



COATINGS AND ANTI CORROSION ENGINEERING REVIEW

February - March 2025 | Volume 15 Issue 6 | ₹ 100



Protecting critical assets: Corrosion mitigation in the chemical industry



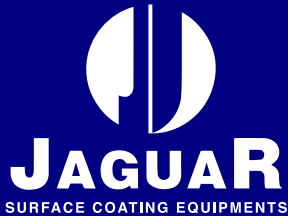
Interview

Mr Mukesh Sharma

*Country Manager, Atlas Copco Specialty Rental Division,
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Technical Feature

Eco-friendly synthesis of graphene using high pressure airless spray system



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*Country Manager, Atlas Copco Specialty Rental
Division, Atlas Copco (India) Private Limited*

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From the Editor-in-Chief...



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Corrosion is a significant problem in the chemical industry, damaging equipment and causing environmental harm. Chemicals like sulfuric acid, hydrochloric acid and hydrogen peroxide are used in many chemical processes, which are inherently corrosive. Aggressive substances like aqueous solutions with different concentrations of salts can corrode equipment. Besides, pH, oxygen and dissolved gases, hardness, and temperature also promote corrosion.

This results in decreased equipment life, environmental damage, plant shutdowns, product contamination, damage to adjacent equipment, and hazardous conditions, amongst others.

The chemical resistant coating market size was estimated at US\$ 7.60 billion in 2024. The sector is expected to grow from US\$ 7.90 billion in 2025 to US\$ 11.26 billion by 2034, at a CAGR (growth rate) expected to be around 4% during the forecast period (2025 - 2034), according to a Market Research Future report.

Factors which drive the demand for the chemical resistant coatings includes the rapid industrial development and urbanization of economies across the globe. Growth means more infrastructure and there has to be an emphasis to ensure that the assets are well protected. In this issue, we try and discuss how this can be done.

In a pioneering move poised to reshape India's innovation landscape, the Union Budget 2025-26, has allocated ₹20,000 crore to the Department of Science and Technology (DST) to initiate a private sector-driven research and development (R&D) fund. This will have an impact on the chemical and petrochemical industry too.

In our Interview section, Atlas Copco elucidates the parameters one should keep in mind while choosing a compressor for one's purpose, especially spray painting and abrasive blasting purposes. This and much more in our latest issue with all our regular columns, new product launches, technical features, etc. Happy reading!

Jolly Lonappan
Editor-in-Chief



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CORROSION, ABRASION & CHEMICAL ATTACKS destroy crores of rupees worth equipment every year. Worldwide research shows that nearly 70%-80% equipment failures are purely due to their surface erosion. The need for effective preventive maintenance therefore is imperative.

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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VERSATILE INDUSTRIAL APPLICATIONS



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Aluma Coat® - TW

A trowelable, easy to apply protective coating, comprising of sintered sapphire-hard ceramic micro beads, doped in polymer resins designed to resist corrosion, abrasion and moderate surface impact. It gives a rough textured surface finish and can withstand maximum service temperature up to 150°C/302°F.



VERSATILE INDUSTRIAL APPLICATIONS



Mineral Crusher Coated with Aluma Coat - TW



Inner Base of Dust Collector Coated with Aluma Coat - TW

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Voliro integrates first drone PEC payload, revolutionizing non-destructive testing technology

Voliro (voliro.com) – the Aerial Mobile Robotics company – is integrating the first-ever drone-enabled Pulsed Eddy Current (PEC) payload, the innovative Non-Destructive Testing (NDT) technology developed by Sixpec®. This marks their first venture into adopting a third-party payload, showcasing a commitment to their open robotic platform and advancing inspection technologies and methodologies, notes a press release from the company.

without direct contact. This technology is invaluable for industries where maintaining the integrity of pipelines, vessels, and structures is critical, such as petrochemicals.

Traditionally, inspections for CUI require using bulky, heavy equipment on scaffolding, by rope access, or by removing the insulation, posing safety risks and high costs. Voliro's integration of the lightweight, second-generation Sixpec® module



By emitting short, high-energy electromagnetic pulses, PEC systems can penetrate through various materials, including coatings and insulation, to reveal hidden corrosion or metal loss without direct contact.

Pulsed Eddy Current technology is a sophisticated method used in the NDT field to detect flaws, such as Corrosion Under Insulation (CUI), in insulated metal components and structures. By emitting short, high-energy electromagnetic pulses, PEC systems can penetrate through various materials, including coatings and insulation, to reveal hidden corrosion or metal loss

onto the Voliro T drone, eliminates these challenges. Their solution enables safe, efficient, and accurate inspections of hard-to-reach areas without the need for direct contact or invasive preparatory work.

This groundbreaking approach was successfully tested at a refinery, demonstrating the capability to detect early-stage CUI with up to 100 mm of insulation thickness.

American Innovations announces next generation cathodic protection test point remote monitors

American Innovations, Ltd. (aiworldwide.com), headquartered in Austin, Texas, recently unveiled its newest Bullhorn RM5 series remote monitoring units. The new Bullhorn RM540 Test Point Monitor and Bullhorn RM520



The new Bullhorn RM540 Test Point Monitor and Bullhorn RM520 Interruptible Bond Monitor provide enhanced compliance data collection, improved connectivity, and reliable performance in the most challenging environments.

Interruptible Bond Monitor provide enhanced compliance data collection, improved connectivity, and reliable performance in the most challenging environments, notes a press release from the company.

These cutting-edge RMUs ensure precise, real-time data collection and seamless integration with American Innovations' Bullhorn Web platform. Users benefit from improved operational efficiency, reduced field visits, and a

simplified compliance process.

"I am very excited to announce that the brand new RM540 Test Point and our RM520 Interruptible Bond Monitors are now available," says Product Manager Cole Finney. "These next-gen devices are engineered to revolutionize pipeline monitoring, offering advanced features that simplify operations while providing actionable, real-time insights."

The unique features of the PEC payload, including new probe design, noise shielding and canceling, and specialized algorithms, ensure high-quality measurements through thick layers of coating and corrosion (patents pending). The new third-party PEC payload developed by Sixpec® is another step into their platform strategy. The Voliro T drone is not just a drone; it's a comprehensive

platform designed to cater to diverse inspection needs. The adaptable payload system allows for the seamless integration of various inspection tools, making the Voliro T an indispensable asset for any work at height.

The platform approach allows Voliro to meet the changing demands of any industry and cater to a wide variety of clients using the same top-of-the-line drone technology.



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Hempel introduces Avantguard 750 Pro, setting new industry standard for corrosion protection

Hempel A/S has introduced Avantguard 750 Pro, the latest innovation in steel corrosion protection and a groundbreaking addition to the successful Avantguard family. Building on 10+ years of Hempel's patented Avantguard technology and proven track record, this new solution reaffirms the company's dedication to sustainability and high-performance coating systems, notes a press release from the company.

production generates approximately 2.8 gigatonnes of CO₂ annually, accounting for 7 - 9 percent of total energy emissions. By improving steel durability, we can help the construction industry address critical environmental and economic challenges."

Designed for new build, repairs and maintenance, Avantguard 750 Pro is a zinc rich, high-solids primer offering the lowest VOC content on the market.



With Avantguard 750 Pro, Hempel continues to set new benchmarks in steel corrosion protection, offering a solution that combines durability, sustainability and performance.

Avantguard 750 Pro delivers unparalleled corrosion resistance, even in the harshest environments. Designed to exceed the current standards, the product is recommended for structures to achieve corrosion protection beyond 35 years. This improved durability significantly reduces CO₂ emissions over the lifetime of steel assets.

"We are excited to introduce a product that significantly increases the longevity of steel structures," says Steen Niemann Madsen, Executive Vice President and Head of Energy and Infrastructure at Hempel. "Globally, steel

"Avantguard 750 Pro optimises application time and boosts productivity due to its fast-drying formula and short overcoating intervals," explains Jose Fernandes, Product Manager for Corrosion Protection at Hempel. "Third-party tested for lean coating schemes, it reduces material consumption and improves competitiveness, enabling customers to lower their carbon footprint and VOC emissions while still achieving superior results that exceed industry standards."

Engineered for versatility, the formula cures at temperatures

Unique biobased paint remover, free from fossil-based solvents, launched by OrganoClick's subsidiary BIOkleen

A new type of biobased paint remover, completely free from fossil-based solvents, has been launched by the Swedish greentech company OrganoClick (organoclick.com) the brand BIOkleen.

With the product Paint Remover Eco, it becomes easier to remove old paint. At the same time, health risks associated with fossil-based solvents commonly found in these types of products are avoided, notes a press release from the company.

Alongside Paint Remover Eco, biobased Graffiti Remover Eco and Brush Cleaner Eco has also being launched.

BIOkleen is one of Sweden's leading brands of environmentally certified maintenance products for homeowners and the professional market. The products are developed by the Swedish greentech company OrganoClick.

After several years of research and development, a series of paint removal products is now being launched where traditional fossil-based solvents from the petroleum industry have been completely eliminated. Instead, the products are based on a natural solvent made from cellulose, making them biobased and

biodegradable. At the same time, the new products are at least as effective as previous alternatives. The new series for paint removal includes Paint Remover Eco (Färgbort Eco), Graffiti Remover Eco (Klotterbort Eco), and Brush Cleaner Eco (Penseltvätt Eco).



Paint Remover Eco is based on a natural solvent made from cellulose, making them biobased and biodegradable.

Robert Weber, CEO of BIOkleen, states: "There is a misconception that products of this kind must feel strong and have a strong smell to do the job effectively, but with Paint Remover Eco, we have managed to prove the opposite."

Says Maria Wennman, Head of Research and Development at OrganoClick: "Another important aspect for Paint Remover Eco is that the product can be applied to vertical surfaces."

Paint Remover Eco is available in 1, 5, and 20 liters. Brush Cleaner Eco is available in 1L, and Graffiti Remover Eco is available in a 1L spray bottle and 20L.

as low as -10°C [14°F] while also providing exceptional tolerance to high humidity. In addition, it provides excellent

crack resistance, even in complex geometries, minimizing the need for rework and repairs.

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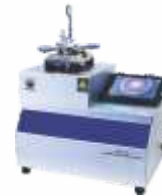
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Polyglass unveils TECNOCOAT: High-performance, monolithic waterproofing and traffic coating systems

Polyglass USA., Inc., a leading manufacturer of roofing and waterproofing systems with a rich history of innovation, has announced the launch of TECNOCOAT, the newest addition to Polyglass' Seal the Envelope™ portfolio. Addressing the needs of today's construction industry, TECNOCOAT offers superior performance for both new construction and restoration projects, meeting the challenges of demanding applications, notes a press release from the company.

TECNOCOAT is a new line of high-performance, monolithic waterproofing and traffic coating systems. Developed and tested to withstand the most extreme environments, TECNOCOAT offers: Exceptional durability and fast drying times (foot traffic-ready in minutes); superior chemical resistance for long-lasting performance in demanding environments; versatility for a wide range of applications, including below-grade foundation applications, plazas, parking decks, and secondary containment areas; a fully bonded, monolithic membrane that provides superior protection against water infiltration; ease of use with both spray-applied and hand-applied options.

PHOTO: POLYGLASS USA, INC



TECNOCOAT offers superior performance for both new construction and restoration projects, meeting the challenges of demanding applications.

New coatmaster® Flex WFT gauge from GARDCO

Paul N. Gardner USA (GARDCO) – worldwide distributors, producers, and designers of quality physical and inspection instruments for the paint, coatings, and related industries – has announced launch of the new coatmaster® Flex non-contact wet film thickness gauge.

The coatmaster® Flex is the most advanced measurement gauge for non-contact wet film thickness measurements, notes a press communiqué from the company. It outperforms other photothermal, LED/laser-based, and ultrasound systems on the market in all relevant industrial aspects. It requires minimal calibration, is insensitive to the angle and distance of measurement and permits measurement of coating thickness directly after the application of the coating material and before drying or curing. Its superior reliability, user-friendliness, safety, cost-effectiveness, precision, and accuracy are highly important to major coating line manufacturers, large paint manufacturers, experts and most importantly by coaters around the globe.

