Le Méridien, Kochi, Kerala. Recognized as India's premier annual technical event, it brings together global experts in NDT, welding, and corrosion.

"ICENDE 2025 marks a significant expansion from previous editions. This year, the conference will host two concurrent events alongside the main NDT conference – a dedicated Welding Conference organized by the American Welding Society (AWS), and a Corrosion Conference led by AMPP Chennai Chapter," said Mr Prakash Gokulanandam, Director & General Manager, The American Society for Nondestructive Testing India (ASNT India, India Section), hosts of the event. "ICENDE 2025 marks a new beginning for India's technical conference landscape by bringing together three critical pillars of industrial safety and integrity – welding, non-destructive testing (NDT), and corrosion – under one unified platform."

"To accommodate this broader scope, two separate exhibit halls are being set up, bringing together 50 to 60 exhibitors from across the NDT, welding, and corrosion sectors. We are expecting participation from over 500 delegates and industry visitors, making this the largest and most diverse edition of ICENDE to date. The expanded format ensures a wider industry representation and increased networking opportunities for all participants," said Mr Gokulanandam.

Several exhibitors are expected to showcase new product launches and technology demonstrations at ICENDE 2025, especially in the areas of advanced NDT techniques, automated welding solutions, and corrosion control innovations. With the addition of the 'welding' and 'corrosion' tracks, exhibitors from across the three sectors are preparing to unveil cutting-edge tools, digital inspection platforms, PAUT systems, CR/DR imaging solutions, corrosion-resistant materials, and AI-enabled inspection software. These launches will highlight the evolving landscape of inspection and fabrication technologies and offer attendees a first-hand look at the future of the industry.

The conference will commence on Day 1 with a formal inauguration ceremony, followed by plenary and keynote addresses delivered by eminent industry leaders from the fields of non-destructive testing, welding, and corrosion.

Special highlights include:

☐ Marine NDT, welding, and corrosion sessions

☐ Industry 4.0 in oil and gas session

☐ Panel discussion on "Innovation across borders: enabling safer pipelines with shared expertise"

Day 2 and Day 3 will begin with keynote presentations and continue with three parallel technical tracks dedicated to NDT, welding, and corrosion, running concurrently in separate halls.

Kochi has been selected as the host city for this edition due to its growing prominence in the marine, space, oil & gas, shipbuilding, and infrastructure sectors, which closely align with the themes of NDT, welding, and corrosion. The city offers excellent connectivity, modern venues, and a strong industrial presence, making it an ideal location to bring together professionals from across the country and beyond. The event is designed to be hosted in different destinations across India each year to ensure broader industry outreach and regional participation. Rotating the venue each year helps engage diverse industry hubs and ensures the conference remains inclusive, dynamic, and representative of India's widespread industrial ecosystem. Last year, the event was held at the Ramoji Film City, Hyderabad, Telangana.

"With dual exhibit halls, integrated technical sessions, dedicated special tracks, and a shared vision for advancing industrial excellence, ICENDE 2025 is set to deliver a richer, broader, and more impactful experience for all participants making it a landmark event that promotes cross-sectoral learning, collaboration, and innovation," said Mr Gokulanandam.

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CII Surface & Coating Expo (SCE 2025) emerging as key platform for industry engagement and innovation

The Confederation of Indian Industry (CII) is organizing the 5th edition of Surface & Coating Expo (SCE 2025) July 17 – 19, 2025 at the newly built extension of the Chennai Trade Centre, Chennai, India. "CII has been organizing its flagship event Surface & Coating Expo since 2014. With four successful editions, the event has received an overwhelming response from the stakeholders of the industry across the globe and has evolved as India's largest and exclusive event focused on surface engineering, preparation, coatings, finishing, corrosion protection, environmental engineering and technologies," said Dr U Kamachi Mudali, Chairman – CII Surface & Coating Expo, Chairman – CII Corrosion Management Division and Vice Chancellor, Homi Bhabha National Institute (HBNI).

The event has received participation from over 300+ exhibitors spread across 13,000+ sqm of display area. This has seen a 40% increase with number of participations compared to the previous edition which had 220 exhibitors with 10,000+ sqm of display area. The previous edition drew 15,512 business and trade visitors with this edition expecting around 20,000+ visitors from across the globe.

"This surge highlights the Expo's rising global prominence and its growing role as a key platform for industry engagement and innovation," said Dr Kamachi Mudali, who has been heading this event along with the guidance of a strong industry-led steering committee.

Adhesives and Sealants Expo; Technology Conference and Exhibition on Electroplating (TCEE); AutoMatFab Expo (Automotive Materials & Fabrication); CORTEM 2025 (Corrosion Technology & Management) are the four parallel events that will be organized along with SCE 2025. These events draw a wider range of stakeholders, from manufacturers and end-users to policy makers, making it a comprehensive industry gathering.

Concurrently six sectorial conferences: International Conference on Surface & Coating; Adhesives & Sealants Summit; International Conference on Corrosion Technology & Management; Technology Conference on Electroplating; Certified Training Course on Paints and Coatings; and a session on Plating & Pollution Control (in Tamil) will be organized with over 150 world-class speakers attended by 800+ delegates. "We are confident that the knowledge and insights shared here will spark new initiatives, foster innovative solutions, and pave the way for continued growth in our industry," said Dr Kamachi Mudali. Apart from the conference there would be an 'Open Floor Talk' on Automotive Materials and Fabrication by eminent speakers from the Industry.

