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COATINGS AND ANTI CORROSION ENGINEERING REVIEW

June - July 2024 | Volume 15 Issue 2 | ₹ 100

Handling corrosion a key part of Asset Integrity Management

Interview
Dr Patrick Dodds
CEO and Founder of Hexigone

Technical Feature
Life prediction of a component – a sure way to plant safety

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INTERNAL PIPE COATING EQUIPMENTS

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- Floor coatings

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APPLICATIONS

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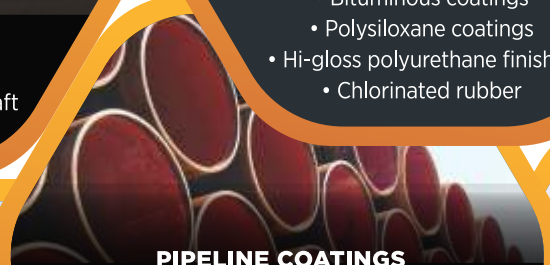
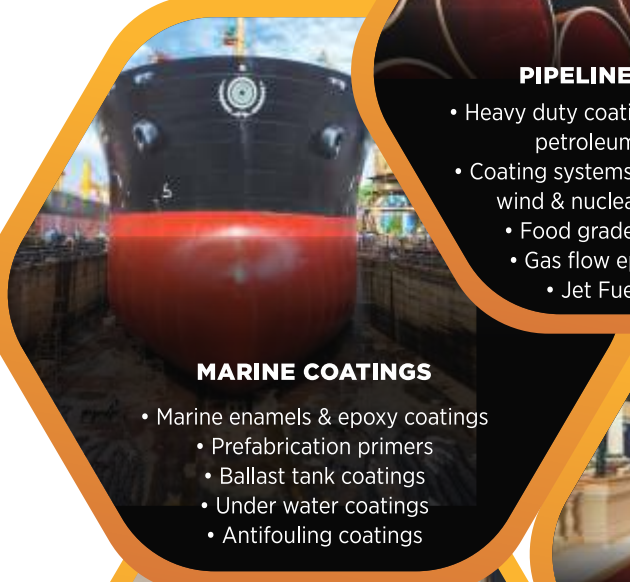


PIPELINE COATINGS

- Heavy duty coatings for chemicals & petroleum industries
- Coating systems for thermal power, wind & nuclear power plants
- Food grade epoxy linings
- Gas flow epoxy coatings
- Jet Fuel coatings

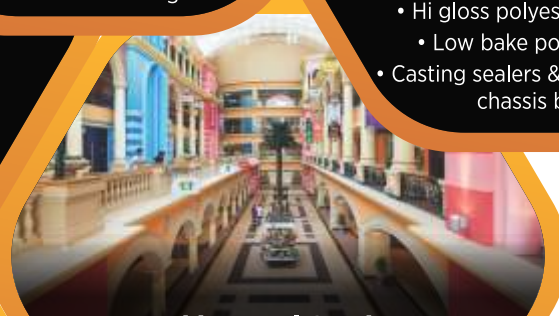
OEM COATINGS

- Quick drying primer & top coats, low bake & stoving systems
- Thermosetting acrylics
- Hi gloss polyester top coats
- Low bake polyurethane
- Casting sealers & unicoat epoxy chassis black



MARINE COATINGS

- Marine enamels & epoxy coatings
- Prefabrication primers
- Ballast tank coatings
- Under water coatings
- Antifouling coatings



Architectural Coatings

- External coatings
- Internal coatings
- Hygiene coatings
- Anti carbonation coatings

FLOOR COATINGS

- Penetrating Primer
- Screed
- Solvent less Epoxy
- Solvent less PU

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ENGINEERING REVIEW

COVER PHOTO:123RF

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From the Editor-in-Chief...

How well do we understand the real cost of corrosion and corrosion mitigation? This was a question raised during the Technical Conference on Coatings and Corrosion at the Middle East Metallurgy, Corrosion & Coatings Expo 2024 (MECOC Expo 2024) held in Abu Dhabi, UAE recently. After all, if corrosion professionals do not understand the cost of corrosion, how are they going to convince the management?

One has to necessarily consider spending money on corrosion mitigation measures for as long as one can, whether it is an already operating asset, or developing a totally new project. Corrosion management practices implemented throughout organizations ensure safer, long-lasting protection of assets such as pipelines, oil storage tanks, refineries, ships, etc; increase return on investment (ROI) while decreasing life cycle costs; and preserving the environment. It is essential that, a culture focused on corrosion management, much like process safety management, must exist within the organization, such that corrosion management is part of the organization's overall management system.

Corrosion auditing is one way of investigating the worthiness of corrosion control techniques and suggested suitable economic method to control corrosion. It is inspecting the corrosion sites, analyzing the reasons for corrosion, suggesting methods of prevention, doing a cost analysis of prevention and losses due to corrosion.

One of the first line of defense in corrosion mitigation is the coating. Coating may seem a simple thing, but one of the major elements that contribute to asset integrity and safety over the design life. Coating failures do occur leading to tremendous losses. As essential as the coating, is proper surface preparation. Proper surface preparation extends the life of the coating and hence the life of the asset. The problem is that surface preparation and coating application is usually scheduled at the end of the maintenance operation cycle and need to be rushed!

In fact, surface preparation is the key for coating life. 70% of coating failures occur due to poor surface preparation. In other words, the life of the coating depends 70% on surface preparation.

In this issue, we try and discuss the topic about asset integrity management, a systematic process that ensures the safety and reliability of assets throughout their life cycle by managing risks and monitoring their technical integrity. It is our hope that corrosion will become a part of organizations' corporate cultures!

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.

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Butterfly Valve Coated with Aluma Coat - BR

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Aluma Coat® - TW

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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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AkzoNobel's new powder coating for two-wheelers focuses on key Indian market

Motorcycle manufacturers can now kickstart improved cost and energy savings following the launch of Interpon A3000 from AkzoNobel's Powder Coatings business.

PHOTO: AKZONOBEL

One of the key features of Interpon A3000 is its durability; it helps prevent corrosion, combats interference from fuel, oil and other chemicals, and offers high resistance to chipping from stones and pebbles – all of which keeps vehicles looking better for longer.

The company's first single layer powder coating for two-wheelers, the newly introduced product can help customers accelerate their efficiency gains, without compromising on performance or aesthetics, notes a press release.

Interpon A3000 is focused in particular on the key Indian market, home to well over 200 million two-wheeled vehicles. Last year alone, it's estimated that more than 18 million two-wheelers were sold in India. The product will also be available globally.

"The new range gives motorcycle manufacturers and their suppliers the perfect combination of sustainability, durability and style for their modern designs," explains Jeff Jirak, Director of AkzoNobel Powder Coatings. "With a single layer system, we can help reduce our customers' costs, since application times are much shorter, which contributes to lowering their carbon footprint."

Available in an array of colors and metallic effects, Interpon A3000 is designed to protect and enhance the body parts, wheels and trim of any two-wheeled vehicle, in line with the performance levels specified, tested and approved by OEMs. It also aims to cater for the "naked" design trend, where the engine and other parts of the motorbike (such as the body frame, fuel tank, brake levers and cylinder heads) are visible.

One of the key features of the product range is its durability. It helps prevent corrosion, combats interference from fuel, oil and other chemicals, and offers high resistance to chipping from stones and pebbles – all of which keeps vehicles looking better for longer.

A low energy version will also be available, enabling the powder to cure at a lower temperature and further reduce the energy consumed. This will play an important role in helping the company to achieve its ambition of halving carbon emissions across the value chain by 2030.

BASF's Coatings division launches a new generation of clearcoats and undercoats for the Asian Pacific refinish market

BASF's Coatings division has introduced a new portfolio of eco-efficient clearcoats and undercoats that offers higher quality and increased productivity, and contributes to a significant reduction in CO_2 emissions. With this comprehensive portfolio, BASF aims to support body shops with increased profitability and sustainability, notes a press release.

These new products have received approvals from leading automotive OEMs, demonstrating their sustainability and technical qualities.

PHOTO: BASF

BASF introduces new clearcoats and undercoats under the Glasurit AraClass and R-M Pioneer Series.

Today, body shops are looking for new ways to improve efficiency and profitability to stay competitive, while meeting customer demands for sustainability. This next-generation clearcoats and undercoats directly address these requirements.

"Our new portfolio of leading-edge coatings are specifically designed to support body shops in significantly shortening process times while reducing material and energy consumption," said Susann Kluge, Vice President, BASF Automotive Refinish Coatings Solutions Asia Pacific. "We can now offer body shops a total solution that reflects our commitment to be the industry leader in sustainability."

Building upon the successful launches of Glasurit® 100 Line and R-M®'s AGILIS basecoat lines in 2020, with VOC (volatile organic compounds) value lower than 250 g/l, the latest coatings from BASF further expand the environmentally friendly options available for the automotive repair industry. These innovative coatings feature rapid UV-A and air drying direct-to-metal solutions, providing time and cost saving.

The new portfolio, available under Glasurit AraClass and R-M Pioneer Series, will be gradually introduced to the Asia Pacific markets in 2024. Simultaneously, body shops seeking efficient, streamlined solutions can look forward to the Glasurit ProClass and R-M Advance Series with clearcoats and undercoats that are easy to use and designed to improve workflow, which will also be rolled out in 2024.

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Astral Limited launches comprehensive new paint line as Astral Paints

Astral Limited, a leading innovator in the building construction segment and one of the fastest-growing building material company, has launched its extensive new paint line, Astral Paints. The new brand by Astral Limited offers a vast array of options to meet the needs of every painter, designer, and homeowner, featuring a diverse selection of colors, finishes, and specialized formulations, notes a press communiqué.

PHOTO: ASTRAL PAINTS

The new brand Astral Paints offers a vast array of options to meet the needs of every painter, designer, and homeowner, featuring a diverse selection of colours, finishes, and specialized formulations.

Mr Sandeep Engineer, CMD of Astral Limited, stated, “The launch of Astral Paints marks a significant milestone in Astral Limited's journey. It's a strategic move to diversify and solidify our presence in the ever-evolving Indian market. Our deep understanding and extensive experience within the building materials ecosystem give us a distinct advantage. We are confident that Astral Paints will revolutionize the industry with its versatile paints, extensive color options, and unwavering focus on quality. Paints have always held a special place in my heart, stemming from my father's association with the industry. We embody Astral's core value – 'TRUST' – and deliver on our promise: 'The trust of Astral,' now in Paints.”

Mr Saumya Engineer, CEO of Astral Adhesives & Paints, added, “We are launching Astral Paints not merely to add a feather in Astral Limited's cap, but to establish it as a leading business within the Astral Group. Our consistent and strategic approach has proven successful with our other ventures such as adhesives, construction chemicals, and bathware, and we will maintain this same momentum with paints. While we are not in a rush to go pan-India, we will strategically and incrementally introduce our products into different markets, with the aim of covering the entire country within the next three years.”

The range includes decorative paints for interior and exterior emulsions in luxury, premium, and economy segments, under various product names: Elita, Esteema, and Styla for interior emulsions, and Extura Plus, Extura, and Raga for exterior emulsions. Additionally, Astral Paints offers a wide range of undercoats through primers and putties, synthetic enamels, and ancillary products like rollers and brushes. Understanding consumer needs, Astral has also introduced specialty paints, such as Kitchen Special Paint, which features high durability and oil-resistant properties.

Scottish sensor technology startup Novosound targets expansion in APAC

On the back of recent client wins with global energy giants in the Middle East and North America, Scottish sensor technology scale-up company Novosound (novosound .net) is targeting expansion in the APAC region.

PHOTO: BUSINESS WIRE INDIA

Novosound's Ceilidh system, a wide area corrosion monitoring system improves the efficiency and safety of industrial assets.

Novosound's Ceilidh system, a wide area corrosion monitoring system for industrial groups seeking to improve the efficiency and safety of their assets is a fully patented system for the monitoring of corrosion and solves a number of industry challenges including corrosion under composite-wraps.