The instrument's features include its use to measure

PHOTO: GARDCO



coatmaster® Flex's superior reliability, user-friendliness, safety, cost-effectiveness, precision, and accuracy are highly important to major coating line manufacturers, large paint manufacturers, experts and by coaters around the globe.

directly after application on wet, powder, and cured coatings, regardless of the coating material, thickness, or color (including white); detect and correct deviation early in the process; process controlled, patented technology and material saving; complete with documentation; reduce rejects and increase production quality with immediate testing.

Advantages include savings of 10% - 30% coating material; reducing time for color changes; avoiding cost intensive rejects and reworks; documenting coating processes; establishing industry 4.0 standards; and online-connection to ERP-System.

Backed by the Polyglass Seal the Envelope™ warranty for long-term peace of mind, the TECNOCOAT product line includes a variety of options

to suit specific project needs, including spray-applied formulas like P-2049 and H-2049, and a hand-applied version.



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CRISIL Rating : SME 1 'Highest'



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AkzoNobel launches game-changing waterborne basecoat for bodyshops

A new generation waterborne basecoat for vehicle repair which can significantly improve bodyshop productivity and performance has been developed by AkzoNobel (akzonobel.com).



Autowave Optima is easy to apply and blend and can be used for any type of repair in any climate.

Requiring just a single visit to the spray booth, Sikkens Autowave Optima helps achieve up to 50% faster process times compared with conventional basecoat application methods. It means energy costs and carbon emissions can both be reduced by up to 60%*.

The product's high pigmentation also delivers perfect coverage by applying just 1.5 layers of paint, resulting in material savings of around 15% on average.

"The development of this one-stop application basecoat is a step-change for the car refinishes industry," says Patrick Bourguignon, Director of AkzoNobel's Automotive and Specialty Coatings business. "It addresses many key challenges, including the need for bodyshops to be even more sustainable and efficient, as well as mindful of an on-going skills shortage."

Autowave Optima is easy to apply and blend and can be used for any type of repair in any climate. In combination with AkzoNobel's portfolio of fast-drying premium fillers and clear coats, the new basecoat

can further increase system performance while meeting the highest OEM quality standards.

Adds Bourguignon: "The launch of this new generation product demonstrates how

focused we are on understanding the needs of our customers and supplying the best solutions – both now and in the future – to support bodyshop productivity and performance."

The company's researchers, scientists, technical and sales teams developed, tested and refined the new basecoat alongside selected customers for the Sikkens and Lesonal brands.

SIOResin's WRS-1002 water-based intumescent fireproof resin delivers exceptional expansion and clarity

SIOResin® has introduced WRS-1002, a next-generation water-based intumescent fireproof resin with an outstanding 100x expansion rate, exceptional transparency, and environmentally friendly composition, this innovative formulation is tailored for manufacturers developing transparent fire-retardant coatings for wood materials, notes a press communiqué.

SIOResin® WRS-1002 is engineered to provide exceptional flame resistance and thermal insulation. When exposed to heat, the resin rapidly carbonizes and expands, forming a thick insulating layer that effectively

QLAB's Q-FOG testing solutions for marine applications

QLAB's Q-FOG series provides advanced corrosion testing solutions specifically suited for marine applications. These instruments comply with ASTM B117 standards and are designed to simulate harsh maritime conditions, such as saltwater exposure, humidity, and temperature fluctuations to accurately evaluate coating performance, notes a press communique.

The Q-FOG models enable precise control over critical testing parameters, including salt spray concentration, temperature, and humidity for accurate coating evaluations. Constructed with durable, corrosion-resistant materials, these instruments ensure consistent and reliable performance, making them essential tools for testing the



The Q-FOG models enable precise control over critical testing parameters, including salt spray concentration, temperature, and humidity for accurate coating evaluations.

durability of marine coatings in challenging environments.

The SSP and CCT models recreate wet/dry cycles and atmospheric conditions, while the CRH models offer precise control over relative humidity with adjustable ramp times and an optional shower function.

More details: khushbooscientific.com

blocks oxygen and heat from reaching the substrate. This intumescent reaction is the key to its superior fireproof performance, allowing coated surfaces to withstand extreme temperatures and delay combustion.

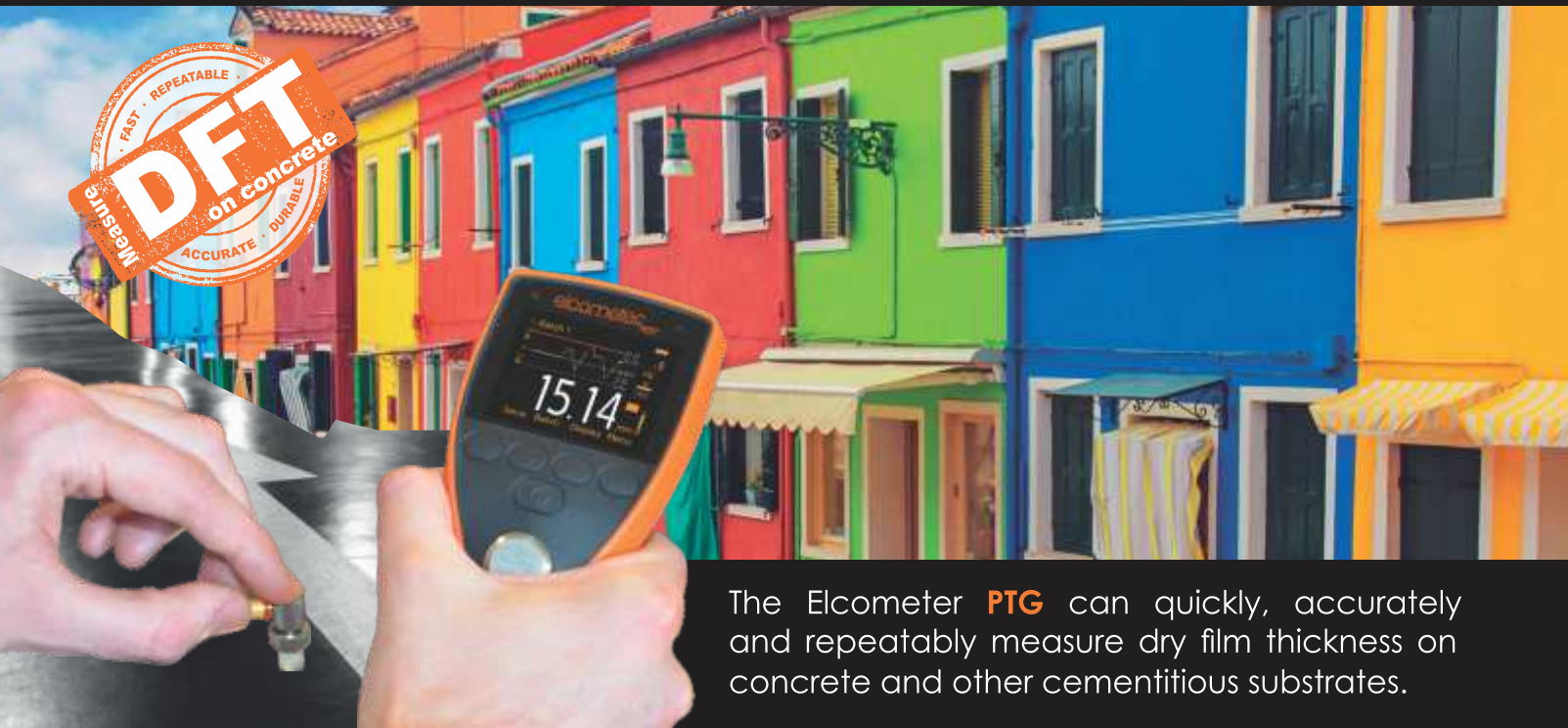
With an expansion rate exceeding 100 times, WRS-1002 ensures comprehensive fire protection while maintaining a clear and



A major advantage of WRS-1002 is its simple and adaptable formulation, making it highly accessible for coating manufacturers looking to develop fire-retardant paints with minimal adjustments.

smooth surface finish. Unlike traditional fireproof coatings, which often compromise aesthetics, this advanced resin allows for decorative transparency, making it ideal for wood coatings where natural grain visibility is desired.

A major advantage of WRS-1002 is its simple and adaptable formulation, making it highly accessible for coating manufacturers looking to develop fire-retardant paints with minimal adjustments. The resin features include room temperature curing for convenient application; low viscosity with high solid content, ensuring smooth blending and application; and excellent compatibility with common coating additives and binders.



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Instrumentation & Technologies



Coatings manufacturers: Which laboratory mixing system is right for you?

To achieve reliable, accurate, repeatable, lab mixing that seamlessly scales up, an industry expert guides coatings manufacturers through the most important factors in selecting equipment and accessories

For coatings manufacturers, laboratory mixing is an exact science. A wide variety of coatings rely on precise mixing where specific formulations, molecular structures, or product characteristics are critical. Many coatings require precise formulations for optimal performance. The chemical formulation of paints and coatings also requires careful blending of pigments, binders, solvents, and additives.

“The products developed in labs touch nearly every part of our lives. So, when mixing coatings, the results must be accurate, reliable, and perhaps most importantly, repeatable. Consequently, utilizing the proper instruments is essential,” says John Bogart, Managing Director of Kett US, a manufacturer of a

full range of laboratory mixing as well as moisture and organic composition measurement equipment.

The challenge is that any mixer that isn't well suited to a lab's requirements can be very disruptive. For example, the mixer may lack sufficient speed, leading to incomplete mixing or poor homogeneity. A mixer may also insufficiently combine materials with multiple viscosities, resulting in “ring layers” where the various viscosities settle at different depths in a poorly mixed product. These kinds of issues are problematic when mixtures or products are in laboratory development and accuracy is critical for the results to be reproducible on a larger scale.

According to Bogart, the key for coatings manufacturers is not only finding lab mixers

that can perform as desired but also selecting those that can reliably do so while withstanding the toughest viscosities over time. As an industry expert, Bogart shares what coatings manufacturers need to know about selecting the most effective lab mixers for their specific applications.

Choosing the best mixer for your lab

For coatings manufacturers, the most important step to take in choosing the right mixer is determining the performance specifications that need to be met. For most labs, the prime factors to consider are speed, related torque, safety, viscosity, and versatility, according to Bogart.

Mixing speed and related torque

The optimal mixing speed depends on the chemical properties, desired reaction outcome, and the specific equipment used. Mixing speeds that are too high or too low can negatively impact the quality, safety, and efficiency of the mixing process. Therefore, choosing a mixer capable of reliably providing the right mixing

speed is essential for achieving uniformity, controlling reactions, and ensuring the desired product characteristics.

In fluid mixing, torque plays a key role in how effectively a mixture is blended. When mixing, torque is the force that the motor applies to turn blades or impellers, which create the necessary shear and turbulence to mix the components. Adequate torque ensures that the entire fluid or material is mixed uniformly. Without enough torque, areas of the mixture may remain unmixed or may not achieve the desired properties.

Consequently, coatings manufacturers should select a



PHOTOS: KETT

For most labs, the prime factors to consider are speed, related torque, safety, viscosity, and versatility.



For coatings manufacturers, the most important step to take in choosing the right mixer is determining the performance specifications that need to be met.

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mixer that satisfies their performance requirements in terms of mixing speed and related torque. To meet this need, Kett, for example, manufactures three categories of mixers that fulfill the performance specifications of coatings manufacturers.

An entry level model with an RPM rate between 0 and 300 rotations per minute provides a related torque of 9.0Kg/cm and is capable of withstanding high viscosities. A mid-level model can reach up to 600 RPM with related torque of 10.0Kg/cm, which is ideal for medium-to-high viscosities. A high-performance model can reach up to 1,000 RPM with related torque of 3.0Kg/cm, covering a low to medium viscosity range.

A basic model will typically provide forward/reverse rotation for efficient mixing. A mid-tier model will have a higher-powered motor in the range of 70W with automatic forward/reverse rotation for improved mixing performance. A higher-end model will provide a more robust motor, such as 120W, for high-viscosity liquids and enhanced torque, expanding its application range, according to Bogart.

Safety

Some lab mixers have inherent defects that can present problems when mixing coatings. For example, lesser mixers can have motor issues that spark during operation. Since coatings are often comprised of volatile substances, this can lead to a fire.

Brushless motors can help to eliminate the fire risk.

“Brushless motors have been specially engineered to prevent sparking, nearly eliminating the risk of fire, and are entirely encased to prevent particles from creeping in and damaging the inner workings of the motor,” says Bogart.