A key highlight of this year's Expo is the dedicated 'Product Launch Area' located within the exhibition hall, where innovation takes center stage. Around 20+ new products are expected to be unveiled during the event, showcasing the latest advancements and breakthroughs from leading exhibitors. This dedicated space underscores the Expo's role as a premier platform for introducing cutting-edge technologies and solutions to the global market.

Another initiative is the dedicated 'MSME Pavilion' with around 50+ MSME Units supported by the Ministry of MSME, Government of India, under the 'Procurement & Marketing Support Scheme.' This initiative aims to boost visibility and business opportunities for emerging Indian enterprises.

This edition's 'Academia – Industry Skill Connect' will uniquely serve as a platform to connect academia and industry, fostering collaboration to enhance skill development and open up new career opportunities for the talented graduate students and younger generation.

The Expo has expanded its global footprint with participation from over 16 countries, including Denmark, France, Germany, Israel, Italy, Japan, Malaysia, Netherlands, Russia, Sweden, Switzerland, Taiwan, Thailand, UAE, UK and USA, bringing diverse innovations and perspectives to the event.

"SCE 2025 is not just another trade show – it's a specialized, strategically located, and industry-endorsed platform that integrates exhibition, knowledge-sharing, and networking to address the growing demands and innovations in surface engineering and coatings in India and beyond," said Dr Kamachi Mudali.

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AUG 20 – 22, 2025	ICENDE	Le Meridien Kochi, Maradu, Kochi, India	ASNT India Section	M: (91) 9746690315 E: events@asntindiasection.org W: icende.in
SEP 03 – 05, 2025	ASIA PACIFIC COATINGS SHOW	Bangkok International Trade & Exhibition Centre, Bangkok, Thailand	dmg events	T: +971 44453773 E: paddyoneill@dmgevents.com W: asiapacificcoatingsshow.com
SEP 07 – 09, 2025	STATIC ARABIA	Dhahran Expo, Al Khobar, Kingdom of Saudi Arabia	Aldrich	T: +971 (0) 42790800 E: sales@staticarabia.com W: staticarabia.com
SEP 23 – 25, 2025	ABRAFATI SHOW 2025	São Paulo Expo, São Paulo, Brazil	Vincentz Network	E: matthias.janz@vincentz.net W: home.abrafatishow.com.br
SEP 25 – 27, 2025	PAINT BANGLADESH 2025	International Convention City Bashundhara (ICCB) Dhaka, Bangladesh	BMPA and REEMS	E: cs2@reemsbd.com W: paintbangladesh.com
OCT 01 – 03, 2025	PAINTEXPO EURASIA	Istanbul Expo Centre, Istanbul, Turkey	Artkim	E: sales@artkim.com.tr W: artkim.com.tr
OCT 06 – 08, 2025	CORCON 2025	Jaipur, India	AMPP India Chapter	T: (91-22) 25797354 E: info@naceindia.org W: corcon.org
NOV 03 – 06, 2025	ADIPEC	Abu Dhabi, UAE	dmg events	E: enquiry@adipec.com W: adipec.com
NOV 12 – 13, 2025	USA COATINGS SHOW 2025	MeadowLands Exposition Centre, New York, USA	United Expo	E: unitedexpo@gmail.com W: usa-coatings-show.com
NOV 24 – 26, 2025	GULF COATINGS SHOW 2025	Expo Centre, Sharjah, United Arab Emirates	NürnbergMesse GmbH	E: matthias.janz@vincentz.net W: www.gulf-coatings-show.com
NOV 25 – 27, 2025	CHINACOAT 2025	Shanghai New International Expo Centre (SNIEC), Shanghai, China	Sinostar	E: info@sinostar-intl.com.hk W: www.chinacoat.net
JAN 27 – 29, 2026	5th MECOC EXPO	Abu Dhabi, UAE	Aldrich	T: +971 4 837 4300 E: register@mecocmiddleeast.com W: mecocexpo.com
FEB 19 – 21, 2026	PAINTINDIA	Bombay Exhibition Centre, Mumbai, India	NürnbergMesse India Pvt. Ltd	T: (+91 22) 62165323 E: paintindia.expo@colorepub.in W: nm-india.com
MAR 15 – 19, 2026	AMPP ANNUAL CONFERENCE + EXPO	Houston, Texas, USA	AMPP	W: ace.ampp.org
APR 14 – 17, 2026	PAINTEXPO	Karlsruhe, Germany	Leipziger Messe	M: +91 9166565118 E: b.verma@leipziger-messe.de W: paintexpo.com
MAY 05 – 07, 2026	AMERICAN COATINGS SHOW AND CONFERENCE	Indiana Convention Center, Indianapolis, Indiana, USA	American Coatings Association	E: cmatthews@paint.org W: american-coatings-show.com
MAY 05 – 07, 2026	SURFACE TECHNOLOGY GERMANY 2026	Stuttgart Exhibition Centre, Stuttgart, Germany	Deutsche Messe	E: info@messe.de W: messe.de

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