Novosound CEO and Founder Dave Hughes said: “The Ceilidh system represents a significant breakthrough in the field of non-destructive testing, addressing complex challenges and specifically tailored for industries where corrosion monitoring is absolutely critical.”

Novosound's Ceilidh is a revolutionary monitoring system for corrosion, utilizing a sparse acoustic array that is capable of detecting and localizing corrosion with sub-millimetre-scale anywhere in its installed area. This is due to the use of high-frequency guided waves which propagate laterally to each of its sensors (rather than in thickness mode). Moreover, machine learning (ML) and artificial intelligence (AI) are used to automate data analysis, deskilling the interpretation of data. Novosound Ceilidh identifies the corroded areas at the earliest time, providing enhanced monitoring which lowers cost through increased efficiency of the inspections team.

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FANUC's New CRX-10iA/L Paint: World's first explosion-proof collaborative paint robot

Global automation leader FANUC America (fanucamerica.com) has unveiled the new CRX-10iA/L Paint collaborative robot, notes a press release. As the first explosion-proof collaborative paint robot for use and sale globally, FANUC's CRX-10iA/L Paint cobot will unlock the benefits of automation for more companies in the painting, powder and/or gel coating with fiberglass reinforcement industries. The new FANUC cobot not only will help boost all types of paint operations including high-mix, low-volume applications, but also is designed to comply with the stringent explosion-proof safety standards.

PHOTO: BUSINESS WIRE

FANUC's CRX-10iA/L Paint cobot is said to be the first explosion-proof collaborative paint robot for use and sale globally.

FANUC CRX cobots have helped automate more applications, including pick and place, palletizing, machine tending and welding, for more companies of all sizes and automation experiences. With the addition of the CRX-10iA/L Paint collaborative robot, now even operations with no robotics experience can quickly and effectively deploy cobots to automate their painting and coating processes by using "easy-teach" features, including drag-and-drop programming and "lead through teach." The benefits of automating include better quality and more consistent finishes as well as cost and waste savings by accurately and efficiently painting.

"FANUC paint robots have been designed and manufactured continuously in Michigan since 1982. Now with the new CRX-10iA/L Paint collaborative robot, more operations will be able to reap the benefits of paint and coating automation," says Ed Minch, Sales Director for Auto Component & General Industry Paint at FANUC America. "We know our customers are struggling to increase their production and efficiency to keep up with rising demand while staying profitable. Cobots that paint will be a gamechanger for companies that might have very little or no prior experience with robots to help them cost effectively automate within a short period of time."

Collaborative robots offer flexible automation with a small footprint and force-sensing technology that enable them to work safely around people. The CRX-10iA/L Paint cobot has a payload of 10 kg as well as the longest reach in its class at 1,418mm, allowing the cobot to access large workpieces in even the most difficult of places that can pose ergonomic challenges for humans to manually reach. Featuring the same smooth and rounded design of the CRX series, the CRX-10iA/L Paint cobot is lightweight at 45 kg and has a small footprint, which can be further enhanced by stacking the control unit onto a light and compact R-30iB Mini Plus controller. Along with the other CRX cobots, the CRX-10iA/L Paint is maintenance-free for 8 years adding to ownership savings and boosting operations.

As with other CRX models, the CRX-10iA/L Paint collaborative robot is easily programmed with the FANUC CRX Tablet Teach Pendant. Via graphical icons, first-time users can create paint path programs using the drag-and-drop interface. Intuitive paint-specific icon commands have also been added for paint applications.

Additionally, the CRX-10iA/L Paint cobot has full optimization capabilities with path editing and ROBOGUIDE software. It can easily be integrated with other equipment used in painting, powder, liquid, coating and fiberglass reinforced plastic (FRP CHOP/GEL) applications.

Biomass-based coatings for wind turbine blade leading edge protection from MCG

The Mitsubishi Chemical Group (MCG) has announced that BENEBiOL™, a biomass-based polycarbonatediol, has been adopted as a raw material for polyurethane coatings for wind turbine blade protection: AROLEP® 940 series by AEROX, following the collaboration under Joint Research and Development Agreement (JRDA) with AEROX. This marks the first-ever use of BENEBiOL™ in wind turbine blade coating agents, notes a press release.

AEROX's AROLEP® 940 series coatings are used to protect the leading edges of wind turbine blades, for which the resistance against wind and rain erosion is necessary. The incorporation of BENEBiOL™ into these coatings will give them outstanding erosion resistance surpassing conventional products even in the harshest offshore conditions and should reduce the frequency and cost of blade maintenance.

PHOTO: MITSUBISHI CHEMICAL GROUP

AEROX's AROLEP® 940 series coatings are used to protect the leading edges of wind turbine blades, for which the resistance against wind and rain erosion is necessary.

BENEBiOL™ is a biomass-based polycarbonatediol pioneered by the MCG Group mainly for use as a primary raw material in polyurethane resins.

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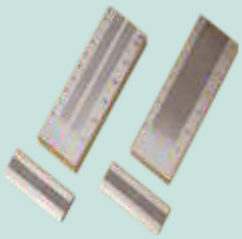
 DVNEXT RHEOMETER	 CTX™ TEXTURE ANALYZER	 FINENESS OF GRIND GAUGES (HEGMAN GAUGE)	 DIGITAL ROTOTHINNER	 AUTOMATIC CUPPING TESTER
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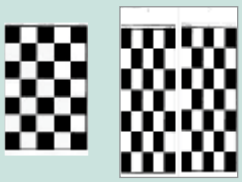
 SKID RESISTANCE TESTER	 TIDAS Automated Grindometer (Hegman Gauge)	 K CONTROL COATER	 CHECKERBOARD CHARTS	 DIGITAL COATING THICKNESS GAUGE (456)
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CRISIL Rating : SME 1 'Highest'

Q-Sun Xe-3 Xenon Test Chamber sets new benchmark for accelerated weathering studies

When developing materials and products for outdoor use, accelerated weathering tests are essential for predicting long-term durability. Q-Lab's Q-Sun Xe-3 Xenon Test Chamber provides full spectrum sunlight simulation along with unparalleled control over UV, moisture and temperature to meet the most demanding international test specifications, notes a product write-up from the company.

PHOTO: Q-LAB

The Xe-3 utilizes Xenon arc lamps to reproduce the entire UV/visible/IR spectrum of natural sunlight from 260-800nm wavelengths. This allows comprehensive testing of properties like gloss, color, mechanical strength and more under realistic daylight exposure conditions. Optical filter systems enable precise control over UV levels, humidity and black panel temperature.

With the ability to perform constant UV/temperature, constant humidity or cycling between day/night and wet/dry conditions, the Xe-3 meets global weathering standards like ISO, ASTM, SAE, AATCC and more. Its large 51 x 38 cm flat sample plane maximizes specimen capacity and proprietary vertical specimen holders prevent condensation dripping.

The smart flat array automatically maintains equal specimen spacing for uniform irradiance across all samples. Integrated black panel temperature control from 31 - 120°C provides extremely tight temperature management and monitoring for sensitive materials testing.

Operating the Xe-3 is simple via the intuitive touchscreen controller with real-time run monitoring and networking capability. Automated exposure control minimizes user intervention. Water cooling and purification systems are built-in for dependable long-term operation.

With its advanced xenon arc technology, cycling capabilities, and precision monitoring/control, the Xe-3 meets the standards for accelerated weathering research and testing across diverse industries like automotive, aerospace, construction, electronics, medical devices, plastics and more.

Other features include long lasting lamps, durable filters, precise temperature control, optional chiller, humidity control, optional water spray to simulate outdoor moisture attack on select models, and user-friendly software.

More details: khushbooscientific.com

Biuged Automatic Cross Hatch Tester

The cross cut method has been widely used as an important method to evaluate the adhesion degree between coating and substrate. Although the traditional manual cross cut method is simple and convenient, due to the operator's cutting speed and coating, cutting force cannot be accurately controlled, the test results of different testers are different. The latest ISO 2409-2019 standard has clearly defined that in order to obtain uniform and consistent cutting, automatic cross hatch adhesion tester with motor drive shall be used as far as possible.

The Biuged BGD 535 Automatic Cross Hatch Tester is an auto cross cut instrument designed to the latest ISO 2409 and ASTM 3359 standards, notes a press release from Aadarsh Technologies (aadarshtech.com), their agents in India. Compared with similar products in the market, it has the following advantages: Adopts 7-inch industrial grade full touch screen, which can edit relevant cutting parameters and display the parameters clearly and intuitively; cutting speed, cutting stroke, cutting distance and cutting number (the number of squares) can be set; preset conventional cutting program, which can complete the cross cut operation with one key; the load force in the cutting process is automatically compensated to ensure constant load and consistent cutting depth of coating; automatic clamping test sample, simple and convenient; after a certain cutting direction is completed, the working platform automatically and accurately rotates 90^0 so that the cutting lines caused by artificial rotation cannot be completely crossed vertically; data storage and report output.

PHOTO: BIUGED

The Biuged BGD 535 Automatic Cross Hatch Tester is an auto cross cut instrument designed to the latest ISO 2409 and ASTM 3359 standards.

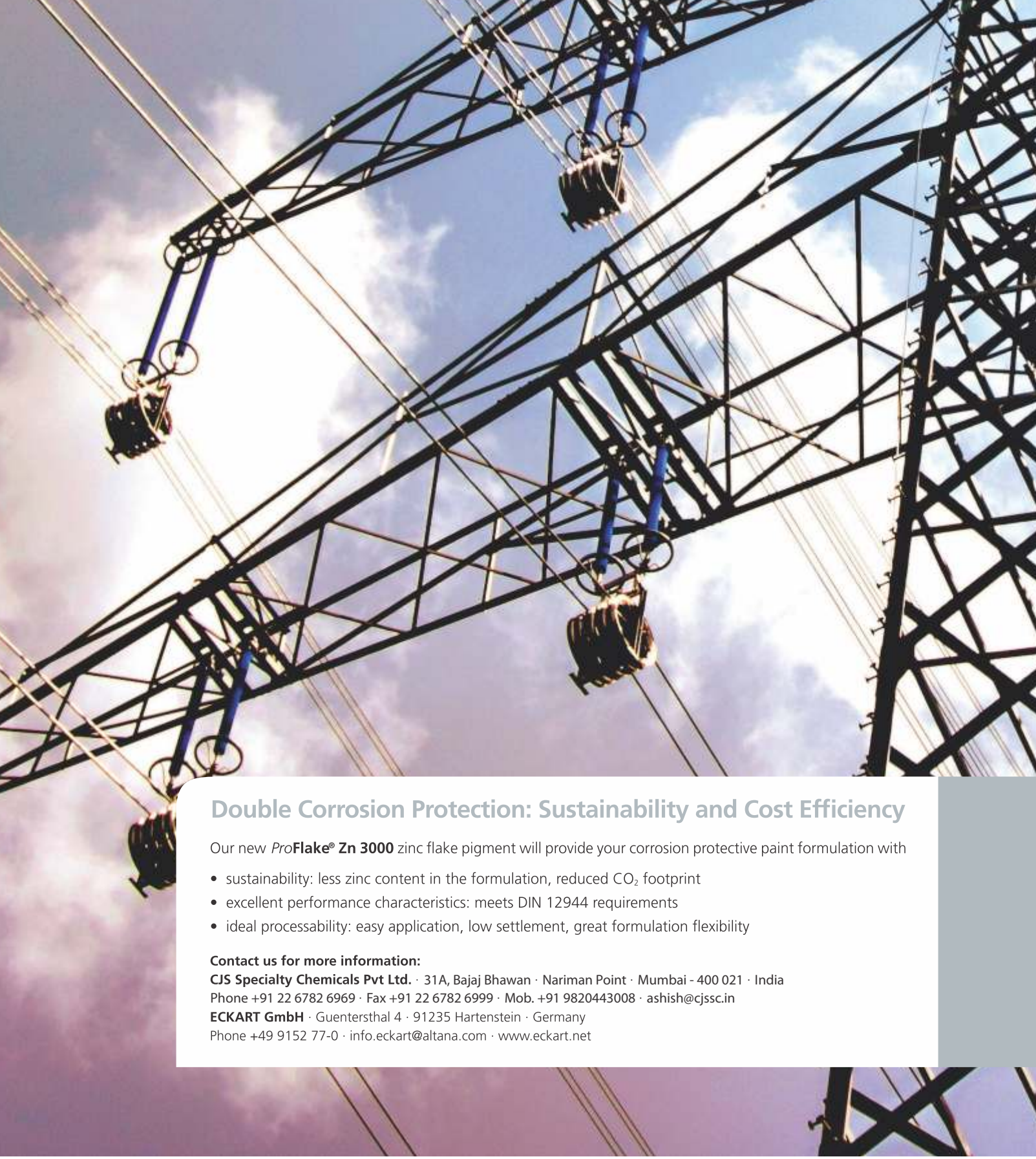
Optimize coating performance through climate control solutions for blasting, painting, and coating

Climate control is indispensable during blasting, painting, and coating processes in industries like tank manufacturing, pipelines, and reactors. High humidity often leads to condensation on metal surfaces, causing coating issues such as blooming and flash rust, thus compromising the longevity of the finish.