He adds that dual safety systems, with thermal motor protection and a current limiter, can also help to protect the mixer from overheating.

Maintaining mixing speed

Laboratory and factory mixing can be challenging, particularly when coatings manufacture involves materials with varying viscosities. Multiple viscosities can lead to “ring layers” in a mixture, where the varying viscosities settle at different heights within the mixture, resulting in poorly mixed, inadequate materials or products.

To resolve this issue, Kett developed its Z+ model of mixers, which provide high torque regardless of the thickness or viscosity of the mixture.

“Even as mixtures change in viscosity as they are combined and materials react with one another, the speed remains constant,” says Bogart.

To expedite the mixing process and eliminate unmixed “ring regions” towards the top or bottom of a blend with varying viscosities, the OEM offers models that raise and lower when mixing. This reciprocating motion ensures that the entire batch of each coating material is entirely and evenly mixed.

Mixing versatility

In the course of development over time, coatings manufacturers will often need to mix a wide range of formulations and sample sizes in special conditions. Consequently, it can be advantageous to have a host of options and tools available that can increase the safety, flexibility, efficiency, and accuracy of mixer use.

In this vein, keyless chucks can help to streamline the change of mixing shafts with safe, secure attachment to the mixer without a key. Free-Joint™ swivel mounts enable changing shafts and adjusting the mixing height without moving the motor, according to Bogart.

Programmable settings, digital controls, LED digital displays, 0.5-second sampling frequencies, and change of rotational direction with the touch of a button can improve mixer accuracy and efficiency as well, he suggests.

To further enhance safety, utilizing a remote control mixer model equipped for fume hood use, with external output for rotation speed and torque control can be helpful. A model with a remote-controlled agitator can be ideal for demanding agitation



Coatings manufacturers should select a mixer that satisfies their performance requirements in terms of mixing speed and related torque.

tasks and external control capabilities. Using a model that provides analog voltage outputs for rotation speed and torque, allowing viscosity monitoring with a recording meter during agitation can help to improve quality control, adds Bogart.

With all the options available, working with an expert OEM that provides a comprehensive range of mixers and accessories along with engineering assistance and technical expertise can help coatings manufacturers select the equipment most suitable for their lab. Utilizing the most accurate, reliable, repeatable, and versatile equipment, in turn, will not only streamline product development but also promote quality and successful production scale up down the line.

For more info, visit: kett.com.



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Atlas Copco Rental eliminates need for significant upfront capital investment

Atlas Copco Rental, provide industry-leading portable air compressors and onsite nitrogen generators that enhance the efficiency and quality of spray painting and abrasive blasting operations, notes Mr Mukesh Sharma, Country Manager, Atlas Copco Specialty Rental Division, Atlas Copco (India) Private Limited, in a chat with C&ACER

What products offered by ATLAS COPCO are best suited for the spray painting and abrasive blasting purposes?

Spray painting and abrasive blasting might seem straightforward at first glance, but the choice of equipment and the quality of air used can have a significant impact on both the surface finish and the longevity of the paint or cleaned surface. Making the wrong choices can also lead to increased costs. At Atlas Copco Rental, we provide industry-leading portable air compressors and onsite nitrogen generators that enhance the efficiency and quality of these operations.

Our portable engine-driven compressors come with an inbuilt aftercooler. These compressors are specifically

designed for spray painting and abrasive blasting. The integrated aftercooler ensures that the compressed air is free from moisture and oil residues, which is crucial for preventing contamination and achieving a high-quality finish. This feature also extends the life of blasting equipment and reduces maintenance costs by preventing metal rust shortly after sandblasting. Additionally, these compressors are space-saving, making them ideal for customers who need high-quality air without moisture in limited spaces.

When it comes to spray painting, the use of nitrogen is revolutionizing the industry. Nitrogen is an inert and anhydrous gas, meaning it doesn't react with the paint. This ensures an even and focused spray, resulting in



Mr Mukesh Sharma, Country Manager, Atlas Copco Specialty Rental Division, Atlas Copco (India) Private Limited.

improved paint quality, faster task completion, and approximately 10% less paint is required. The benefits of using nitrogen include enhanced paint quality, increased efficiency, cost savings of 15% to 25%, and safety and environmental compliance by avoiding abrasives containing free silica. Using the right flow and number of nozzles also improves productivity, saving on fuel and labor costs.

At Atlas Copco Specialty Rental, we offer portable compressors and onsite nitrogen generators to meet the highest standards of quality and efficiency, optimizing costs and productivity for spray painting and abrasive blasting applications. For more information on our air compressors and nitrogen generators, please visit our

website or contact our sales team.

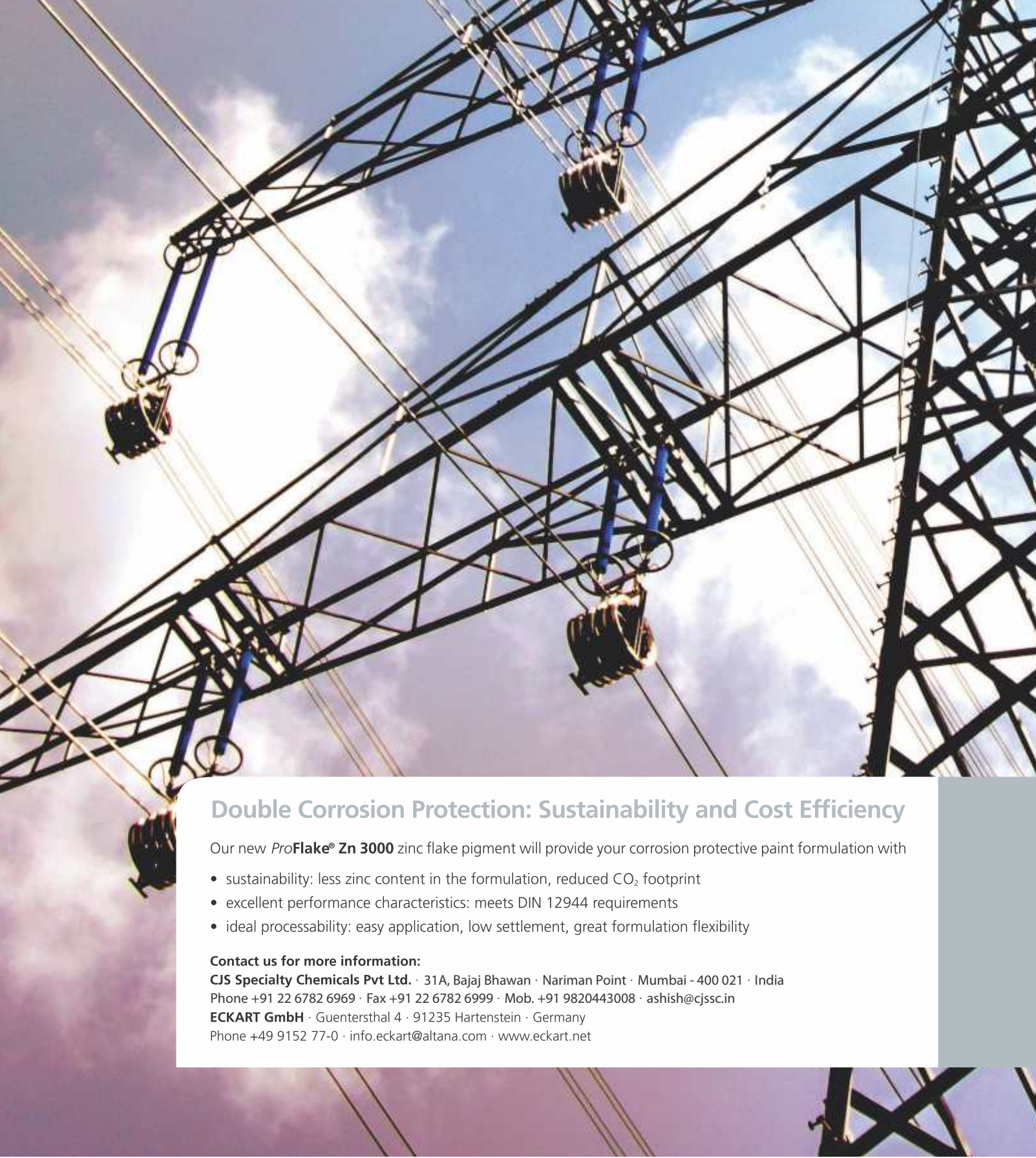
What are the benefits of hiring a compressor rather than owning one?

One of the key advantages of renting equipment is that it eliminates the need for significant upfront capital investment. This allows businesses to allocate their financial resources more efficiently. Additionally, renting ensures that there are no losses during turnarounds and projects due to the absence of air or steam, as the rental equipment is readily available and can be deployed quickly.

At Atlas Copco Rental, we pride ourselves on providing flexible and agile solutions that can be adapted to meet specific needs of different projects and industries.



The benefits of using nitrogen generators include enhanced paint quality, increased efficiency, cost savings of 15% to 25%.



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Renting allows businesses to access the latest technology and equipment without the need for continuous upgrades and maintenance.

Moreover, renting from Atlas Copco provides peace of mind. Rest assured that you are in capable hands and focus on what truly matters, both professionally and personally. Our rental solutions also allow businesses to scale up or down their equipment usage based on changing demands, ensuring that they can meet market fluctuations effectively.

What are the parameters one should keep in mind while choosing a compressor for one's purpose, especially spray painting and abrasive blasting purposes?

When hiring a compressor for efficient spray painting and sandblasting, it's essential to consider three key parameters: pressure, Free Air Delivery (FAD), and air quality.

Pressure varies based on the material and purpose of your work. For instance, hard steel surfaces typically require around 100 psi. Our compressors with PACE and VSD technology allow for adjustable pressure, enhancing versatility. Maintaining optimal nozzle pressure is crucial for productivity, as pressure drops can significantly reduce efficiency.

FAD is another critical factor, especially in sandblasting where all compressed air passes through the nozzle. The nozzle size and working pressure determine FAD

consumption. Insufficient FAD leads to lower nozzle pressure and reduced productivity. Our compressors are designed to provide consistent airflow, ensuring optimal performance.

Air quality is paramount for both the operator's health and the quality of the application. High-quality air with minimal oil and moisture is crucial to prevent hose clogging and surface contamination. Using nitrogen instead of compressed air for spray painting can offer several benefits, including a more even and focused spray, leading to paint savings between 15% and 25%.

Choosing the right compressor involves considering these factors to enhance productivity, reduce costs, and achieve superior results. It's advisable to contact rental experts to ensure you select the best equipment for your needs.

A brief about ATLAS COPCO and their rental service...

Atlas Copco Specialty Rental provides equipment's for Oil-free air, Onsite Nitrogen Generation, Steam Generation, and power on temporary and long-term rental. Our customers choose us during planned contingencies and emergencies, we also provide tailored services according to specialty solutions needed by our

industry. We see an emerging trend for customers availing our services to meet their changing demands.

How does this service work and can one access this all over India?

Atlas Copco Specialty Rental is present across India, with Pune being the centre, and has presence in Gujarat, Delhi, Maharashtra, Kolkata, Karnataka, and Telangana. Our strategic expansion in India with new satellite depots is set to significantly enhance service efficiency and customer accessibility. By establishing these depots, we can ensure that our rental solutions are more readily available to customers across various regions. The depots in Maharashtra and Kolkata are fully operational. Additionally, we are expanding our presence with new depots, like the one in Bengaluru, to enhance service delivery. This localized presence allows us for quicker response times and more efficient service delivery, as the depots can cater to the customers in no time. Customers can get in touch by visiting the website or directly calling the toll-free number +1800 120 110030.

What kind of a growth do you see for your business especially in relation to the spray painting and abrasive blasting sectors in India?

Spray painting and abrasive blasting sectors in India are set for significant growth due to infrastructure development, urbanization, and manufacturing expansion.

The Indian paints and coatings market is projected to grow at a CAGR of 9.38% from 2025 to 2030, driven by initiatives like the Smart City



Choosing the right compressor enhances productivity, reduce costs, and achieves superior results.



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Mission and government infrastructure programs. Increased foreign direct investment in the construction sector and rising urban population with higher disposable income are boosting demand for high-quality paints and coatings.