Issues commonly encountered, including poor surface preparation and corrosion due to high humidity, necessitate a solution that ensures optimal environmental conditions. This is where desiccant-based dehumidification systems come into play, notes a press note from Technical Drying Services (Asia) Pvt Ltd (tdsasia.net).

Desiccant dehumidification systems maintain recommended humidity levels, temperature, and ventilation, meet paint manufacturer specifications, and enable year-round operation regardless of ambient conditions. These systems are invaluable because they reduce project time, predict tank downtime, and increase coating life.

The benefits are clear: longer coating and paint life, prevention of surface defects, specified temperature and humidity conditions, improved paint adhesion, and uninterrupted maintenance cycles. Considering that dehumidification costs a mere fraction of the total treatment cost for corrosion prevention, investing in such systems becomes beneficial and essential for optimal coating performance and durability.



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Hexigone: 'India, a key geographical region for our future growth strategy'

CEO and Founder of Hexigone, Dr Patrick Dodds, on a recent visit to India in a chat with C&ACER

Can you introduce us to your company Hexigone?

Hexigone Inhibitors specializes in micro-reservoir technology that is added to paints and protective coatings to prevent corrosion – addressing the multi-trillion-pound global problem with our patented products. Hexigone was founded in 2016, following a scientific breakthrough that emerged from a research project at Swansea University. I was researching the topic in response to the growing industry demand for safe alternatives to hexavalent chromate – the most widely used corrosion inhibitor, which was banned in Europe in 2019 due to the dangers posed to human health and the environment.

Hexavalent chromate is a known human carcinogen that causes serious health problems in workers exposed to it. While its use is still permitted outside of the EU, it is expected that other countries will follow suit in banning it soon, creating a gap in the market for effective, cost-saving, chromate-free substitutes.

I worked in collaboration with industry partners to develop more resource conscientious inhibitors. The result is a product proven to be ten times more effective than market leading alternatives.

After being awarded the Armourers and Brasiers Materials Venture Prize, Hexigone became operational in 2017, transitioning from laboratory discovery to a commercial entity. In 2019, following multiple feasibility studies, we implemented an international business development strategy.

PHOTOS: HEXIGONE

Dr Patrick Dodds, CEO and Founder of Hexigone.

How does your technology work?

Hexigone Inhibitors was created to develop and manufacture our smart reservoir system – sold as a corrosion inhibiting additive for coatings under the trademarked name Intelli-ion®. The inhibitors are bound to a resin reservoir system and remain locked in until they're needed. Corrosive ions prompt the reservoirs to release the inhibitors which migrate towards the metal surface. The reservoir also takes in corrosive ions, preventing them from reaching the metal surface. The inhibitors quickly released to form a nanolayer over the surface, attracting more of itself to that nanolayer and forming something called an organo-polymeric matrix. Joining this with dissolved metal ions in a chain kind of process, to form a hydrophobic film – this means it is essentially self-healing. In the lab tests, our system outperforms both hexavalent chromate and other chrome-free alternatives.

The product also works synergistically with other

Intelli-ion® AX1 is chemically triggered 'on demand,' to release from the active sites, when corrosion ions are detected.

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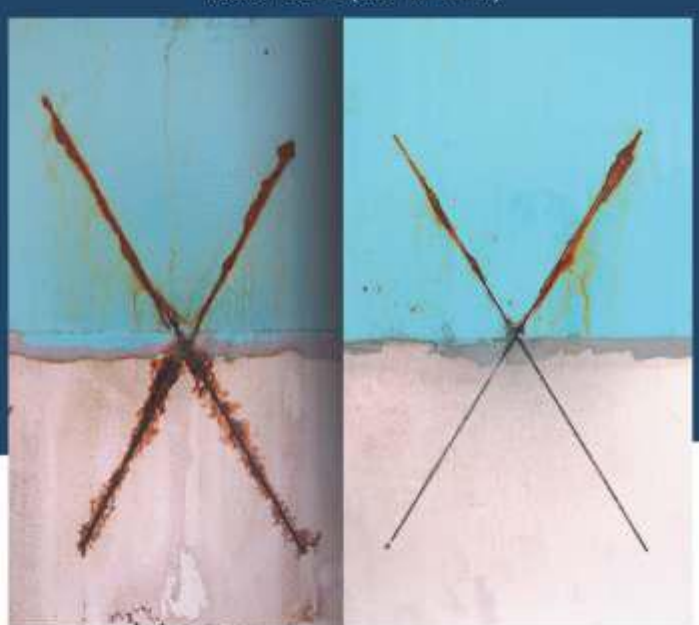

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INTELLI-ION® 'SMART' CORROSION PROTECTION

additives available on the market – such as zinc phosphate. It's well-known that zinc phosphate does not perform to the level of chromates.

The protection process of zinc phosphate requires the sparingly soluble salt to dissolve. Theoretically, the zinc phosphate would dissolve under the coating at a high enough concentration to allow the phosphate ions to form a film over the metal surface. But the time required to get to that point means that the corrosion cell establishes itself before any protection can take place. The fast-acting nature of the Hexigone products gives phosphate the time to join into the layers being formed over the surface of the metal to quickly create a phosphate complex giving a high level of protection.

What is it that is novel about your products?

Our products are novel and unique to the market, protected by three granted patents. For example, Hexigone's corrosion inhibitor – Intelli-ion® AX1 is the only corrosion inhibitor to employ a 'smart' protection mechanism. Unlike encapsulated inhibitors, Intelli-ion® AX1 is chemically triggered 'on demand,' to release from the active sites, when corrosion ions are detected. The technology hasn't gone unnoticed, and we are already supplying coatings companies worldwide – as well as winning *Materials Performance*'s (MP) 'Corrosion Innovation of the Year Award' in 2021 and The British Coatings Federation 'Sustainable Innovation Supplier Award' in 2022.

When adding 1% Intelli-ion® AX1 as a specialty ingredient within primer systems – coatings manufacturers can save 5-10% on their anti-corrosion additives per kg of paint.

So how would your company be different from manufacturers of similar products?

Our primary objective was to eliminate the need to use hexavalent chromates – making us chromate, phosphate and heavy metal free. Our product is fully organic and not encapsulated but is also a solid that does not dissolve, this adds to the film build of the coatings. We can effectively maintain our customers' performance and boost their cost savings with just small additions of our technology.

Where can your products be used?

With applications across a wide range of industries including construction, oil and gas, marine and aerospace, Hexigone's corrosion inhibitors help to reduce corrosion damage on boats, vessels, planes, oil tanks, buildings and much more. The product is very versatile and can be used in solventborne, waterborne and powder coating applications.

Where is your manufacturing unit located?

Our corrosion inhibitors are manufactured in South Wales, U.K., and in response to growing demand, our plant is currently undergoing significant scale-up.

We dedicate special effort to renewable sourcing and energy efficiency. The

Hexigone is committed to advancing sustainability in the coatings industry by offering solutions that are not only sustainable but also high performance.

manufacturing units are supplied by a 20kW solar PV system which is utilized within the building to offset CO_2 emissions and substantially supplement the power requirements. Hexigone holds the British Gas Zero Carbon certificate which means 100% of the business electricity supplied is backed by renewable energy guarantee of origin certificates. As a result, we can be confident that not only is our product sustainable in nature, but our manufacturing process is kind to the planet, also.

Not only that, we are also taking an end-of-life chemical product, recycling it and transforming it into our product. By repurposing this material, we're effectively diverting it from landfills and incinerators. This commitment to sustainability has been recognized with a Gold rating by EcoVadis®, a leading provider of business sustainability ratings, in 2022 and 2023. So, we really are committed to advancing sustainability in the coatings industry by offering solutions that are not only sustainable but also high performance.

And, to ensure our corrosion inhibitors meet the highest standards, each batch of our product is tested via stringent quality control processes. At Hexigone, every product must pass three rigorous quality control tests with narrow limits for moisture, the concentration of the active ingredient, and particle size. This process takes place in an independent UKAS accredited Quality Control Laboratory where we can ensure every Hexigone product shipped has passed extremely high-quality control standards. We're also ISO 9001 and 45001 certified, these internationally recognized standards reflect our dedication to upholding exceptional quality standards and ensuring the safety and well-being of our employees.

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Hexigone's corrosion inhibitors are manufactured in South Wales, U.K., and in response to growing demand, the plant is currently undergoing significant scale-up.

Which are your major markets worldwide?

Currently, it is Europe, USA, South America, Central America and India of course.

With corrosion costing the world economy trillions every single year, and the global corrosion inhibitors industry valued at more than £5.6bn, the potential overseas market is huge.

Over the last two years, Hexigone has been collaborating with coating manufacturers all over the world. With each company's technical validations coming to an end, Hexigone has exported orders to clients in India, the USA and multiple destinations in Asia and South America. We are also currently in commercial talks with several new customers in North America, Europe and the APAC region.

Asia is set to be a key growth market for the company, we are on the verge of completing major deals with two multi-billion-pound coating giants in the region.

How new India is for you and what kind of a market or growth rate do you see?

India, a leading economy and fast-developing country with over 3,000 paint manufacturers and nearly all the global Tier 1's having a presence in the country, there is no surprise it is a key geographical region for our future growth strategy. We have been here for just over 12 months, still in the nurturing phase, but we're witnessing promising signs. Unfortunately, we can't give you exact figures just yet, but we are seeing a good acceptance and adoption of our products across many sectors.

How do you intend to reach out in a market like India?

For a large and diverse country like India, we needed a local partner. Therefore, we partnered with Ankush Enterprise, headquartered in Mumbai, an excellent organization with a great team, and amazing local connections. Ankush Enterprise is one of the largest importers of specialty chemicals in the region and has 25 years' experience providing multiple verticals with technical solutions. Their deep knowledge of the Indian paints and coatings market, combined with their ability to sell a high-value concept, makes our partnership positioned for success.

What do you feel about the market in India?

The growth opportunity in India is substantial due to its highly innovative market. Unlike many other countries, where innovation can be relatively stagnant, India actively embraces innovation, making India the perfect market for us. We've observed significant R&D activity and openness to new ideas and products. There's a drive for innovation here, with a great mindset and eagerness to pursue improvement. The market recognizes and values the benefits of innovation.

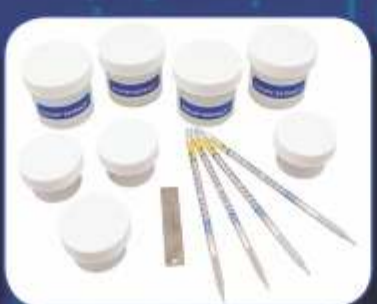
Have you any plans to start manufacturing activity in India?

We are investigating this as a strategy, as the industry is highly energized and exciting. It would make complete sense to have manufacturing to support the regional demand.

LEADER IN PAINTS, COATING & CORROSION TESTING INSTRUMENT & EQUIPMENTS







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EFFCO: Focused on taking its growth to the next level

Family owned and run Pune-based MSME, EFFCO Finishes & Technologies has been specializing and innovating in the manufacture of eco-friendly corrosion protection technology for global markets

EFFFCO Finishes & Technologies Pvt Ltd., manufactures water base and solvent base zinc flake chemistry as per ISO10683 / ASTMF3393 for the automotive, railway, telecom, windmill, solar, and other sectors under the brand name 'ECOMET.' The ECOMET corundum coating technology can be an efficient alternative to the traditional hot dip galvanizing, electroplating, electro galvanizing and other similar finishes. These non-electrolytically applied Corundum zinc flake coatings provide good protection against corrosion. These coatings consist of a mixture of zinc and aluminum flakes, which are bonded together by an inorganic matrix.

The company is a family-owned and run MSME based in Pune and has been specializing and innovating in the sector of manufacturing eco-friendly corrosion protection technology. "The first step was in 2008 when I, along with my wife Mrs Laxmi Dhakane, started our venture with a small facility in Mumbai," said Mr Kalyan Dhakane, CEO, EFFCO. "This was the first step to shape our dream into reality. Here, we started serving in customers with our products and services as per their requirement in different sectors."

The year 2013 saw the company move into Pune, the automotive capital of India, to cater to a larger section of the automotive industry and its relative fastener sector.

PHOTOS: EFFCO

Mr Kalyan Dhakane, CEO, EFFCO Finishes & Technologies Pvt Ltd.

"Our journey has been full of exciting challenges and learning experiences. Starting with a small unit, our company has grown and now has its manufacturing unit, an advanced R&D section and headquarters at Hinjewadi, an industrial hub in Pune," said Mr Dhakane. "We take care to continuously expand our team with expertise in all departments."

The year 2013 saw the company move into Pune, the automotive capital of India, to cater to a larger section of the automotive industry and its relative fastener sector.

In the year 2021 EFFCO Finishes & Technologies added another feather in its cap with a new product range to fulfil various industry needs and catering to over 50 plus national and international customers. By 2022, the company had appointed distributors in Argentina, Netherlands, and Russia as business partners for sales, marketing and distribution for the innovative products made by EFFCO. The company's technologies and products are now being exported all

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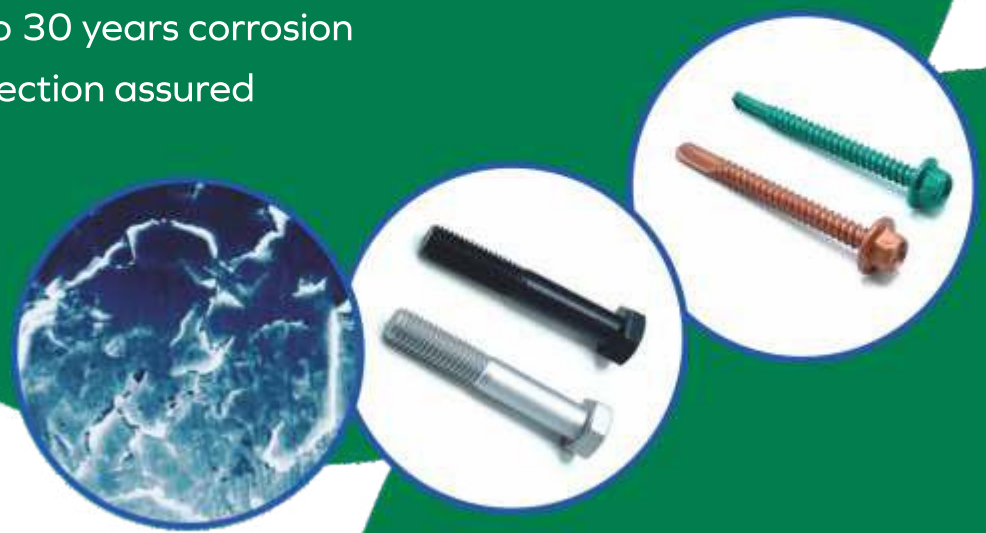

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- ECOMET Corundum One
- ECOMET 500 LC
- ECOMET 500 & 1000
- ECOMET Titanium CDG
- ECOMET Titanium CDG Air Dry
- ECOMET Seal Coat
- ECOMET Black Beauty
- ECOMET Top Colours
- ECOMET Top COF Controller

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around the world including the European Union, North America and Latin America.

EFFCO believes in manufacturing of environmentally friendly new generation corrosion protection technology which replaces the polluted electroplating mechanism stopping the discharge of the pollutants into the atmosphere. Additionally, it does not involve the usage of acids and water, thus giving a greener Earth! EFFCO is constantly using innovation technologies like recycling the rejected, shelf-life expired, and solidified scrap paint to make it re-usable. "This way waste and toxic landfilling and scrapping can be avoided thereby saving national and natural resources," said Mr Dhakane.

Besides, the corundum anti-corrosive coatings lasts for up to 30 years, increasing the shelf-life of metal products and assemblies eliminating the need for frequent treatments and replacements, again saving precious natural resources!

"Environmental friendly coating over metal to protect from oxidation is always a challengeable task to be performed," said Mr Dhakane. "Have you heard of SST up to 6,500 hrs and 30 years of corrosion protection by 15 microns coating thickness over fasteners and metal hardware parts?"

"Well, ECOMET Corundum-Zinc-Al flake based thin layer formation is able to achieve the results and form a non-deferrable protection metallic article even without using any declarable or hazardous substances," emphasized Mr Dhakane. He explained, the coating layer performance is able to exhibit other performances other than red oxidation like hydrophobic, non-stick, cathodic protection, bimetallic protection, sacrificial and resistance to aggressive environments. The process do not require acids or other pollutant based pre-cleaning methods or media making it is completely free from hydrogen embrittlement and environment friendly.

The ECOMET corundum coating technology can be an efficient alternative to the traditional hot dip galvanizing, electroplating, electro galvanizing and other similar finishes.

The coating application plant and machineries are also environmental friendly with dust collectors, VOC extractors, and mist collectors, fume extractors and do not generate larger quantities of effluent waste to be treated.

Due to the controlled coating layer, the thin film offers controlled torqueing and desired coefficient of friction values as per ISO16047. The thin layer of corundum corrodes 0.01 – 0.02 microns per annum under predictive validation tests 6,500 hrs in SST and several exceeding CCT cycles for various industrial applications.

Overseas clients with the EFFCO team being welcomed at their facility in Pune.

This coating can be applied in various industry segments like automotive, renewable energy, infrastructure, engineering construction, rail and mass transportation for wide variety of metal parts including but not limited to fasteners, screws, hardware, springs, clamps, clips, brackets, connecting parts, powder metal parts, casting parts and other metal components.

As a one stop solution for their customer needs, EFFCO also provide turnkey projects for setting up plant and machinery for zinc flake coating technology.

One of their latest creation, the Dry Spin Machine, is not just a technological genius it represents EFFCO's vision for the 'Make in India' initiative. Incidentally, all their products are 'Made in India.'

From planning and concept to design and manufacturing, EFFCO's journey to develop this innovation took two years.

The machine designed specifically for the fastener industry executes three essential processes seamlessly – dipping components into the paint, spinning to apply the paint uniformly, and finally a controlled drying and cooling process.

The company has been a recipient of various awards and recognition at national and international levels. In May 2022, the company and its innovation technology had been awarded for Outstanding Contributions to National

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The company has been a recipient of various awards and recognition at national and international levels.

Development – Atmanirbhar Bharat by All India Achievers Foundation, New Delhi.

The next month June 2022, the company and its innovation technologies was accorded the 'Fastest Growing Indian Company Excellence Award – Global Business Opportunities,' held in Bangkok.

The founder of EFFCO, Mr Dhakane, comes from a humble background of farmers from interiors of Maharashtra (Beed) and now has an experience of more than 30 years in the industry. With his love for nature, he has even set up a bovine care area adjacent to the factory premises.

Said Mr Dhakane, "The Company was founded with a vision to reach momentous heights in the global economy where we can contribute significantly towards producing ecofriendly technology." It was his dream to be one of the only manufacturers of zinc flake coating technology. He has been consistently investing time and effort in building such a technology so that the company can cater to all requirements of the customer with its superior quality products and the new generation smart coating technology. Ably assisted by his children Mr Kunal Dhakane and Ms Ashwini Dhakane, EFFCO is now focused on taking its growth to the next level.

The family is preparing to expand its business activities of manufacturing and supply chain across the globe i.e. Europe, America, Asia Pacific and in China to cater to global OEM client's requirements.

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Handling corrosion a key part of Asset Integrity Management

A culture focused on corrosion management, much like process safety management, must exist within the organization, such that corrosion management is part of the organization's overall management system

Corrosion management is a key part of Asset Integrity Management (AIM). This involves controlling and monitoring material degradation, such as corrosion, erosion, cracks, and fatigue. In fact, AIM is a systematic process that ensures the safety and reliability of assets throughout their life cycle by managing risks and monitoring their technical integrity. Corrosion management practices implemented throughout organizations ensure safer, long-lasting protection of assets such as pipelines; increase return on investment (ROI) while decreasing life cycle costs; and preserving the environment.

It is essential that, a culture focused on corrosion management, much like process safety management, must exist within the organization, such that corrosion management is part of the organization's overall management system. For this to happen there must be cooperation across the organization. First the corrosion professional should broaden his competence with respect to business tools, to include financial decision making, and risk assessment, which is based on expected activity for evaluating corrosion control expenditures.

"One of the things that came up constantly was, 'how well do we understand the real cost of corrosion and corrosion mitigation?' said Mr Christopher Houghton, Business Development Manager, KREFER, an experienced oil industry consultant with over 40 years of experience working with some of the largest and most challenging oilfields in the industry across the North Sea, North America, Caspian Sea and the Middle East, while speaking at the Technical Conference on Corrosion and Coatings at the Middle East Metallurgy, Corrosion & Coatings Expo 2024 (MECOC Expo 2024) held in Abu Dhabi, UAE recently. He said: "After all, if we corrosion professionals do not understand the cost of corrosion, how on earth are we going to convince the management? When we build an asset, the design life is usually anywhere from 20 to 60 years. So, if we are already operating an asset, or developing a totally new project, we have to consider spending money on corrosion mitigation measures for as long as we can."

PHOTOS: 123RF

Come a long way

The fact is, we have come a long way. It's not too long ago when corrosion was viewed as inevitable — assets needed to be replaced because they wore out. It is now recognized by the industry that corrosion management saves money and reduces risk. It's just good business and the perfect thing to do!

The concept of corrosion management may often mean different things to different people and organizations.

While over the past few years the understanding of what corrosion management is has increased, there is still a long way to go, since a considerable number of people and organizations regard the concept of corrosion management to be similar to or the same as corrosion engineering. For example, in the pipeline industry corrosion management often means simply meeting regulatory requirements by carrying out cathodic protection and internal corrosion monitoring programs. These programs are considered a cost to the bottom line and corrosion professionals have to constantly justify these costs, while no consideration is given to cost benefits and ROI. These organizations can broaden their view of corrosion management by considering the economic impact of implementing corrosion engineering versus not implementing. By developing a culture of corrosion management buy-in throughout the organization, the full benefit of corrosion management can be achieved.

The good thing though is that corrosion management concepts are being embraced by some in the industry. They have started to create a corporate culture with buy-in from all levels of management with corrosion being part of the companies' overall management system.

The most obvious advantages of utilizing an asset integrity management approach are:

- ☐ Reduced risks
- ☐ Increased safety
- ☐ Increased reliability
- ☐ Improved environmental performances

Corrosion management a dynamic approach

A large amount of the unforeseen incidents that occur in process plants are related to corrosion and erosion. Corrosion management is therefore essential in order to maintain the integrity of the facility, increasing the level of safety as well as improving cost-efficiency.

Corrosion management is a dynamic approach where we control and monitor an asset's technical integrity related to material degradation such as corrosion, erosion, cracks and fatigue. It is a part of the overall management system, and is described in a Corrosion Management Strategy. A corrosion management strategy aims to define roles and responsibilities and ensure ownership, ensure focus on high risk system and identify barriers and Key Performance Indicators (KPI).