The abrasive blasting sector is expected to grow at a CAGR of 7.9% from 2024 to 2031, fuelled by the Make-in-India initiative and the demand for precision tools and high-quality finished products. Government focus on infrastructure and construction services through targeted policies and budget allocations will further drive growth.

Atlas Copco Rental is well-positioned to capitalize on these trends with its high-performance compressors and advanced air treatment solutions, supporting the growing demand for high-quality surface treatment processes in various industries.

(Data Source: India Abrasives Market - Market Size, Sustainable Insights and Growth Report 2024-2031; Paint Industry in India Size, Share & Market Analysis.)

What parameters should a customer keep in mind while hiring a compressor?

When hiring a compressor, there are several key parameters one should consider ensuring the application delivers its best performance. First, you need to ensure that the compressor meets the pressure criteria for your specific application. This is crucial for achieving the desired results.

Next, consider the FAD, it's

important to match the air delivery volume to the needs of your tools to maintain efficiency and productivity.

The type of compressor is also important. Depending on your application, you might need an oil-free or oil-injected compressor. Each type has its own advantages, so it's essential to choose the right one for your needs.

Additionally, aftertreatment systems like aftercoolers and filters are vital for maintaining high air quality. These systems help remove moisture and contaminants from the compressed air, ensuring optimal performance and longevity of your equipment.

Lastly, consider the mobility and size of the compressor. Depending on your work environment, you might need a portable compressor that is easy to move around or a larger, stationary unit. It's important to choose a compressor that fits well within your workspace and meets your operational requirements.

What are the typical errors customers make while using a compressor, again with special reference to the spray painting and abrasive blasting jobs?

In spray painting, using a compressor with inadequate air pressure and flow can result in poor paint atomization, uneven finishes, and increased overspray. Moisture and oil contamination from unfiltered compressed air can cause defects like fisheyes and blisters. An improperly sized compressor can lead to pressure drops and inconsistent spray patterns, while



Optimizing spray painting and abrasive blasting with on-site PSA nitrogen generators enhances quality, increases efficiency and save costs.

insufficient filtration allows contaminants to mix with the paint, causing surface imperfections.

In abrasive blasting, moisture and oil in the air supply can cause abrasive material to clump, clogging equipment and reducing efficiency. Incorrect pressure settings can either damage the surface or result in insufficient cleaning. It's important to adjust pressure according to the material and desired finish. Using an improperly sized nozzle can lead to inefficient blasting and increased equipment wear. Regular maintenance of the compressor and blasting equipment is crucial to prevent breakdowns, reduced performance, and increased downtime.

What are the advantages of using ATLAS COPCO products vis a vis your competitors?

Atlas Copco Specialty Rental offers several advantages over competitors, including a wide range of state-of-the-art equipment, reliable and

energy-efficient solutions, and tailored services for various industries. Our equipment is regularly maintained and updated, ensuring optimal performance and reducing downtime. We provide 24/7 customer support and have strategically expanded with new satellite depots in India to enhance service efficiency and accessibility.

As the market leader and an original equipment manufacturer (OEM), we actively engage with customers and strategically invest in technology to design our rental fleet according to emerging trends. This approach ensures the financial stability of our operations. In the capital-intensive rental business, substantial investment is required to build and maintain a fleet that meets customer demands.

This combination of high-quality equipment, customized solutions, excellent customer support, and strategic investment in technology makes Atlas Copco Specialty Rental a competitive choice in the market.



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A critical defense against corrosion: Exploring the role of protective coatings

Protective coatings are the frontline defense against corrosion, combating the specific challenges of the Middle East's operating environment

Corrosion poses a significant challenge for the oil and gas industry in the Middle East. The region's extreme environmental conditions, such as high temperatures, fluctuating humidity and saline atmospheres, accelerate the degradation of industrial assets. Thus, protecting critical infrastructure against corrosion remains a maintenance issue but a business imperative to keep operations steady and costs low.

The Middle East's unique corrosion challenges

Harsh environmental factors make the Middle East

particularly vulnerable to corrosion. High ambient temperatures combined with the presence of salt in the atmosphere create an ideal setting for corrosion under insulation (CUI). Thermal cycling, which occurs when temperatures fluctuate, further exacerbates the issue by causing condensation within insulated systems. This moisture accelerates corrosion, leading to frequent failures in pipelines, storage tanks and processing equipment.

CUI accounts for a significant portion of maintenance costs in the Middle East. Industry estimates suggest that up to



PHOTOS: 123RF

Harsh environmental factors make the Middle East particularly vulnerable to corrosion.

60% of pipe maintenance expenses are tied to CUI-related damage. The financial and operational impact of unplanned outages due to

corrosion underscores the importance of proactive measures to extend asset lifecycles.

Know specialized coatings

Protective coatings are the frontline defense against corrosion, combating the specific challenges of the Middle East's operating environment. Specialized coatings designed to withstand high temperatures, resist chemical exposure and perform under thermal cycling remain essential for maintaining asset integrity.

The region has shifted toward high-performance systems like multipolymeric coatings and siloxanes. These coatings combine flexibility with thermal and chemical resistance, making them ideal for protecting assets in demanding conditions. For example, multipolymeric



Protecting critical infrastructure against corrosion remains a maintenance issue but a business imperative to keep operations steady and costs low.



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matrices protect against corrosion under extreme temperature fluctuations. At the same time, siloxanes offer superior resistance in high-heat applications.

Application methods also contribute to maximizing the performance of protective coatings. One-coat systems that cure quickly at ambient temperatures improve productivity during maintenance and new construction projects. These coatings allow operators to reduce downtime while maintaining durability and protection.

Align with industry standards

Globally recognized standards like ISO 19277 and NORSOK M-501 serve as benchmarks for coatings. These standards define testing methods and performance criteria to ensure coatings can endure harsh conditions. ISO 19277 focuses on coatings for insulated systems, emphasizing resistance to water immersion, thermal cycling



PHOTO: ISTOCK

Corrosion poses a significant challenge for the oil and gas industry in the Middle East.

and salt spray exposure. In contrast, NORSOK M-501 outlines broader requirements for protective coatings, ensuring durability in offshore and industrial environments. Middle East operators who adhere to these standards can more effectively mitigate the risks associated with CUI and other forms of corrosion.

Support sustainability goals

Protective coatings contribute to sustainability goals by extending critical assets' life, reducing maintenance frequency and lowering material waste. Also, coatings with low volatile organic compounds (VOCs) align with sustainability targets,

minimizing the impact on air quality. Lastly, as the region invests in renewable energy and transitions toward more sustainable energy sources, coatings designed for durability and environmental compatibility will be critical in supporting these initiatives.

What's ahead?

The Middle East oil and gas industry faces corrosion challenges due to its harsh environment and demanding operations. Protective coatings offer a solution to combat these risks when chosen and applied correctly. By leveraging these technologies and adhering to global standards, regional operators can protect their assets, reduce costs and maintain operational efficiency in harsh environments.



The financial and operational impact of unplanned outages due to corrosion underscores the importance of proactive measures to extend asset lifecycles.



Author: **Chris Magel** is the PPG Oil and Gas Segment Manager, Europe, Middle East and Africa, Protective Coatings. He has 15+

years of experience in protective coatings for the oil and gas industry.

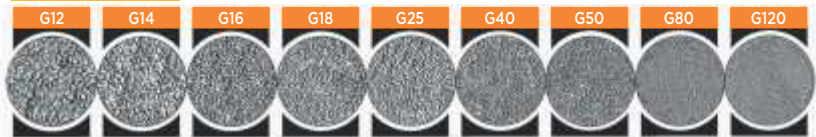


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Protecting critical assets: Corrosion mitigation in the chemical industry

According to various reports, the Indian chemical industry aims to reach a US\$1 trillion market value by 2040, driven by innovation, AI, and sustainability, positioning India as a global leader in the sector

Corrosion is a significant problem in the chemical industry, damaging equipment and causing environmental harm. Chemicals like sulfuric acid, hydrochloric acid and hydrogen peroxide are used in many chemical processes, which are inherently corrosive. Aggressive substances like aqueous solutions with different concentrations of salts can corrode equipment. Besides, pH, oxygen and dissolved gases, hardness, and temperature also promote corrosion. Corrosion in the chemical industry is the gradual destruction of materials due to chemical reactions with their environment. It can occur in a variety of forms, including galvanic

corrosion, crevice corrosion, corrosion under insulation, pitting corrosion, and uniform corrosion, amongst others.

This results in decreased equipment life, environmental damage, plant shutdowns, product contamination, damage to adjacent equipment, and hazardous conditions, amongst others.

Corrosion mitigation in the chemical industry involves using coatings, inhibitors, and other methods to prevent metal deterioration. Paint or oil can be used to protect metal; sealers, overlays, and barrier systems can be used to prevent moisture, chloride ions, and carbon dioxide from entering structures.

Corrosion inhibitors are



PHOTOS: 123RF

substances that slow down corrosion reactions. They are added to acids, steam, and cooling waters to reduce corrosion. Inhibitors can be used internally in carbon steel pipes and vessels.

Cathodic protection is another method of corrosion control that can be used to protect metal surfaces. Using alloys that are less reactive than the base metal can help prevent corrosion

Other methods include changing the environment, changing the material, and placing a barrier between the material and its environment. Proper ventilation or dehumidification can also help prevent corrosion.

Chemical resistant coating market size

The chemical resistant coating market size was estimated at US\$ 7.60 billion in 2024. The sector is expected to grow from US\$ 7.90 billion in 2025 to US\$ 11.26 billion by 2034, at a CAGR (growth rate) expected to be around 4% during the forecast period (2025 - 2034),



according to a Market Research Future report.

Factors which drive the demand for the chemical resistant coatings are quite a number. One of these factors includes the rapid industrial development and urbanization of economies across the globe. Coatings which protect infrastructure are very important in industries which include but are not limited to chemical processing, oil and gas, and manufacturing because they work in highly corrosive environments. Moreover, the growth of the marine and construction industries also increases demand as these industries use a large amount of chemical resistant coatings on their equipment, pipelines, and structures which experience extreme conditions.

One more factor is the stringent emission norms which compel enterprises to use longer-lasting coatings which require less maintenance or replacement, hence reducing emissions. In addition to this, there have been innovations in water-based and environment

friendly coatings which have increased the use of coatings in regions with low tolerance for VOC emissions. Increasing focus on sustainability together with long lasting infrastructure in the oil and gas, marine, and transportation industries also drive the growth of chemical resistant coatings greatly.

There is also an increase in the use of fluoropolymer and epoxy-based coatings as they are highly resistant to chemical reactions and corrosion. Besides, due to the increasing need for oil, gas and construction services throughout the world, the market is also enjoying growth.

The emerging markets, especially the Asia-Pacific region, are experiencing rapid innovation which will bolster the demand for coatings that can endure harsh chemical conditions. Furthermore, the increased investment in infrastructure development and the use of durable industrial machinery will continue to trigger market growth.

Growth opportunities

Several trends are exhibiting

in the market for chemical resistant coatings today. The shift towards environment friendly coatings is one such trend, as there is an increasing demand towards water based and low VOC products due to rigorous environmental standards. In addition, developments in technology have enabled the production of more robust and long enduring coatings for industrial and marine use.

The market, however, still faces the challenge of high raw material costs such as petrochemicals because of the volatile price and high demand from sectors such as oil & gas. Moreover, these regions have stricter regulations which lead to the need for businesses to have a higher investment in innovation which helps meet these regulations. Stricter emission and hazardous chemical rules imposed by environmental watchdogs in regions like North America and Europe will lead to trouble for companies trying to stay profitable while being innovative. The combination of high competition and growing demand will make maintaining market growth very challenging.

The major participants in this market include Grauer & Weil (India) Ltd, Berger Paints, AkzoNobel, BASF, Daikin Industries, Hempel, and Jotun. AkzoNobel and BASF are the manufacturers of coatings to a variety of industries with demand for a high degree of chemical resistance. They have a great amount of resources devoted to research and development which allows them to synthesize coatings that pass

industrial and environmental requirements. Daikin specialize in high end fluoropolymer coatings which provide excellent chemical resistance in a very demanding environment. These companies keep up with competition and change their product lines, grow their businesses overseas, and meet the surging needs for chemical resistant coatings in different scopes of work.