"Corrosion is a real and true threat across our assets. They vary from place to place. Sometimes it is under the surface not visible for us, sometimes, it is visible. One of the first line of defense in corrosion mitigation is the coating," emphasized Mr Omar El Sinnary, Manager, Engineering Services (Inspection & Corrosion), ADNOC Gas. "It is a subject very close to my heart! Coating failures do occur leading to tremendous losses. These can happen for various reasons starting from surface preparation, selection of a proper coating system, its application, the environment, say surface vibration, etc."

"Coating may seem a simple thing, but one of the major

elements that contribute to asset integrity and safety over the design life. One also has to be doubly sure about the quality of application, the talent and experience of the contractor and his commitment to the job. The environment too plays a crucial part during the paint application. One has also to make sure about the humidity, the dust factor, the temperature… For example, there is a certain constraint in regard to the coating application especially in higher temperatures. Then, whether the asset area being coated is insulated or non-insulated, the metallurgy or material of the asset, etc, etc." said Mr El Sinnary.

Proper surface preparation

"As essential as the coating, is proper surface preparation," said Mr El Sinnary. "Proper surface preparation extends the life of the coating application and hence the life of the asset. The problem is that surface preparation and coating application is usually scheduled at the end of the maintenance operation cycle of maintenance operations and need to be rushed!"

"To overcome this, systems are being developed with shorter application times and cycles," said Mr El Sinnary. "Another factor is the struggle to focus on choosing the best coating system, and this might not be the cheapest. As part of the industry, I can tell you the pain of corrosion and the problems it creates for us due to the cost of production loss, the down time, the time taken for putting the plant back into normal operation. So, it really matters! The next factor is the absolute correct way of application of the coating in accordance with the specifications mentioned during the project phase," said Mr El Sinnary. "Some of them are very complicated, multi-layer systems that require a proper environmental chamber during application, proper drying before the second coat, etc, etc. By doing all this in a construction yard environment, we can achieve good results and a very high quality coating. Again, the moment we have to do a repair job in the field during the lifetime of the asset, we will never achieve the same quality of coating again. So, if our coating lasts say 10 to 15 years, you would be lucky to get half that duration when reapplied in a field situation. So with the right selection of coating, with the right plan, with the right surface preparation, definitely one will end up with an intact or robust system in place."

In fact, surface preparation is the key for coating life. 70 % coating failure is due to poor surface preparation or the life of the coating depends 70 % on surface preparation.

Corrosion auditing is one way of investigating the worthiness of corrosion control techniques and suggested suitable economic method to control corrosion. It is inspecting the corrosion sites, analyzing the reasons for corrosion, suggesting methods of prevention, doing a cost analysis of prevention and losses due to corrosion.

Challenges on the field

"It's a real challenge on the field," said Mr Karim G. Said, Technical Superintendent, Asset Integrity Services, OQ Downstream, Sultanate of Oman. "That is during the turnaround we have very limited time and very limited resources. We have to return the asset back to operation and normalize the plant in a very short period. And this at times does not allow us to go for the final curing of the coating. Of course, there are solutions like nowadays you can get coatings with lesser curing times. Or say during winter, one may use a dryer to increase the temperature, etc."

"But after all during a maintenance activity, it is not always possible to achieve the desired effect," noted Mr Said. "In the first place, the coating application is the last component in the chain of any maintenance activity. After the maintenance handover, there is considerable pressure on the application team to finalize it at the earliest in order to return the asset back in operation."

"My advice is to go for a proper plan," emphasized Mr Said. "Most companies have an established standard and procedure where we say categorize the coating application and the system based on the environment. Planning is very important because we know the system, what is the duration required for painting per square meter and adapt resources, logistic and application to be in line with the standard plan."

"A good corrosion management system is good for industry and we need to work at reaping the benefits. Corrosion engineers should

regularly speak to management in the terminology of their science and technology. They need to adopt the language of their management and regularly expand the conversation to include discussions of safety, ROI, and Life Cycle Cost (LCC). Corrosion threats should be mitigated to a point where the expenditure of resources is measured against the benefits gained. To determine whether a corrosion management investment is appropriate, it can be compared to the potential corrosion consequence through an ROI analysis, which often includes inspection and other maintenance costs," emphasized Mr Said.

Four steps of a continuous cycle

There are basically four steps in a corrosion management cycle.

Planning: A detailed plan is established based on results from a risk assessment, and includes inspection, monitoring and mitigation programs.

Execution: Implementation of defined and planned activities and programs as well as identifying KPIs in order to measure critical parameters, and to ensure corrosion control.

Reporting / measure: Measure and evaluate KPIs and data from inspection activities as well as monitoring and mitigation activities, and prepare status reports and improvements. Collect, compare and present data through a corrosion management information system.

Improve: Review the effectiveness of the corrosion management programs, and improve the corrosion management activities and take necessary actions.

Standards and guidelines

Standards provide guidelines to organizations wishing to develop a CMS. NACE Task Group (TG) 564 has developed a 'Standard Framework for Establishing Corrosion Management Systems.' It is based on ISO-55000 management standards and a framework developed in NACE's IMPACT Study, which examines the role of corrosion management in industry and government and establishes best practices.

The concept of corrosion management may often mean different things to different people and organizations. While over the past few years the understanding of what corrosion management is has increased, there is still a long way to go, since a considerable number of people and organizations regard the concept of corrosion management to be similar to or the same as corrosion engineering. These organizations can broaden their view of corrosion management by considering the economic impact of implementing corrosion engineering versus not implementing. By developing a culture of corrosion management buy-in throughout the organization, the full benefit of corrosion management can be achieved.

The acceptance of the CMS concept may be likened to the acceptance of today's safety management culture. A few decades ago, safety management merely dealt with occupational safety, which considers relatively high occurrences of slips, trips, and falls, whereas process safety (low likelihood of occurrence and high consequence) received little attention. After a few major process safety-related accidents, a culture developed throughout the oil and gas and refining and petrochemical industries, where safety has become an integral part of the organizations' management systems. All levels of the organizations now speak the same safety language and have the same goal to improve both occupational and process safety. It is our hope that corrosion will go through the same transition and become part of organizations' corporate cultures.

Life prediction of a component – a sure way to plant safety

Prof A. S. Khanna, Chairman, SSPC India

Chemical process industries, including refineries and petrochemical plants, have several critical components, which are either exposed to extreme chemical environment or at temperatures, where there is a possibility of the environment to react with the material component. To run a plant with no or minimum failures, it must follow a suitable material selection, which comply with the life of the plant

Introduction

One of the requirements of various establishments is the safety of the plant and the personnel involved. Further, no plant manager would want any unwanted plant shutdown due to the failure of the plant component, and then spend time for its replacement.

Material selection is the first step once a rough design of the plant is ready. Based on the selection, one can fix the thickness of different components and also the environment, which will help predict the life of the component.

Any chemical or process plant has three main categories of materials:

☐ In the case of materials used for structural application of the plant, more than 80 percent of this is normal steel. Many of these structural steels usually are exposed to atmospheric environment. Thus, based on whether the environment is from C1-C5 type, corrosion protection can be controlled by a paint coating suitable in that environment. However, additional precautions are needed if the pollution due to the plant is also affecting the structural steels. For structural steels, one either uses galvanised steel or carries out painting after the fabrication. If in the initial stages, the members are properly shotblasted followed by a suitable paint, for example, an epoxy intermediate coat after a Znbased primer coat with a top layer of polyurethane, it will give a life of six to eight years. Use plastics, polyvinyl chloride (PVC) / corrugated polycarbonate (CPC) or fibre reinforced plastic (FRP) wherever possible in place of metallic materials where aqueous corrosion is an issue. This prevents material degradation to a larger extent.

PHOTOS: 123RF

☐ For the actual plant component, the material requirement can be different and can be based on the environment and temperature needed. It can be a low-alloy steel, stainless steel or a superalloy. For example, for a component exposed to water / steam system, it is always advisable to use ferritic steels or low-alloy steels. Austenitic material should not be exposed to water / steam environment.

For seawater circulation or condenser cooling type of applications, either Monel (Ni:Cu in 70:30 ratio) or duplex / super austenitic / ferritic stainless steels can be used. For high temperature applications, the choice of the alloy can be made depending on the temperature. It must be known whether the temperature is above 900°C or below. For temperatures below 900°C, chromia based alloys can be used, and for temperature above 900°C, alumina based alloys can be used.

☐ Whether the environment is sulfur free or containing sulfur, also decides the choice of the alloy. An environment with strong sulfur activity must be chosen with high Cr content. Pure oxidation environment can have low-Cr content of an alumina forming alloy. Temperature requirement also needs the selection of material based on its strength requirement at that temperature as well as its creep properties. Standard austenitic stainless are good up to 750°C, and high-alloy stainless steels can go up to 900°C. For temperature above 900°C, it is advisable to use superalloys.

How to decide their life?

Once the materials have been selected, how does one make sure that they will give the expected life or not? Life prediction becomes an important aspect. Generally, it is based on factors such as corrosion allowance, past experience (own or reported), fracture mechanic approach, etc. But, in practice, one finds that there are several questions that need to be answered on such a prediction. For example, fracture mechanics is advocated as the primary mechanism of predicting failures.

However, KIC (fracture toughness test) is usually irrelevant until defects have progressed significantly into the material. The larger problem is preventing the penetration at the outset; predicting and preventing the occurrence of such initial penetrations is primary. Another example is 'corrosion allowance' to account for future corrosion damage. Unfortunately, the corrosion allowance does not account for any of the localized corrosion processes and various flow-accelerated corrosion phenomena. Thus, corrosion allowance is misleading. Many a times one predicts corrosion assuming the environment is pure water. This, however, can give wrong prediction as many chemical species present in ppm level in the relatively pure water can concentrate due to heat transfer and boiling on surfaces. Unwarranted reliance on inappropriate accelerated tests has led to some major mistakes in the selection of materials and design, as in many cases, the results of accelerated tests are difficult to be extrapolated due to change in mechanism of corrosion. The difficulty of communication between designers and those who understand predicting performance has often led to lack of serious consideration of potential failures.

A new approach

To overcome some of these problems, Roger Staehle developed the Corrosion Based Design Approach (CBDA) and the Location for Analysis Matrix (LAM) as means for providing a rigorous approach to quantify and organize the necessary information for prediction. Many hurdles come in the way while developing an approach of prediction. There are some inherent problems that question life prediction such as continuous change in conditions with time, attack by multiple environments on the same component, occurrence of corrosion by components, which are not considered as part of environment, etc. For example, corrosion of heat exchanger tubes by Cu ions contamination from condenser tubes. Lack of knowledge of field experience and statistical nature of corrosion-related failures are inherent as they involve diverse inputs from the material and environment exhibits 'broad scatter'. In discussing the dependencies of the steps in the CBDA as well as in the LAM, the term 'principal variables' is used. The seven principal variables that affect the modes of corrosion are: temperature, stress, pH, electrochemical potential, concentration of species, alloy composition and alloy structure.

CBDA steps

The following are the ten steps of CBDA:

Environmental definition: 'Defining the environment' is the most important step in predicting performance. It is also the step that is given least attention and for which there is little understanding by the technical community. It is important to define the environment from all possible angles, which can cause

damage to the material, location and even chronology of the attack to be considered.

Material definition: It is important to define material completely; steel means, low alloy, normalised or tempered, micro alloyed; stainless steel means which type and composition, including the extent of tramp elements impurities, inclusions, etc.

Mode definition: The 'mode' of corrosion refers to the morphology and avenues by which materials are corroded or degraded. Even the 'submode', which refers to the same mode in the same material in somewhat the same environment, involves different dependencies on the principal variables. A good illustration of two sub-modes is the stress corrosion cracking (SCC) that occurs in alkaline and acidic environments; both are of the SCC mode but depend differently on principal variables.

Super-position: It has to be considered whether the variables that describe environments on the surface are at least to some extent coincident with those that describe the various possible modes of failure. If such coincidence occurs, then the materials, designs or environments may need to be modified before any further steps are taken.

Define failure: A clear definition of failure for the system may be considered. In some cases, even tarnishing of the surface could be a failure, while in the other case, unless the material cracks, failure would not be considered.

Statistical definition: This is one phenomenon that puzzles many in the case of

heat exchanger boiler tube consisting of hundreds of tubes. If one finds a small failure in one of the tubes, it can be said that many materials and environmental parameters look uniform throughout the component. However, some micro mechanisms may be different, such as the local microstructure of the steel may have some inclusions, or inhomogeneity in compositions, slight variations in the microenvironment, etc. The best way to confirm this factor is not to conclude on the basis of one sample, but at least three samples.

Accelerated testing: The main objective of the accelerated testing is to estimate when the failure would occur under the conditions of the engineering application. Many of the tests are made accelerated, either by increasing the temperature or by carrying out the tests at higher concentration. Both these factors can give misleading information if the mechanism of failure changes either of these – temperature or concentration. Hence, acceleration must be limited to a stage where there is no change in the mechanism of failure from the actual

Prediction: Prediction involves utilizing the first seven steps of the CBDA to determine whether the design life objective can be reached.

Monitoring and feedback: It is not always practical to produce a perfect prediction. It may not be desirable in some cases. However, it is practical to monitor performance. Such monitoring usually includes a combination of periodic inspections and continuous monitoring. This information is then compared to predictions or with certain limits to assess the approach to failure. Results from monitoring are then fed back to operators and designers to determine whether modifications are necessary.

Fix: Based on the results from above, together with comparing these results from the predictions, actions are developed to prevent or minimize the occurrence of serious failures. Such actions may involve any of the following: ☐ Modify the environment to add inhibitors or to change the corrosivity; ☐ Change the design or materials; ☐ Add monitoring equipment.

Conclusion

Life prediction of components is not simple because of several parameters that affect individually. On certain occasions, the effect is synergistic. Any predictions based on one factor are not complete in true sense, though it might help in predicting some behaviour of the component. The use of laboratory testing or accelerated tests help understand the specific behaviour but is not a true representation of the actual failure, which occurs at relatively slow rates. The best way, therefore, is to use periodic monitoring data, experience and post analysis of any failure on the same component or which is reported in literature on the same material, basic properties of raw materials, alloy composition and severity of the environment.

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High-performance coating protects tanks at biopolymer production plant

At a biopolymer production plant in Scotland, UK, a high-performance, anti-corrosion coating was used to coat the internal lining of three tanks, protecting them against aggressive, acidic substances for the long term

At a chitosan production plant in Scotland, UK, a high-performance, anti-corrosion coating was used to coat the internal lining of three tanks, protecting them against aggressive, acidic substances for the long term. Given the important role the tanks play in the process of turning large amounts of shellfish by-product into the biopolymer chitosan, it was imperative that these assets were safeguarded against future damage with the use of a high-performance coating.

Production of biopolymer from shellfish shell by-product

CuanTec has created a circular economic business model designed to mitigate the carbon footprint created from the unnecessary disposal of unused shell within the shellfish industry and converting it into valuable chitosan products.

Indeed, the carbon footprint of food waste is staggering. According to data from the UN, food waste contributes to 8% of global greenhouse gas emissions. This means that if food waste was a country, it would be the third-largest emitting country in the world.

At COP28, negotiators from 200 Parties agreed on the science from the Intergovernmental Panel on Climate Change (IPCC) that global greenhouse gas emissions need to 'be reduced by 43% by 2030,' in order to limit warming to 1.5°C (2.7°F) by 2050, in line with the Paris Agreement. With this in mind, circular business models such as that offered by CuanTec, play an important role in mitigating carbon footprints and limiting global warming to 1.5°C (2.7°F).

Figure 1: High-performance coating required to protect tanks against corrosion.

PHOTOS: BELZONA

Figure 2: Tank used in process of creating biopolymer, chitosan.

Safeguarding key assets

Considering the important role businesses such as CuanTec play in this decarbonization and up cycling journey, it is absolutely fundamental that key assets within these types of businesses, such as machinery, equipment, buildings and structures, are safeguarded to an excellent standard. Otherwise, damage and wear can jeopardize the integrity of assets, and therefore this can undermine the environmental benefits these types of business models offer.

For example, the carbon footprint of steel is phenomenal: for every tonne of steel produced, nearly double the amount of carbon dioxide (CO_2) is released back into the atmosphere. Therefore, if a steel asset becomes damaged, not only can this

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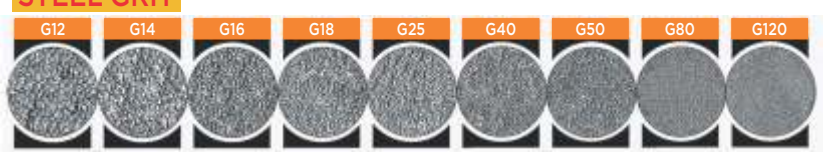

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Figure 3: Application of high-performance coating, Belzona 1391T.

lead to costly replacement fees, but this process can also incur a hefty carbon footprint as well.

As such, numerous industries invest in industrial repair composites and high-performance coatings in order to bypass this replacement process. In this way, polymeric technology mirrors the circular economic model of businesses like CuanTec, as this technology can repair, protect and even intrinsically improve assets that would otherwise be decommissioned and sent to landfill. Thus, it could be argued that polymeric technology has a critical part to play in the decarbonization of multiple sectors, supporting a net zero by 2050 pathway.

Pre-used tanks in need of rigorous corrosion mitigation measures

CuanTec wanted to deploy three steel tanks in their process of turning shellfish shell into high quality, traceable chitosan products, made to the exacting technical specifications of their customers. The tanks had already been in use elsewhere, but were otherwise still in good condition. In order to ensure the tanks were capable of withstanding the harsh chemicals they would come into contact with, the Customer decided to invest in some polymeric technology to protect them.

System specification: High performance coating, Belzona 1391T

Following an inspection from Clive Leadbitter, Senior Field Sales Engineer at authorized Belzona Distributorship, Belzona UK, the high-performance coating, Belzona 1391T, was specified. As this system is capable of protecting assets against corrosion in extremely aggressive and acidic environments, this was the ideal solution for the steel substrate for this specific application.

In addition, as Belzona 1391T can be applied in situ without the need for hot work, this would ensure that the application was carried out as quickly as possible, whilst minimizing the health and safety risks that can arise when hot work is involved.

Application procedure

Commenting on the application procedure, Clive said: "Surface preparation was carried out by grit-blasting. Following this, using a stiff-bristled brush, two coats of Belzona 1391T were applied at a thickness of 450 μm (17.72 mil) per coat. Once the application had cured within the space of 24 hours, the application was complete."

Polymeric technology supports net zero by 2050 pathway

Considering the important role businesses like CuanTec play in carbon mitigation, it is absolutely critical that key assets are protected for the long term against damage such as erosion and corrosion. As such, polymeric technology plays an important part in safeguarding these assets, and therefore contributing to the net zero by 2050 pathway.

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Stringent government regulations mandating the use of fire protection coatings contribute to market growth

The escalating pace of industrialization has accentuated safety concerns, driving the adoption of fire protection solutions

In the realm of industrial safety, the application of fire protection coatings plays a pivotal role in safeguarding steel structures against the devastating impact of fire incidents. Primarily, two categories of fire protection coatings dominate the market landscape: intumescent coatings and cementitious coatings. Intumescent coatings, also known as passive fire protection (PFP) coatings, expand upon exposure to heat, forming an insulating char that mitigates heat transfer to the steel substrate. These coatings find extensive applications in industries vulnerable to hydrocarbon hazards, such as the petrochemical and oil & gas sectors, as per a report by Persistence Market Research.

Understanding intumescent coatings

Intumescent coatings can be further classified into cellulosic fire protection products and hydrocarbon fire protection products. The former is tailored for steel components in buildings, containing combustible materials derived from sources like plastics and wood. On the other hand, hydrocarbon fire protection products are designed for structures exposed to hydrocarbon-based fire risks. Despite being solvent-free, epoxy intumescent coatings in the hydrocarbon category produce dense chars that adhere well to steel surfaces even under turbulent fire conditions.

Market dynamics

The global fire protection coatings market is propelled by several factors. Firstly, the escalating pace of industrialization has accentuated safety concerns, driving the adoption of fire protection solutions. The surge in construction activities, coupled with increasing disposable income, amplifies the demand for fire protection coatings across diverse sectors like building and construction, automotive, and aerospace. Furthermore, stringent government regulations mandating the use of fire protection coatings in industries such as oil & gas and chemicals contribute to market growth.

Changing standards for fire safety, coupled with environmental considerations, are poised to reshape the market landscape. Advancements in technology, particularly in nanotechnology, have expanded the application scope of surface and fire protection coatings. Despite these growth drivers, concerns regarding the environmental impact of fire protection coatings and their widespread usage pose challenges to market expansion.

PHOTO: 123RF

Market segmentation

The fire protection coatings market is segmented based on product type and application. Product types include cementitious coatings and intumescent coatings, further categorized into cellulosic fire protection and hydrocarbon fire protection. Application areas span across aerospace, oil and gas, marine, electrical and electronics, automotive & transportation, building and construction, textile, furniture, and others.

Regional outlook

While Europe and North America boast well-established markets for fire protection coatings, the Asia-Pacific region presents significant growth opportunities. Rapid industrialization and infrastructural development in emerging economies fuel the demand for fire protection solutions. Moreover, the adoption of stringent safety regulations, akin to developed economies, further propels market growth in the Asia-Pacific region.

Key market participants

Several prominent players operate in the global fire protection coatings market, including Fire Protection Coatings Limited, Akzo Nobel N.V., Sika Limited, 3M, and BASF SE, among others. These players continually innovate to develop efficient

and environmentally friendly coatings, catering to the evolving needs of end-users.

Market trends and future prospects

The fire protection coatings market is witnessing several notable trends that are poised to shape its trajectory in the coming years. One significant trend is the integration of nanotechnology, which has led to the development of more efficient and versatile coatings. Nanotechnology enables the formulation of coatings with superior fire resistance properties, enhanced durability, and reduced environmental impact.

Moreover, there is a growing emphasis on eco-friendly formulations and sustainable manufacturing practices within the coatings industry. Market players are investing in research and development initiatives to engineer bio-based and low-VOC (volatile organic compound) coatings that comply with stringent environmental regulations.

Another emerging trend is the customization of fire protection coatings to meet the specific requirements of diverse end-user industries. For instance, coatings tailored for the aerospace sector may prioritize lightweight and heat-resistant properties, whereas coatings for the automotive industry may focus on impact resistance and aesthetic appeal.

Furthermore, advancements in fire testing protocols and standards are driving the demand for coatings that offer superior fire performance and compliance with regulatory requirements. Manufacturers are investing in testing facilities and certifications to validate the efficacy of their products, thereby enhancing market credibility and consumer confidence.

Challenges and opportunities

While the fire protection coatings market presents lucrative opportunities for growth, it also faces several challenges. One of the primary challenges is the adverse environmental impact associated with certain coating formulations. The use of hazardous chemicals and the generation of toxic by-products during manufacturing and application processes raise concerns about pollution and health risks.

Moreover, the high cost of advanced fire protection coatings may deter widespread adoption, particularly in emerging economies with budget constraints. Market players need to strike a balance between product performance and affordability to address the needs of diverse customer segments.

However, these challenges also present opportunities for innovation and market differentiation. Companies investing in research and development to create eco-friendly formulations and cost-effective solutions stand to gain a competitive edge. Collaborations between industry stakeholders, including manufacturers, regulatory bodies, and research institutions, can foster knowledge sharing and accelerate technological advancements.

Conclusion

In conclusion, the global fire protection coatings market is driven by evolving safety regulations, technological innovations, and shifting consumer preferences. Market participants must navigate a dynamic landscape characterized by regulatory compliance, environmental sustainability, and technological advancements. By embracing innovation, adopting sustainable practices, and collaborating across the value chain, industry players can capitalize on emerging opportunities and drive growth in the fire protection coatings market.