“The chemical and petrochemical industry in India is seeing a continuous growth of around 7.8% CAGR,” said Mr S. Ravichandran – Deputy General Manager, Berger Paints (Industry). “This demand is only going to increase spurred by growing infrastructure development.” He was speaking at the webinar titled Protecting Critical Assets – Corrosion Mitigation in the Chemical Industry, organized by the Confederation of Indian Industry.

According to various reports, the Indian chemical industry aims to reach a US\$1 trillion market value by 2040, driven by innovation, AI, and sustainability, positioning India as a global leader in the sector. “Everyone is looking at India and so this sector also is bound to grow. We also find exports are growing. It is now around 12% of our average share in total national exports,” said Mr Ravichandran. Growth means more infrastructure and there has to be an emphasis to ensure that the assets are well protected.

The policies of the government too look very encouraging right from setting up Plastics Parks to Centres of



Excellence, and encouragement through promotions and awards. In a pioneering move poised to reshape India's innovation landscape, Finance Minister Nirmala Sitharaman, in the Union Budget 2025-26, has allocated ₹20,000 crore to the Department of Science and Technology (DST) to initiate a private sector-driven research and development (R&D) fund. The government has also committed funds for fostering innovation in deep tech and emerging sectors, aiming to bolster strategic autonomy in critical technological domains. This will have an impact on the chemical and petrochemical industry too.

There are over 80,000 types of chemicals being produced and they can be classified under various headings like feedstocks, basic chemicals, commodity chemicals, intermediary chemicals, specialty chemicals, and so on, said Mr Ravichandran.

“The chemical industry has to deal with various kinds of materials like dissolved solids, gases, carbon dioxide, sulphur dioxide, ammonia, and we even have to face lots of bacterial activity happening in certain scenarios.”

“Then you have to deal with toxicity, the concentrations, the pH values, cyclical exposures, immersion conditions, the velocity, the availability of oxygen, etc., and all of this is going to increase the challenges to corrosion management,” said Mr Ravichandran.

Berger Paints for Business offers high-performance solutions for the chemical industry too, besides other



sectors, both industrial and architectural.

An interesting technology introduced by Berger is the thermochromatic paints, said Mr Ravichandran. In simple terms, thermochromatic paints literally change colour depending on the temperature of the surface to which it has been applied or the immediate atmosphere.

Explaining how it works, Mr Ravichandran said, “At an ambient temperature, the color will be say green. The moment the temperature increases, say to 250°C on the substrate, the color changes to blue. At 450°C+ it turns to a white or grey shade.”

Imagine, alerting someone to a potentially hot surface using thermochromic paint is not only extremely practical but can help to avoid serious injuries. This behaviour of the paint will also help the asset owner take immediate action in case of any criticality in the plant. “This is a very new introduction to the industry and ‘Made in India,’ from our own R&D,” said Mr Ravichandran.

Another area of concern in chemical plants is the floor, where one can experience a thermal shock. This happens

when there is a cyclical change in temperature from high to low and vice versa where the concrete can start chipping off. “We have developed a product called Polyurea Concrete that has higher impact resistance, higher scratch resistance and is also a product that has chemical resistance, particularly for shop floors in chemical plants,” said Mr Ravichandran.

Another company, Induron Protective Coatings announced the launch of its newest product, Novasafe. Novasafe is a furfuryl modified, thick film, ceramic-filled novolac epoxy and it can stand up to the most extreme environments encountered in treatment plants.

“Water and wastewater treatment plant owners, operators, and engineers are under more pressure than ever to protect our national water infrastructure,” said William Seawell, Induron technical service manager. “In a period of increased influent volume, more chemically extreme influent, and increasing regulatory pressure, there is an increasing need for longer immersion coating service lives.

“For years, Induron's method of choice for protecting buried ductile iron pipe interiors, water tank interiors and water treatment plant interiors has been thick film ceramic epoxy technology,” Seawell added. “In response to industry challenges, Induron is bringing that same technology to the most extreme service environments encountered in treatment plants with its introduction of Novasafe ceramic novolac.”

Novasafe's formulation chemistry is unique in the industry, and it is able to accomplish what treatment plant operators need in the most extreme environments with one less coat compared to traditional epoxies and less film thickness than polyurethane/polyurea. Novasafe is able to accomplish this with its unique resin and filler package.

As a benchmark of performance, Novasafe is able to withstand exposure to sulfuric acid at all concentration ranges for extended periods of time. Many industry novolacs can withstand dilute or 98% sulfuric acid but the range of 93-97% has historically been problematic for unbaked novolac products –

even in the oil and gas industries where this is a significant issue.

“While Novasafe is not appropriate for all services – no lining material is – there is a place in every treatment plant specification or treatment plant where Novasafe can assist in providing long-term asset protection, reducing maintenance load, saving maintenance dollars and improving the look of the facility,” said Davies Hood, Induron president.

“The chemical industry is one of the top sectors affected by corrosion, followed by the oil and gas. Anyone can easily understand that being a chemical environment, that corrosion is a major factor here,” said Mr Vigneshwar T – Segment Lead – Water & Chemical, JSL (Industry). “The chemical industry and oil and gas are the two major industries where corrosion management has to be taken care of at priority.”

Amongst the major chal-

lenges within the chemical industry is the extremely corrosive environment they work in. The pH levels, the temperatures, the handling, are all major factors which determines the corrosion environment in the chemical industry. This means high operational costs with maintenance and downtimes. Because of this, there has to be periodic inspections, which brings us to asset integrity management, said Mr Vigneshwar. “So whatever plants we create becomes an asset. So how do we protect that asset?”

“When we see rust, we try to mitigate that,” said Mr Vigneshwar. “So when it comes to setting up a plant, there are so many steps involved like the policy matters, the design, the maintenance, and then it comes to the methods and procedures. We have sequential activities to be carried out to make sure this corrosion is handled in a very critical way. Then, we have to take into account the cost of

corrosion!”

“But is it only the economics of the cost incurred because of corrosion the only factor?” said Mr Vigneshwar. “We also have to factor in the cost of safety and the environment. The economic cost, one can calculate. It can be a direct or indirect loss, like material or metal replacement, capital replacement, maintenance costs, and even insurance or technical support costs. But when it comes to safety cost, is it calculable? Fatal accidents and human safety when it relates to corrosion are costs that is not reversible. Nor is the environmental cost which includes sustainability. Nobody wants to remember or a repeat of the Bhopal tragedy that's still etched in everyone's minds. It was being very much clearly reported that it is because of the storage tank leak due to the corroded pipelines and walls and other safety equipment.”

“Next, we have this Vizag gas leak. This happened very recently in 2020. Here, the high-power committee report clearly mentioned the cause as rust due to poor tank design without any lining. This was cited as a major cause of the gas leak.”

The most common methods of corrosion prevention as you will be aware are paints and coatings, corrosion inhibitors, cathodic protection and use of non-metallic materials.

Another area of concern is the effluent treatment plant that is nearly part of every chemical unit. They pose their own problems of corrosion.

“One way would be to take

care of this in the design stage itself. If the required steps are taken maintenance cost can be reduced and the lifecycle cost can be increased,” said Mr Vigneshwar. Stainless steel is an option. There are many grades of stainless steel and each grade has its own capabilities in handling corrosion resistance and each grade has its own strength and weaknesses towards it.”

“Besides corrosion resistance, when we use the stainless steel instead of other materials, we have a huge weight reduction when it comes to design. And next, erosion resistance. Again, when it comes to sustainable environment, it is a recyclable; high scrap and reuse value. And low carbon emission.”

Stainless steel also has an aesthetic value, good mechanical properties and strength and can handle varying temperature ranges from cryogenic to high temperatures.

It is common knowledge that stainless steel is corrosion resistance. But why the resistance. Industry needs to be aware of the various grades of stainless steel developed and available in the market and the knowledge that a particular grade of stainless steel can solve the problem. One does not look only at the material cost, but in overall. If really stainless steel is going to cost you that much, how does one see it in every place. We have stainless steel bus shelters, stainless steel sinks, and even stainless-steel dustbins, signs off Mr Vigneshwar.



Role of desiccant dehumidification in empowering blasting, painting, and coating processes

In order to overcome the moisture menace, industry players can employ desiccant dehumidification solutions for achieving stable environmental conditions conforming to temperature, relative humidity, and dew point specifications outlined by the industry

Desiccant dehumidification is an essential requirement for performing industrial processes in a power plant and refinery setup as well as fabrication jobs. The sectors are involved in carrying out very sensitive and intricate operations that majorly hinge on blasting, painting, and coating processes. The processes are very sensitive to moisture, where even the slightest presence of humidity can ruin the entire efficiency. As a result, this requires the industry players to employ effective climate control measures to drive the optimal output of operations in tanks, columns, reactors, vessels, pipelines, bullets, and more.

Elaborating on the same,



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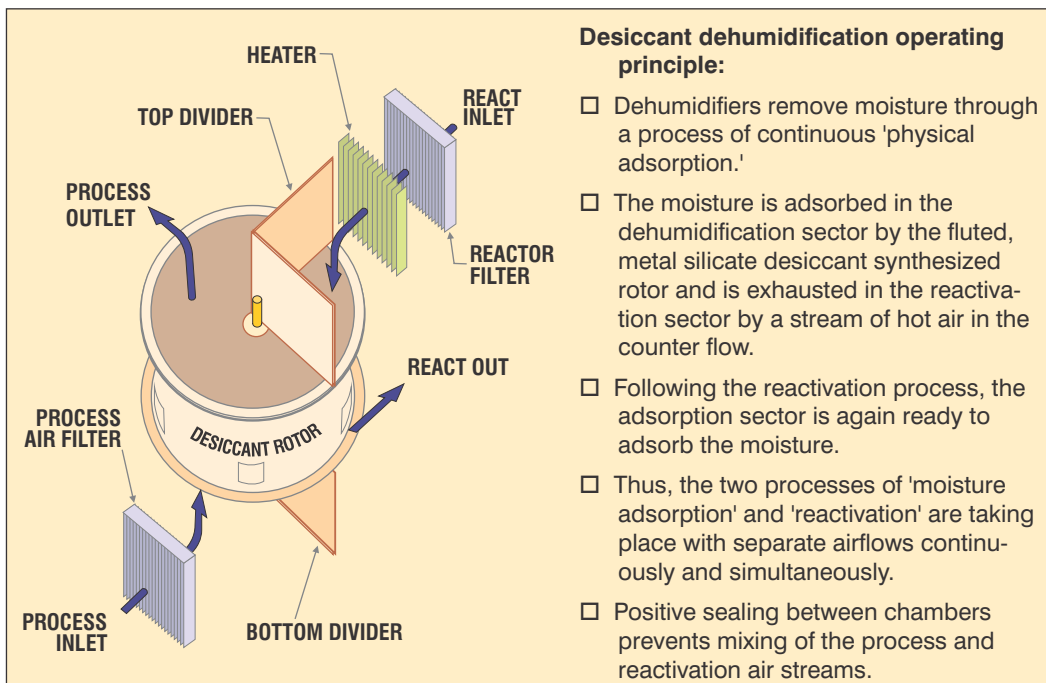
PHOTOS: TDS

humidity acts as a major deterrent jeopardizing the blasting process, which is the initial step towards facilitating painting and coating proce-

dures. Humidity causes the failure of the entire blasting process, where it forms condensation on the blasted surface preceding the

painting process. Conducting painting on the condensed surface is responsible for blistering and delamination problems. Moisture can be considered the major factor accountable for damaging the surface preparation and coating operations. Where it significantly shrinks the life of the coating system, the repercussion goes a long way, resulting in premature coating failure directly affected by improper surface preparation. Therefore, in order to drive optimal results, it is imperative to ensure thorough surface preparation, overseeing immaculate adhesion between the coating and the substrate. This in turn contributes to the success of coating and painting procedures.