Feature courtesy: ***Shantanu Hasabnis****, Marketing Executive, Persistence Market Research Pvt Ltd; e-mail: shantanu@persistencemarketresearch.com*

Oregon State University researchers advance pigment chemistry with moon-inspired reddish magentas

An Oregon State University (OSU) researcher who made color history in 2009 with a vivid blue pigment has developed durable, reddish magentas inspired by lunar mineralogy and ancient Egyptian chemistry.

Mas Subramanian, distinguished professor of chemistry, and collaborators at OSU report the findings of the study, funded by the National Science Foundation, in the journal *Chemistry of Materials*.

The new pigments, which could be used as energy-efficient coatings for vehicles and buildings, are based on divalent chromium, Cr2+, and are the first to use it as a chromophore; chromophores are the parts of a molecule that determine color by reflecting some wavelengths of light while absorbing others.

“To date, no earth-based mineral has been reported to contain chromium in the divalent state as one of the components,” said Subramanian, the Milton Harris Professor of Materials Science in the OSU College of Science. “However, the analysis of lunar mineral samples collected from Apollo missions showed the occurrence of chromium in the divalent state.”

Divalent chromium has the same number of unpaired electrons as trivalent manganese, the chromophore responsible for the intense color of YInMn blue, which Subramanian's team discovered 15 years ago. The Shepherd Color Company licensed YInMn blue for use in a wide range of coatings and plastics, and it also inspired a new Crayola crayon color: Bluetiful.

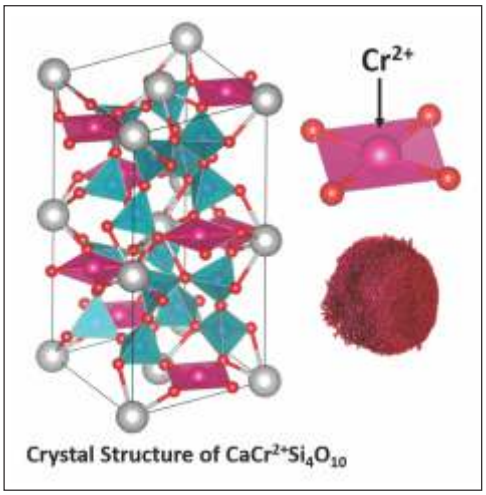
When YInMn blue was discovered, researchers had been experimenting with new materials that could be used in electronics applications and mixed manganese oxide – which is black in color – with other chemicals, then heated them in a furnace to nearly 2,400 degrees Fahrenheit.

One of their samples turned out to be a brilliant blue, named YInMn blue after the component elements yttrium, indium and manganese. It was the first blue pigment discovery in two centuries and a huge advance in safety and durability as well as vividness.

In the new study, Subramanian, research associate Jun Li and graduate student Anjali Verma were inspired by the divalent copper that serves as a chromophore in Egyptian blue, which is the world's first known synthetic pigment and dates to more than 5,000 years ago.

The researchers replaced the divalent copper in Egyptian blue with divalent chromium, leading to durable, reddish magenta pigments. To stabilize the divalent chromium on Earth, researchers maintained high temperatures, almost 2,500 degrees Fahrenheit, under high vacuum during the synthesis that started from chromium metal, chromium trioxide and other chemicals.

“Most of the magenta-colored pigments used today are organic chemicals and suffer from stability issues when exposed to ultraviolet rays and heat from the sun because they can break down organic chemical bonds,” Subramanian said. “Inorganic magenta pigments are rare, and most require a significant amount of cobalt salts that are hazardous to both humans and the environment.”



Crystal Structure of $CaCr^{2+}Si_4O_{10}$

IMAGE: OREGON STATE UNIVERSITY

The magenta pigments developed by OSU researchers are thermally and chemically inert because of their high preparation temperature and remain unaltered structurally and optically upon exposure to acid and alkali, the authors note.

In addition, unlike pigments that contain cobalt, the chromium-based magenta pigments are highly reflective of heat from the sun – meaning they have a cooling property that would lead to energy savings for cars and structures coated in them.

“Most pigments are discovered by chance,” Subramanian said. “The reason is because the origin of the color of a material depends not only on the chemical composition but also on the intricate arrangement of atoms in the crystal structure. So someone has to make the material first in a laboratory, then study its crystal structure thoroughly to explain the color.”

Despite recent advances in quantum mechanical theories and computational methods, predicting a crystal structure that will produce an intense inorganic pigment of a desired color is still elusive, he added.

“We got lucky the first time with YInMn blue, and now we are coming up with some fundamental chemical and crystal structural design principles to rationally create new pigments,” he said. “Determining the key structural ingredients required for making vivid colors should allow for shorter times between pigment discoveries. Science doesn't always follow a prescribed path, but we're exploring pigments with divalent chromium as a chromophore in diverse coordination environments in crystal structures of various inorganic compounds.”

The NSF funding for the just-published study was a special grant earmarked for high-risk, high-reward research. The grant is known by the acronym EAGER, which stands for Early Concepts Grants for Exploratory Research.

WEG and Nexa establish a partnership for the reuse of mining waste in the development of liquid anticorrosive paints

WEG has partnered with Nexa, one of the world's largest zinc producers, to develop liquid anticorrosive paints with the addition of jarosite, a waste derived from zinc metallurgy, notes a press communiqué. The new solution will focus on carbon steel and cast-iron surfaces, with the capacity expected to provide protective effects, reducing the use of conventional raw materials and promoting circular economy in the industry. The initial results of the project and preliminary studies indicate that the paint has high compatibility with epoxy, alkyd, and acrylic resins, with effective corrosion protection.

The partnership between the two companies will last for three years and involves an investment of Brazilian Real (R$) 4 million, raised from the Financier of Studies and Projects (Finep), a public agency for the promotion of Science, Technology, and Innovation. The goal is to develop innovative solutions through this initiative, leveraging WEG's expertise in paints and Nexa's expertise in mining and metallurgy waste beneficiation.

"WEG promotes technological partnerships through open innovation to accelerate development and generate innovative solutions, as in this case where the development of a coating that can harness the anticorrosive potential of jarosite, a mineral generated in the zinc beneficiation process, is being studied," says Rafael Torezan, Managing Director of WEG Coatings Business Unit. "This important initiative with Nexa demonstrates WEG's commitment to developing innovative and sustainable solutions," he adds.

The use of jarosite as a pigment originated at the Federal University of Minas Gerais (UFMG), with the support of Professor Fernando Cotting, who conducted initial tests and presented the viability of paint development.

"The transformation of mining and metallurgy towards a sustainable path is possible, and projects like this demonstrate it. Circular economy is the best alternative for disposed waste, and Nexa's Mining Lab platform promotes and makes feasible this type of development, aligned with the best ESG practices. The partnership with WEG further accelerates, promoting development between supplier and customer, and the project already begins with a well-defined chain," says Caio Van Deursen, innovation manager at Nexa.

With the continuous supply of jarosite, Nexa will reduce mineral waste levels at the Juiz de Fora unit and continue its circular economy, decarbonization, positive legacy, productivity, and safety agenda, which are part of the company's ESG strategy.

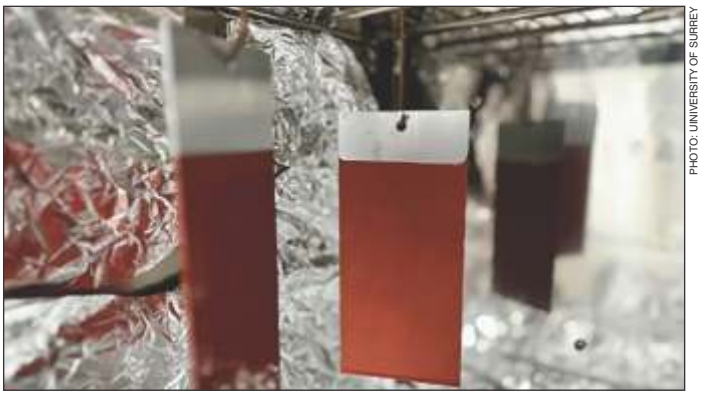


PHOTO: UNIVERSITY OF SURREY

The initiative, developed by Nexa's Mining Lab, studies the utilization of jarosite, the most generated waste in zinc metallurgy worldwide.

Nexa Resources is one of the largest zinc miners in the world, as well as a producer of copper and lead. With over 65 years of experience in the mining and metallurgy sectors, it operates in Brazil and Peru, with a headquarters in Luxembourg, and supplies its products to all continents worldwide. Its employees work daily focused on building the mining of the future, aiming to be increasingly sustainable, innovative, and with the best practices in safety and respect for people and the environment.

Founded in 1961, WEG is a global electro-electronic equipment company, operating in the capital goods sector a with focus on electric motors, gearboxes and drives and controls, energy generation and transformers, electrification products and systems, automation and digitalization.

WEG stands out in innovation by constantly developing solutions to meet the major trends in energy efficiency, renewable energy and electric mobility.

With manufacturing units in 15 countries and present in more than 135 countries, the company has more than 40,000 employees worldwide.

Blastline Institute launches the ICA certified training program for blasters and painters

The coating industry is a highly technical field that requires skilled personnel to perform quality surface preparation and protective coatings application. The AMPP Industrial Coating Application (ICA) program is a comprehensive training program based on the NACE No 13/SSPC-ACS-1 standard that sets the criteria for a qualified workforce that can meet the contractors' and facility owners' need for consistent, quality work completed accurately, safely, and at a reasonable cost. Blastline Institute (blastlineinstitute.com), based in Kochi, Kerala has launched this AMPP (formerly NACE International) ICA certified training program for blasters and painters.

"With five-day duration, the course offers a comprehensive exploration into the principles and practices of industrial coating application," said Mr Abby Joseph Panikulam, Manager – Operations, Blastline Institute. "Designed for professionals seeking to advance their expertise, this program combines theoretical knowledge with practical application; ensuring participants are well-equipped to meet industry standards. With a focus on quality, safety, and efficiency, this course is an essential step for those committed to excellence in the field of industrial coatings."

A digital 3D painting simulator is added to this Course for enhanced experience and faster skill development in additions to hands on workshop sessions.

The course curriculum for the Surface Preparation (Blaster) segment includes: Surface preparation fundamentals; examining the substrate; pre-cleaning; ambient conditions; hand and power tool cleaning; dry abrasive blasting; the abrasive blasting process, and abrasive types and properties.

The Coating Application (Painter) module features: Reasons for coating; coating fundamentals; curing mechanisms; receiving and storing paints / thinners; mixing and thinning paints; coating application considerations; coating application equipment; and monitoring and measurement. The course eligibility is SSLC/+2.

PHOTO: 123RF

Blastline Institute is a specialized technical learning establishment, with a vision to train, and educate individuals, and upgrade their skill set in industrial grade applications. They are experts in providing seamless industrial learning experiences to quality inspection professionals in marine, oil and gas, and other heavy industries.

Highlights of the courses include a well-detailed study plan, practical learning experience, and an advanced learning facility which has drawn students from all over the world. A value rich feature of Blastline Institute is the prolific, profound and progressive learning experience provided by the experienced and skilful members of their faculty department. Around 70% of the total students choose to join our Blastline Institute from within the Middle East job sites, to fast-track their skillset and technical knowledge in the related field. Students get a multicultural learning experience at Blastline Institute certified by TWI (The Welding Institute), ASNT (American Society for Non Destructive Testing), Bureau Veritas, and other course providing institutions.