Considering that highly

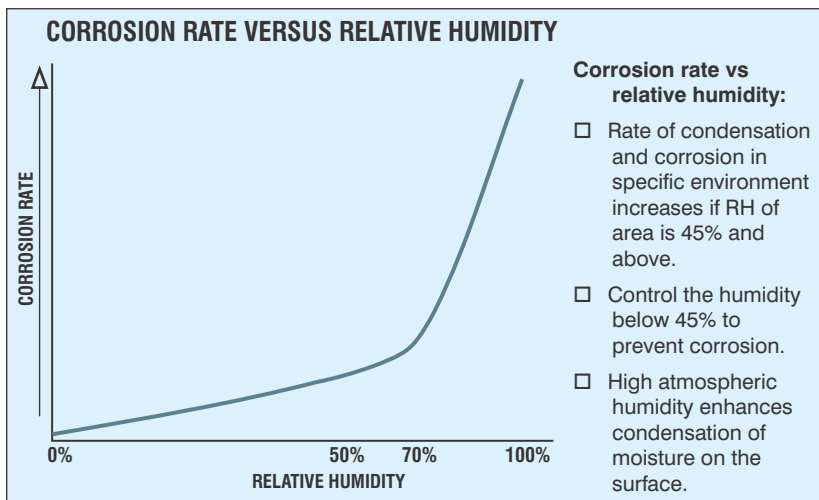


vulnerable materials such as petrochemicals or chemical gases are stored in the tanks, improper coating can also bring about the contamination and dilution of these chemicals. Hence, it is advisable to maintain strict environmental conditions, as humidity poses a significant threat to coating life, where it undergoes peeling when conducted on a cold metal surface.

Furthermore, monsoon and cold nights exhibiting high humidity levels increase the chances of condensation.

This leads to a common problem of corrosion, called rust bloom or flash rust, delaying or bringing the entire coating process to a halt.

In order to overcome the moisture menace, industry players can employ desiccant dehumidification solutions for achieving stable



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environmental conditions conforming to temperature, relative humidity, and dew point specifications outlined by the industry. The technology comes with the proficiency to maintain relative humidity (RH) below 55% and keep the temperature within the range of 30°C to 35°C. In the process, it also achieves a constant -5°C dew point differential between the air and the surface to be coated. Likewise, it is also proficient at maintaining a dew point

difference of -12°C between the air inside the tank and outside.

Therefore, deploying desiccant dehumidification solutions comes in handy for averting condensation on the surface by eliminating moisture from the coating system. While improving the coating life, the technology efficiently reduces inter-coat delamination, which plays a crucial role in enhancing curing properties. Owing to the advantages of the systems, industry players can enjoy marked cost and quality difference, time saving and can work round the clock in comparison to performing corrosion preventive painting.

Considering that an effective coating process is essential for the success of blasting, painting, and coating processes, desiccant dehumidifiers are at the heart of these procedures. Guaranteeing proper surface preparation, the technology is at the forefront of ensuring the longevity of the industrial processes involved in the sector.



Considering that highly vulnerable materials such as petrochemicals or chemical gases are stored in the tanks, improper coating can also bring about the contamination and dilution of these chemicals.



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Services.

Eco-friendly synthesis of graphene using high pressure airless spray system

The efficiency of this process, combined with lower processing times in the airless spray route ensures that the cost for producing graphene remains low making it an ideal producing route for industrial use, notes Prof A. S. Khanna, (Retd) IIT Bombay

Abstract

Graphene appears to be a wonder material of the present decade. Its special properties such as electrical conductivity, electronic mobility, mechanical strength, and optical properties have caught the attention of both the scientific as well as industrial communities. One of the biggest bottlenecks of its widespread usage is its availability in large volumes. Hence any research that focuses on industrial scalable production is the need of the hour. Keeping this in mind, a novel high pressure eco-friendly approach has been

developed to produce graphene that can cater to the industrial demands of graphene.

Introduction

Graphene, also termed as the “wonder material,” has generated a lot of curiosity in the scientific and industrial community since its invention in 2004^[1]. Graphene is a two dimensional structure consisting of a single layer of carbon atoms. With a tensile strength of 130GPa^[2], graphene is the strongest material ever discovered. It has extremely high electrical conductivity and electron

mobility^[3]. Any application of graphene will find it difficult to see the light of the day unless it is available in plenty from an eco-friendly synthesis method.

There have been multiple graphene producing routes which either use Chemical Vapor Deposition or chemical and mechanical energy to exfoliate graphite into graphene. Unfortunately, these routes suffer from high cost, low yield or a combination of these factors. Hence, developing an alternate route of graphene production was warranted that can help cater to the large volumes of defect

free graphene requirement.

High pressure exfoliation or airless spray pressure technique was devised after taking into account the drawbacks of the available graphene production routes. The use of pressure can be explained using a simple example of a stack of paper. When one blows a stack of paper, it separates out into individual sheets. Similarly, graphite can be thought as a stack of individual graphene sheets. If it subjected to air pressure, using a spray machine for example, it should separate out into individual layers.

Although van der Waals forces of attraction, that hold the individual graphene sheets together, are weak in nature, it requires significant force to overcome this binding force. Hence a more sophisticated version of spray equipment, airless spray, was used to exfoliate graphite into graphene. Airless spray atomizes the fluid coming out which will aid the exfoliation process.

Process

In order to atomize and exfoliate the graphite with high yield, high quality graphite was intercalated with salt ions by soaking the salt in a solution containing water and surfactants. This causes

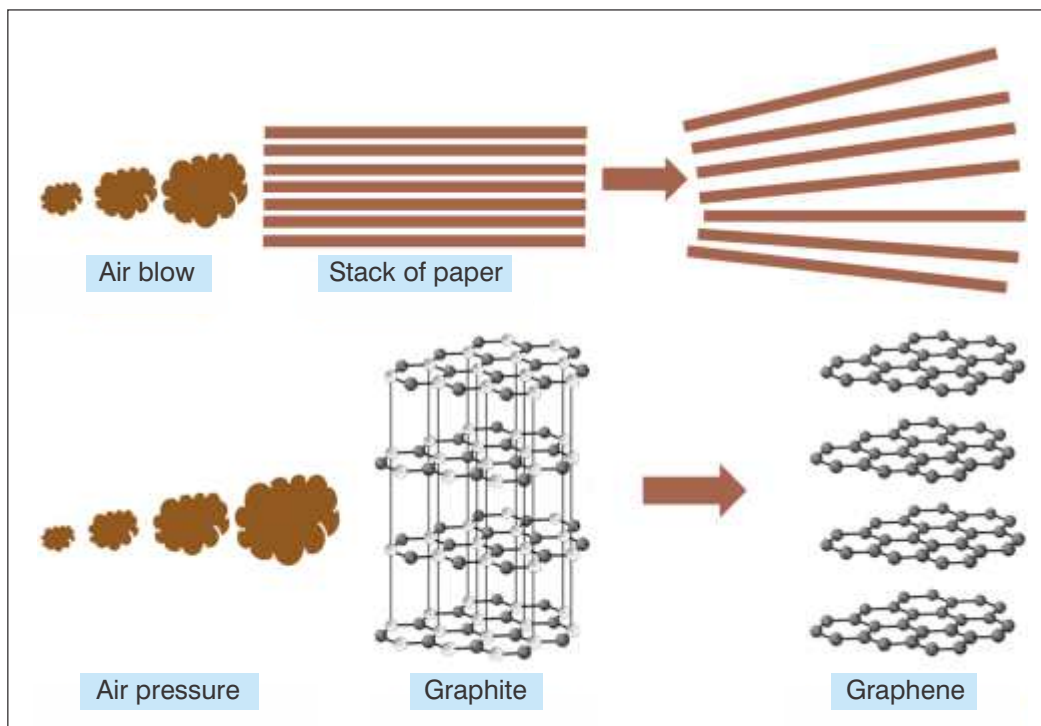


Figure 1: Exfoliation using air pressure.

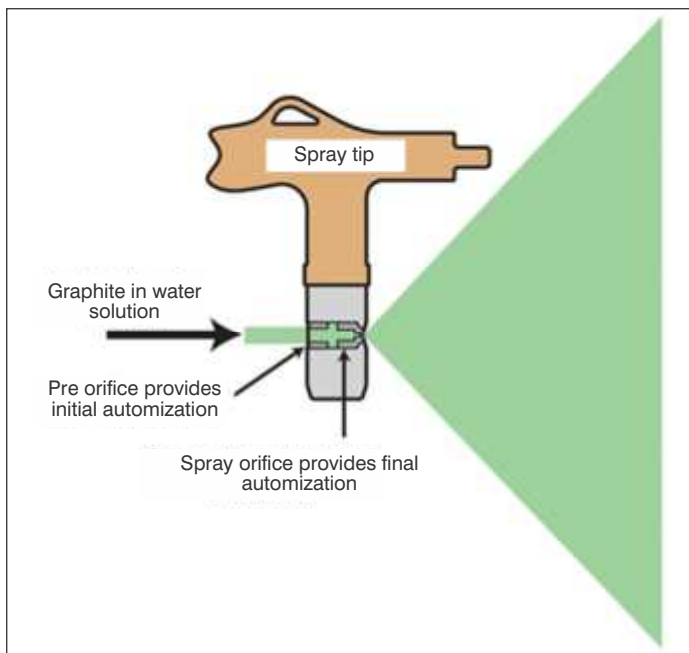


Figure 2: Schematic diagram of atomization process.

increase in the d-spacing between the graphite layers thereby weakening the van der Waal forces between the stacked graphite layers. The expanded graphite solution was then sprayed (Graco Magnum 262805 X7 HiBoy Cart Airless Paint Sprayer) into a container at high pressure. This cycle was repeated three times. The nozzle of the spray gun creates a fan of the outgoing graphitic solution thereby atomizing the graphite particles and forcing the individual sheets of graphene to separate out. The solution was then subjected to bath

sonication (30 min) and centrifugation (10,000 rpm for 30 min). The supernatant was separated and heated at 80 °C to obtain a concentrated graphene in water solution. Graphene produced was characterized using Raman Spectroscopy and TEM.

Results

Soaking cycle optimization

The soaking time and concentrations of the intercalating salt used were optimized using X Ray diffraction analysis. For any given time, it was observed that the shift in 2 values, indicating the increase in inter



Figure 3: High pressure liquid exfoliation carried out in lab. (A) Complete equipment; (B) Graphite solution being sprayed at high pressure; (C) Graphene after sonication and centrifugation in liquid (left) and powder (right) form.

layer spacing was more or less same for concentrations beyond 1% of salt. Hence in order to avoid excess salts, 1% salt was chosen as the ideal amount of salt for intercalation.

Having fixed the concentration of salt, the variation of 2 values for various time durations was deduced. It

was observed that the interlayer distance increases appreciably for 15 days beyond which not much change is observed. Hence, the soaking conditions were set to be 1% of salt for 15 days.

Table 1 summarizes the peak values of graphite obtained from XRD measurements.

	0.1%	0.3%	0.5%	1%	5%
5 days	26.70	26.69	26.69	26.68	26.68
10 days	26.65	26.63	26.63	26.58	26.58
15 days	26.56	26.55	26.54	26.42	26.41
20 days	26.54	26.52	26.45	26.41	26.39

Table 1: Shift in graphite peak observed in XRD.

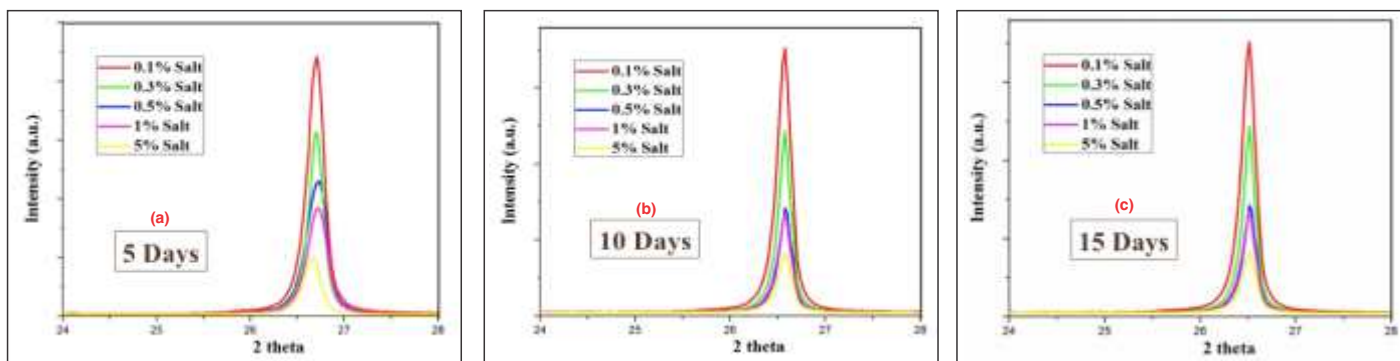


Figure 4: XRD plots of graphite soaked with different concentrations.

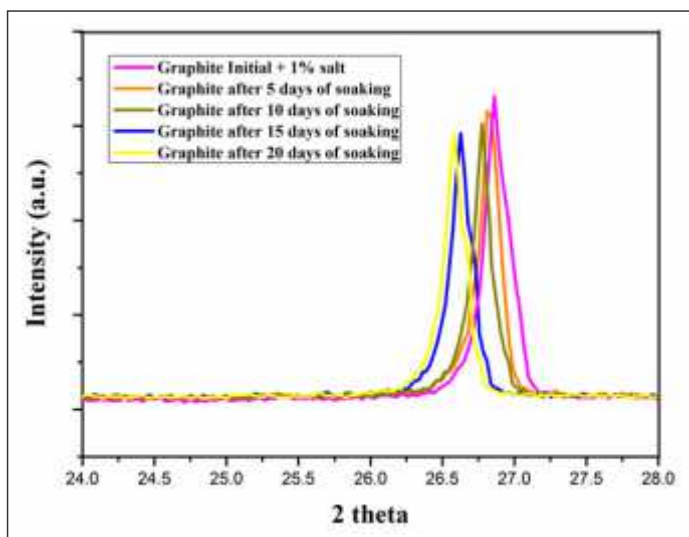


Figure 5: XRD plots of graphite soaked in 1% salt at different time intervals.

There is an increase of about 0.035 Å (Bragg's law) in the interlayer spacing. The shift from the regular structure weakens the interlayer forces of attraction which shall aid the exfoliation process.

Pressure optimization

The next parameter required to be optimized was the pressure at which the graphite was exfoliated. Starting from

low pressure values, experiments were conducted up to 3000psi. The Raman spectra of exfoliated solution indicate that beyond 2500psi, few layer graphene (2 - 5 layers) begins to separate out.

Based on the above optimization studies, it was found that the soaking cycle 1% of salt soaked for 15 days will give the best expansion of graphite

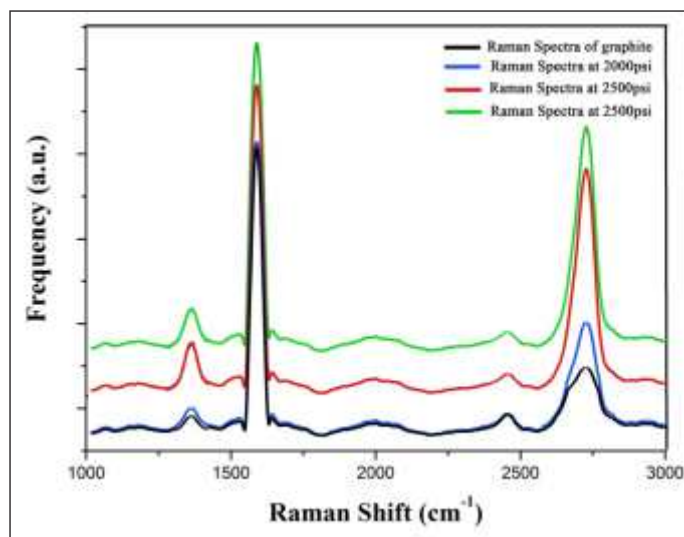


Figure 6: Raman spectra of exfoliated solution at different pressures.

layers and a pressure of 2500 psi will be ideal for exfoliation. The yield of this process was found to be 16 - 18%, almost double that of high shear exfoliation route.

Graphene characterization

D, G, and 2D characteristic peaks of graphene are observable in Raman spectra of the produced graphene shown in Figure 7. As described in earlier Raman spectra, low intensity D peak corresponds to low defect concentration in the produced graphene. G/2D peak intensity ratio and the shape of the 2D peak in the Raman spectra differentiate the produced graphene from graphite^[4]. This ratio is about 0.36 for monolayer and >1 for two or more layers, and increasing with the number of layers^[5]. Judging by the G/2D peak intensity ratio of 1.24 in this case, along with the symmetric shape of the 2D peak, we can conclude the number of layers to be 2 to 5. It has been confirmed through Raman spectra that after centrifugation, the supernatant contains only few

layers of graphene (below 5) and no traces of nano graphite.

Finer points with explanation

High-pressure exfoliation or airless spray pressure technique was devised after taking into account the drawbacks of the available graphene production routes. The uniqueness of the process lies in some of the key features of this technique that makes it a unique and ideal route:

The use of standard airless spray equipment without any modifications

An airless spray system is common equipment in paint coating industries. It is used for high performance protective coatings such as solventless systems, which have high viscosity and require large pressure for atomization. Passing the graphite solution through the airless spray does not require any modification to the equipment and hence this technology can be easily incorporated.

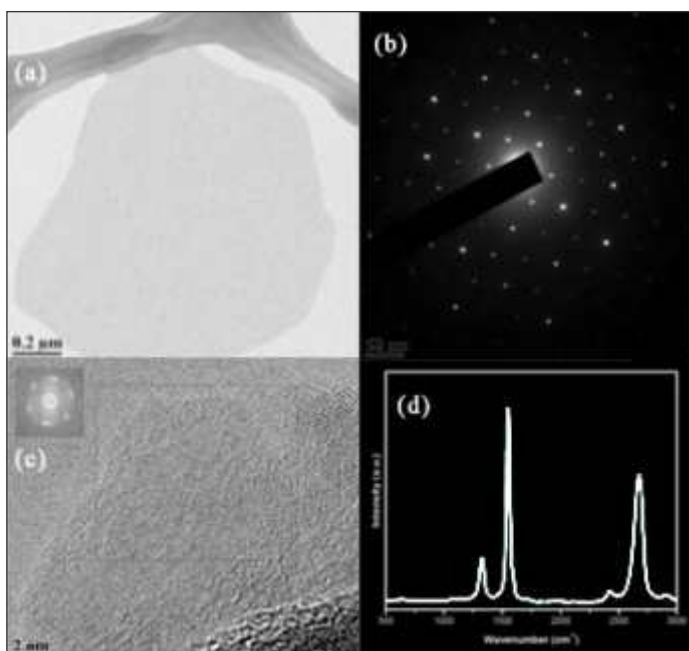


Figure 7: High pressure exfoliated graphene characterization. a) TEM image of a graphene flake; b) Electron diffraction pattern of the produced graphene showing clearly six membered ring; (c) HR-TEM image of graphene and corresponding FFT image (inset); (d) Raman spectra of the graphene sample.



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



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Eco-friendly

In this day and age, using an eco-friendly approach is a must. This process uses water as a solvent instead of harmful solvents like NMP, DMF, etc., that were used in other scalable studies. There is no volatile content released during the process. Additionally, left over graphite (and surfactants), after completion of the process, can be re-used in the next processing cycle without any form of waste.

High efficiency

Intercalation of graphite before spray process weakens the intermolecular forces of attraction between the individual graphene sheets making it easier for the

airless spray system to separate them out. This explains the high efficiency of the airless spray route.

Ability to automate the process

This process is simple in terms of operation and can be easily automated for scaling up and producing larger volumes. Making this a continuous route can largely reduce the cost of power, time and cost of consumables.

Conclusion

With the increasing applications of graphene, the demand of high quality graphene will only increase in the coming days. The use of pressure to exfoliate graphite into graphene is a unique and novel route of producing

graphene. Detailed characterization studies have revealed that the grapheme produced is defect free and of high quality. The efficiency of this process combined with lower processing times in the airless spray route ensures that the cost for producing graphene remains low making it an ideal graphene producing route for industrial use.

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Author: **Prof A. S. Khanna**, retired Professor from the prestigious Indian Institute of Technology Bombay, is now

Chairman, SSPC India, and Technical Director of Thermogreen Cool Coat Pvt Ltd. Prof Khanna guided 27 Ph.d's and more than 130 Master's and B. Tech projects. He has five patents and has an extensive publication list with more than 200 papers in peer reviewed international journals, through which he has got more than 4,500 citations. Prof Khanna has received several awards. He is Fellow ASM International and NACE International, life member of Indian Institute of Metals and Society for Electrochemical Science. He is a Fellow of the Humboldt Foundation, Bonn and also of the Royal Norwegian Science and Technology and Fellow of Japan Key Centre.



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Selektepe developers, I-Tech highlight marine biocides role as key enablers for sustainable shipping

The need for antifouling biocides to actively protect underwater surfaces from biofouling is greater than ever before

As a co-author and signatory of a recently published whitepaper entitled “Antifouling biocides: a key contributor to sustainable shipping” I-Tech, the developers of the barnacle repelling technology, Selektepe believe that education around the important role of antifouling biocides in supporting sustainability in the maritime industry is vital.

As the negative consequences of marine biofouling on fuel use and emissions continue to intensify in parallel with tightening rules around GHG emissions from cargo and passenger ships, the need for antifouling biocides to actively protect underwater surfaces from biofouling is greater than ever before.

Although marine biocides reside in the majority of antifouling coatings used on the global shipping fleet, their crucial role in providing the only possible method for continuous active protection against biofouling species that is applicable for the entire maritime fleet is often underestimated. Concerns regarding the effects of biocides on the marine environment and their safe usage are frequently heightened by marketing campaigns promoting new alternative biofouling management technologies. Effective education and knowledge

around the extensive regulatory regimes that uphold the safety of biocide use in the marine environment can be relatively absent.

I-Tech, as a marine biocide supplier, recently co-authored the whitepaper entitled “Antifouling biocides: a key contributor to sustainable shipping” with eight other global biocide suppliers, with the aim of highlighting the important role of biocides in antifouling coatings; the history of their use, how the safety of their use is regulated, and why the maritime industry needs them in the quest for meeting global sustainability and decarbonization targets.

Currently, more than 95% of the global shipping fleet are using biocidal antifouling coatings to prevent fouling, at the same time the biofouling management technology sector is rife with innovation. This including the continuous advancing of biocidal coating technologies, the development of low-biocide or biocide-free coatings, hull grooming services and technology, and alternative hull surface protection methods.

Lowering the quantity of total biocides in antifouling paints, while still preserving their effectiveness, is a trend that is emerging, particularly in certain areas of the world



Education around the important role of antifouling biocides in supporting sustainability in the maritime industry is vital.

WHAT IS BIOCIDES

Biocides are used to protect people and animals, preserve goods and materials, stop pests and control viruses, bacteria.



Biocides have been tested and used for over twenty years, proving to be the most effective solution for marine vessels.

Despite decades of effort, biocide-free solutions remain unfeasible, with no viable alternatives for the maritime industry. Consequently, more than

95%



of the antifouling coatings currently used by marine cargo- and passenger vessels, and leisure craft contain biocides.

Marine biocides are essential for a transformation to net-zero emission shipping.

where regional regulation supports optimizing and lowering the total biocide content in coatings.

I-Tech, as a supplier of the marine biocide, Selektepe, is positive to this trend. Selektepe, as a barnacle repelling active agent, can be used at extremely low concentrations in an antifouling coating system due to its selective mode of action on barnacle species. With a recommended use at 0.1% per wet weight of paint, it delivers successful and continuous hard fouling prevention performance for the lifetime of the paint system, even when vessels remain stationary for long periods of time.

This ability to enhance low biocide coating systems has made Selektepe popular with paint manufacturers over the past decade. Since the first antifouling coating containing Selektepe was introduced to the industry in 2015, thirty-six antifouling coating products containing the biotechnology have been commercialized by several different global coatings manufacturers. By April 2024, sales of Selektepe reached twenty tons, representing enough Selektepe for over 15 million liters of paint.

The inclusion of Selektepe in global and regional antifouling coatings ranges from 60-month systems for ocean-going vessels, to



The need for antifouling biocides to actively protect underwater surfaces from biofouling is greater than ever before.

outfitting coatings for the protection of newbuild vessels in shipyards, to domestic leisure boat coatings for regional markets.

Makus Jönsson, CEO of I-Tech, says: "As a supplier of a substance that is classified and approved as a marine biocide,

although with a temporary and non-fatal effect on the target organism, we believe that increased knowledge around the need for biocides and how they are regulated is key. This is why we contributed to authoring the "Antifouling biocides: a key contributor to sustainable shipping" white paper and are strong advocates of getting the message out that marine



Cover picture of the recently published whitepaper: "Antifouling biocides: a key contributor to sustainable shipping."

biocides are essential for a transformation to net-zero emission shipping."