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Phone: +91 484 2408477, 2537344, Mobile: 8086990080
Email: info@blastlineinstitute.com
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Date	Course	Place	Organizer	Contact Details
JUL 15 – 19, 2024	BGAS Grade 2 Painting Inspector	Kochi	Blastline Institute	T: (484) 2408477 E: info@blastlineinstitute.com W: blastlineinstitute.com
JUL 22 – 26, 2024	CSWIP 3.1 Senior Welding Inspector Level II	Kochi	Blastline Institute	T: (484) 2408477 E: info@blastlineinstitute.com W: blastlineinstitute.com
JUL 29 – AUG 02, 2024	CSWIP 3.1 Senior Welding Inspector Level II	Kochi	Blastline Institute	T: (484) 2408477 E: info@blastlineinstitute.com W: blastlineinstitute.com
AUG 05 – 09, 2024	BGAS Grade 2 Painting Inspector	Kochi	Blastline Institute	T: (484) 2408477 E: info@blastlineinstitute.com W: blastlineinstitute.com
AUG 05 – 09, 2024	BGAS Grade 3 Painting Inspector – Offshore	Kochi	Blastline Institute	T: (484) 2408477 E: info@blastlineinstitute.com W: blastlineinstitute.com
AUG 12 – 17, 2024	CSWIP 3.2 Senior Welding Inspector Level III	Kochi	Blastline Institute	T: (484) 2408477 E: info@blastlineinstitute.com W: blastlineinstitute.com
AUG 19 – 23, 2024	CSWIP 3.1 Senior Welding Inspector Level II	Kochi	Blastline Institute	T: (484) 2408477 E: info@blastlineinstitute.com W: blastlineinstitute.com
AUG 19 – 24, 2024	Basic Coatings Inspector / CIP Level 1 Course	Kochi	Corcon Institute of Corrosion	T: (022) 24106494 E: info@corrosionindia.org W: corrosionindia.org
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SEP 02 – 06, 2024	CSWIP 3.1 Senior Welding Inspector Level II	Kochi	Blastline Institute	T: (484) 2408477 E: info@blastlineinstitute.com W: blastlineinstitute.com
SEP 02 – 07, 2024	Basic Coatings Inspector / CIP Level 1 Course	Vadodara	Corcon Institute of Corrosion	T: (022) 24106494 E: info@corrosionindia.org W: corrosionindia.org
SEP 09 – 13, 2024	BGAS Grade 2 Painting Inspector	Kochi	Blastline Institute	T: (484) 2408477 E: info@blastlineinstitute.com W: blastlineinstitute.com
SEP 09 – 13, 2024	Certified Coatings Inspector / CIP Level 2 Course	Vadodara	Corcon Institute of Corrosion	T: (022) 24106494 E: info@corrosionindia.org W: corrosionindia.org
SEP 16 – 18, 2024	Peer Review – CIP 3 Senior Certified Coatings Inspector Course	Mumbai	Corcon Institute of Corrosion	T: (022) 24106494 E: info@corrosionindia.org W: corrosionindia.org
SEP 23 – 27, 2024	CSWIP 3.2 Senior Welding Inspector Level III	Kochi	Blastline Institute	T: (484) 2408477 E: info@blastlineinstitute.com W: blastlineinstitute.com

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Chennai to host CORCON 2024

The next edition of CORCON 2024, Asia's largest corrosion conference in India, will be held at the Chennai Trade Centre, Chennai,November 20 – 23, 2024.

CORCON, the annual conference and expo on corrosion science and engineering held in India, is the largest event of its kind in Asia, attracting participation from academic and research institutions, public and private sector organizations including defence establishments and professionals. This event offers an excellent platform for exchange of information on matters concerning corrosion, learning about existing and upcoming products and technologies and networking. As the world faces more and more with the ageing infrastructure, it is imperative for advocates of corrosion mitigation to unite and address the problem. Each year over 1,000 industry leaders from around the world come together at CORCON, in an effort to tackle corrosion issues and inform participants of the latest solutions and methods.

Factors to attend the conference include: talks by eminent speakers from distinguished scientists and top professionals around the world; source and purchase the latest products, technology and services from around 90+ exhibitors; increase productivity with new ideas and innovations; and, networking opportunities with over 1,000 industry leaders and decision makers from various industries in corrosion mitigation from around the world.

CORCON facilitates valuable opportunities to discover the latest resources for its attendees on corrosion issues and challenges.

Symposia topics include: Corrosion in automotive industry; corrosion in nuclear industry; corrosion and mitigation in renewable energy; corrosion in defence sector; coatings linings and thermal insulation; cathodic and anodic protection; microbial corrosion and inhibitors, corrosion control in water treatment utilities, corrosion issues in biomaterials; materials and composites; corrosion in petrochemical, refineries and fertilizer industries; marine corrosion; corrosion in oil and gas sectors; corrosion in concrete and infrastructure; corrosion monitoring and testing.

PHOTOS: AMPP INDIA CHAPTER

Exhibitors at CORCON are able to communicate directly to their key demographic and familiarize them with the newest advancements in corrosion mitigation products and services.

At CORCON 2024, the AMPP India Chapter Corrosion Awareness Awards are presented to honor and respect individuals / institutions for their contribution to corrosion awareness and development in the field of corrosion science and technology in India. Over the years, 153 scientists, teachers, engineers, professionals, along with 57 students and 28 public / private sector laboratories have been honored with the awards, presented under various categories which include: Excellence in Corrosion Science & Technology Awards for excellent contributions to the field of corrosion evaluation, corrosion control, corrosion management and corrosion awareness; Distinction in Corrosion Science & Technology Awards for distinctive contribution to the field of corrosion evaluation, corrosion control, corrosion management and corrosion awareness including some exemplary contributions / achievements; Excellent Laboratory Award for excellent contribution to the field of corrosion science and technology by monitoring, testing, evaluation of performance and quality of materials, and research / development works; Student Awards for thesis on corrosion science and technology for degree during the year commencing July 1, 2023; Meritorious Contribution Award for meritorious contribution to the field of corrosion science and technology and activities at AMPP and other similar organizations; Lifetime Achievement Award to a nominee selected by the Chapter Governing Board of AMPP India Chapter.

More details on: corcon.org

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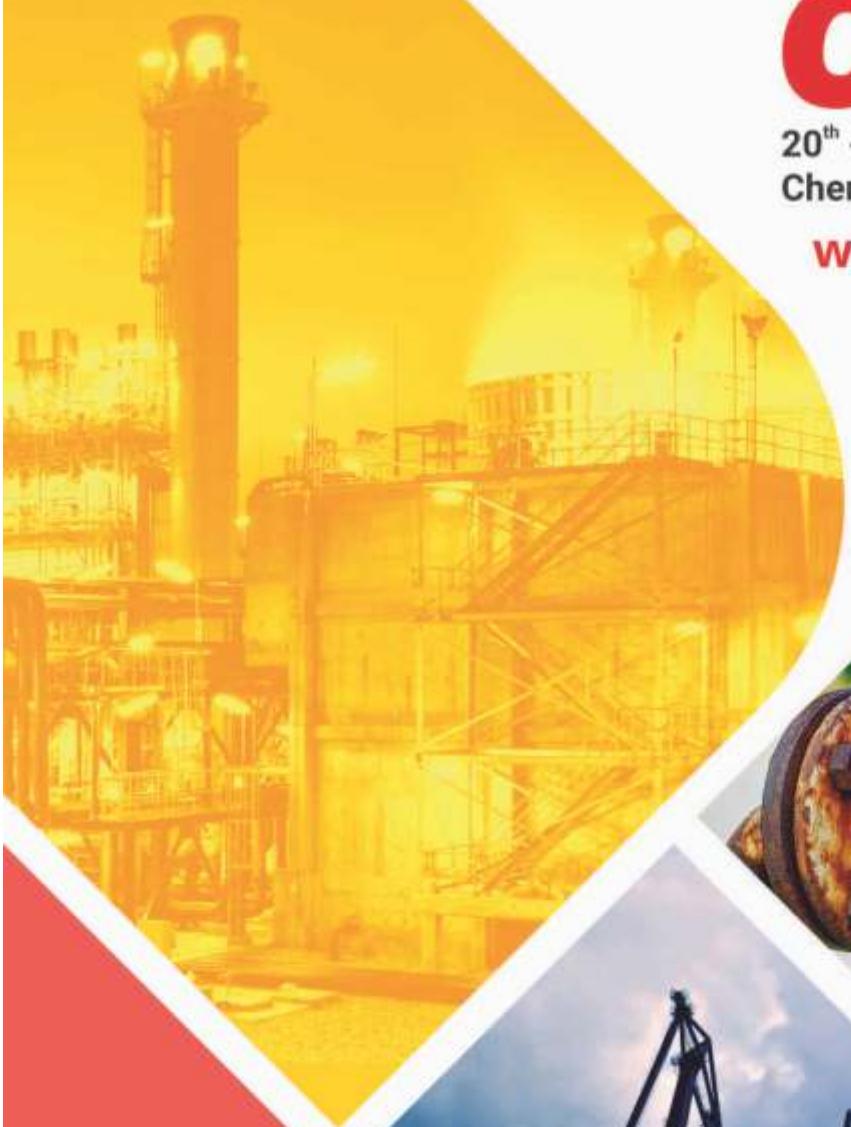

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SEP 01 – 05, 2024	EUROCORR 2024	Palais des Congres, Paris, France	European Federation of Corrosion	E: eurocorr2024@cefracor.org W: eurocorr.org
SEP 04 – 06, 2024	MET & HTS 2024	Bombay Exhibition Centre, Mumbai, India	Tafcon Projects India Pvt Ltd	T: +91-11-49857777 E: jitender.joshi@tafcon.in W: tafcon.in
SEP 04 – 06, 2024	COATINGS TRENDS AND TECHNOLOGIES SUMMIT	The Westin Chicago Lombard Lombard, Illinois, USA	BNP Media	W: bnpmedia.com
SEP 11 – 13, 2024	ASIA PACIFIC COATINGS SHOW	Convention Centre Jakarta, Indonesia	dmgevents	T: +971 44453773 E: paddyoneill@dmgevents.com W: asiapacificcoatingsshow.com
SEP 19 – 21, 2024	EXPO PAINT AND COATINGS 2024	ICCB Dhaka, Bangladesh	Toredo Fairs India Pvt Ltd	T: (91) 98453 63225 E: info@expopaintcoating.in W: expopaintcoating.in
SEP 23 – 25, 2024	EUROPEAN TECHNICAL COATINGS CONFERENCE	Palace of the Popes of Avignon, Avignon, France	AFTPVA	W: etcc2024.org
NOV 11 – 14, 2024	ADIPEC	Abu Dhabi, UAE	dmg events	E: enquiry@adipec.com W: adipec.com
NOV 20 – 23, 2024	CORCON 2024	Chennai Trade Centre, Chennai, India	AMPP India Chapter	W: corcon.org
NOV 27 – 29, 2024	COAT INDIA 2024	Yashobhoomi, Dwarka New Delhi, India	ACEXM7 Events Pvt Ltd	E: support@acem7.com W: coatindia.in
DEC 03 – 05, 2024	CHINACOAT 2024	China Import & Export Fair Complex, Guangzhou, China	Chinacoat Exhibition Ltd	W: chinacoat.net
FEB 23 – 25, 2025	EGYPT COATINGS SHOW	Egypt International Exhibition Center, Cairo, Egypt	dmgevents	T: +971 44453773 E: paddyoneill@dmgevents.com W: egyptcoatingsshow.com
APR 06 – 10, 2025	AMPP ANNUAL CONFERENCE + EXPO 2025	Music City Center, Nashville, Tennessee, USA	AMPP	W: amp.org
MAY 13 – 15, 2025	SAUDI ARABIA COATINGS SHOW 2025	Dhahran Expo, Dammam, Saudi Arabia	dmgevents	T: +971 44453773 E: paddyoneill@dmgevents.com W: saudiarabiacoatingsshow.com
JULY 02 – 04, 2025	WEST AFRICA COATINGS SHOW	Landmark Centre, Lagos, Nigeria	dmgevents	T: +971 44453773 E: paddyoneill@dmgevents.com W: westafricacoatingsshow.com
SEP 03 – 05, 2025	ASIA PACIFIC COATINGS SHOW	Bangkok International Trade & Exhibition Centre Bangkok, Thailand	dmgevents	T: +971 44453773 E: paddyoneill@dmgevents.com W: asiapacificcoatingsshow.com

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