"This whitepaper provides the perfect vehicle for the industry to gain better understanding of marine biocides and their role in the shipping industry, in addition to providing vital context around the aspects impacting their current and future use," concluded Jönsson.

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Berger Paints bags prestigious award for Innovation in Paint and Coating Solutions for Coaches

Berger Paints India bagged the prestigious honor for Innovation in Painting and Coating Solutions for Coaches of the Indian Railways at the 6th Rail Analysis Innovation & Excellence Summit 2025 held at the Hotel Le Meridien, New Delhi, January 31, 2025. Mr Sanjay Chowdhury, Vice President and Business Head, Berger Paints India, received the award on behalf of his company. The series of

awards are given to organizations that have provided outstanding contributions to the rail industry and have truly set new benchmarks in innovation, excellence, and collaboration.

Rail bogies need to be corrosion and weather resistant. Berger Paints India is the first company to introduce fluoropolymer coatings on the FIAT Bogie as per JIS Japanese technology with the approval of RDSO

(Research Designs & Standards Organisation), the research and development and railway technical specification development organization under the Ministry of Railways of the Government of India.



Mr Sanjay Chowdhury, Vice President and Business Head, Berger Paints India, with the award for Innovation in Painting and Coating Solutions for Coaches of the India Railways.

PHOTO: MR SANJAY CHOWDHURY / BERGER PAINTS

Nouryon opens new office in Al Dhahran to strengthen presence in Saudi Arabia and the Middle East

Nouryon, a global specialty chemicals leader, has announced the opening of its new office in Al Dhahran, Saudi Arabia. The new office is in the prestigious Al Abdulkarim Tower, the tallest commercial tower in the Eastern Province, in the heart of one of the largest cities in

the Gulf. This move marks a significant milestone in Nouryon's commitment to expanding its operations and better serving its customers in the Middle East.

"We are very pleased to inaugurate our new office in Al Dhahran, reinforcing our

commitment to the Saudi Arabia market and the Middle East," said Mr Sobers Sethi, Senior Vice President Emerging Markets and China at Nouryon. "This strategic investment will support our customer service, logistics, and supply chain capabilities, as well as our growth ambitions in the region."

The new Al Dhahran office will primarily function as a sales hub. A commercial team will be based there to serve key end markets in the region including packaging, polymer specialties, building and construction, oilfield and personal care.

"The opening of this office is a testament to our dedication to the Saudi Arabia market. By localizing our operations and

getting closer to our customers, we are better positioned to understand and meet their needs," said Ameer Al Majed, General Manager at Nouryon Saudi Arabia. "Our focus on customer centricity and providing tailored solutions will drive our growth and success in this dynamic region."

Nouryon operates in Saudi Arabia as a joint venture with Yusuf bin Ahmed Kanoo Company, further strengthening its presence and capabilities in the region. With operations in Saudi Arabia for more than 25 years, Nouryon established Nouryon Saudi Arabia for chemicals as the legal entity in 2021 to further expand its operations and serve as a hub for its employees in Saudi Arabia.



The new office in Al Dhahran marks a significant milestone in Nouryon's commitment to expanding its operations and better serving its customers in the Middle East.

PHOTO: NOURYON

MATCOR relaunches Iron Gopher® with price reduction and in-house production

MATCOR, Inc., (matcor.com) a BrandSafway company and a leader in cathodic protection and AC mitigation solutions, announces the relaunch of its patented Iron Gopher® Linear Anode, now available at a significantly reduced price, providing cost-effective insurance to users for challenging horizontal directional drilling (HDD) projects, minimizing risks and reducing costs during installation.

This price reduction is the result of MATCOR's move to in-house production, reducing

reliance on third-party suppliers and shipping delays while ensuring superior quality control. The result is a stronger, more reliable linear anode that minimizes the risk of breakage during installation, helping you avoid idle crews and project delays.

"By bringing production in-house, we've cut costs dramatically, allowing us to offer this premium solution at just a small premium over standard linear anode products," says Ted Huck, Director of Sales at MATCOR.

"When we introduced the Iron

Gopher, its cost limited adoption despite its superior performance," said Ted. "By bringing production in-house, we've cut costs dramatically, allowing us to offer this premium solution at just a small premium over standard linear anode products."

The Iron Gopher has already proven its value in major pipeline projects. A recent customer shared: "The Iron Gopher's design and strength are unmatched for



MATCOR's Iron Gopher Linear Anode.

HDD applications. Installation was seamless, and the product is performing exactly as expected. We look forward to using it on future projects."

Axalta introduces Evergreen Sprint as 2025 Global Automotive Color of the Year

Axalta Coating Systems (axalta.com), a leading global coatings company, has announced its 2025 Global Automotive Color of the Year – Evergreen Sprint. This marks the 11th year Axalta has

introduced its automotive color of the year and the second time it has featured a green shade.

Evergreen Sprint is a rich, deep forest green that pays

homage to the legendary British racing green, a shade that has graced the finest racing machines and symbolizes speed and performance. Axalta's latest color also captures the

thrill of motorsport while bringing a touch of sophistication to sedans and SUVs – making this the perfect look for all vehicle types.

"This striking hue revs up our global automotive color of the year," said Dan Benton, Global Color Marketing Director at Axalta. "Evergreen Sprint stands out on the road and evokes the spirit of competition and adventure. The dynamic color is sure to attract the hearts of passionate drivers."

Axalta's global team of color experts have collaborated annually since 2015 to reveal up-and-coming shades for the automotive market. According to Axalta's Global Automotive 2023 Color Popularity Report, green is found on approximately 2% of vehicles worldwide.



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Could corrosion actually be helpful? New 3D printing technique might turn oxidation into an advantage

When designing a mechanical system that includes metal, the engineer's biggest enemy can be oxidation. The chemical reaction forms rust or causes other kinds of problems, affecting the efficiency or longevity of the device.

Additively manufactured metals – which have led to advances in aerospace, marine and automotive design, among other areas – are more susceptible to failure in a corrosive environment. The 3D printing process causes increased porosity when compared to conventionally manufactured metal.

What if there was a way to make metals stronger through oxidation? That's the radical idea behind new research at Binghamton University's Thomas J. Watson College of Engineering and Applied Science.

Professor Changhong Ke, a faculty member at Watson College's Department of Mechanical Engineering, recently received a \$150,000 grant through the National Science Foundation's Early-concept Grants for Exploratory Research (EAGER) program. The funding is intended to support untested but potentially transformative research ideas or approaches, notes a press communiqué from the University.

Prof Ke will investigate the potential of building nanotubes into additively

manufactured aluminum. He believes that microscopic structures made of boron nitride – a compound commonly used in cosmetics, pencil lead and cement for dental applications – would make the material self-strengthening under corrosive conditions like moisture and seawater.

“You can't avoid oxidation, so we are trying to take advantage of it by turning it into a new, reinforcing mechanism to make the material stronger,” Ke said. “That would be something really amazing. People could try to design the materials to include these sorts of porosities or even purposely introducing structures that can be more easily oxidized because it becomes something beneficial instead of harmful to the material itself.”

The nanotubes threaded throughout the metal are a few nanometers thick, and a few to hundreds of microns long. To see how the oxidation changes the way that nanotubes bind to metal – a core issue in the self-strengthening mechanism, Ke and his team in the Nanomechanics Laboratory will use a force sensor to pull individual nanotubes out of the oxidized metal inside a high-resolution scanning electron microscope, which



Professor Changhong Ke will investigate the potential of building nanotubes into additively manufactured aluminum to mitigate the effects of corrosion.

PHOTO: JONATHAN COHEN

allows them to watch what is happening in real-time.

“We designed this as a sandwich structure,” he said. “It's like a hot dog, with the nanotube as the meat and the metal as the bread.”

Researchers will also test the material on a macro scale, looking at load transfer to learn more about how the oxidation affects the stiffness, strength, and toughness of the nanotube-reinforced metal. Because it's important to understand how any self-strengthening is happening, collaborators from the

University of Illinois will confirm Ke's experimental findings through computational modeling.

“We're hoping this will provide a new perspective to the scientific community about how we view metal oxidation in terms of future material design,” he said. “That could change the research landscape for these metal materials, particularly for 3D printed metal. It has so many promising applications in different areas, and it even could revitalize U.S. manufacturing competitiveness.”

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KIT with IIT Guwahati develops novel surface materials with almost perfect water repellence

Scientists from Karlsruhe Institute of Technology (KIT) and the Indian Institute of Technology Guwahati (IITG) have developed a surface material that repels water droplets almost completely. Using an entirely innovative process, they changed metal-organic frameworks (MOFs) – artificially designed materials with novel properties – by grafting hydrocarbon chains. The resulting superhydrophobic (extremely water-repellent) properties are interesting for use as self-cleaning surfaces that need to be robust against environmental influences, such as on automobiles or in architecture. The study was published in the *Materials Horizons* journal.

MOFs (metal-organic frameworks) are composed of metals and organic linkers that form a network with empty pores resembling a

sponge. Their volumetric properties – unfolding two grams of this material would yield the area of a football pitch – make them an interesting material in applications such as gas storage, carbon dioxide separation, or novel medical technologies.

But also the outer surfaces exposed by these crystalline materials offer unique characteristics, which the research team took advantage of by grafting hydrocarbon chains to thin MOF films. They observed a water contact angle of more than 160 degrees – the larger the angle formed by the surface of a water drop with the substrate, the better the hydrophobic properties of the material. “With our method, we are able to achieve superhydrophobic surfaces with contact angles that are significantly higher than those

of other smooth surfaces and coatings,” states Professor Christof Wöll from KIT’s Institute of Functional Interfaces. “Although the wetting properties of MOF powder particles have been explored before, the use of monolithic MOF thin films for this purpose is a groundbreaking concept.”

The team attributes these results to the brush-like arrangement (polymer brushes) of the hydrocarbon chains on the MOFs. After being grafted to the MOF materials, they tend to form “coils” – a state of disorder that scientists call “high-entropy state,” which is essential for its hydrophobic properties. The scientists asserted that this state of the grafted hydrocarbon chains could not be observed on other materials.

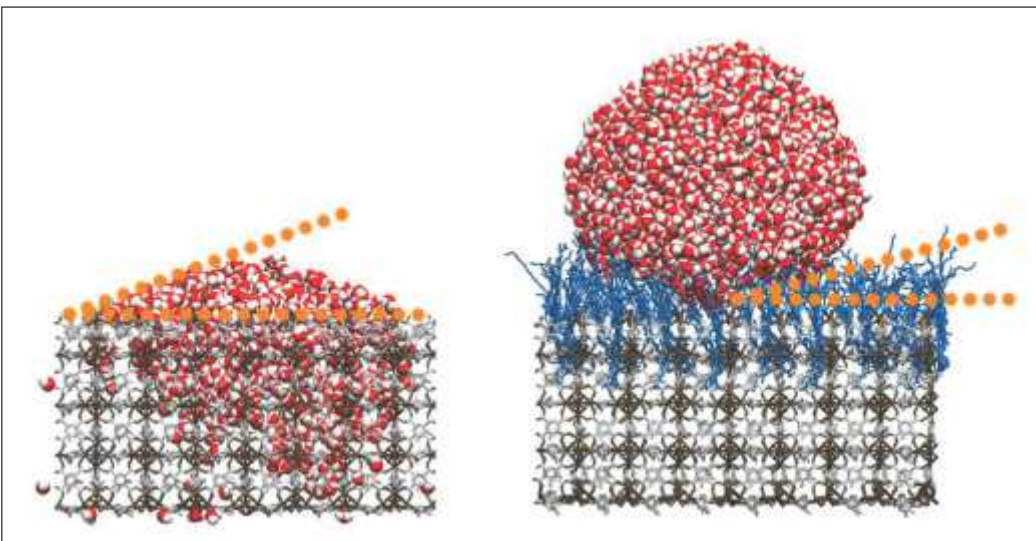
It is remarkable that the water

contact angle did not increase even when they used perfluorinated hydrocarbon chains for grafting, i.e. substituting hydrogen atoms with fluorine. In materials such as Teflon, perfluorination brings about superhydrophobic properties. In the newly developed material, however, it decreased the water contact angle significantly, as the team found out. Further analyses in computer simulations confirmed that the perfluorinated molecules – in contrast to hydrocarbon chains – could not assume the energetically favorable high-entropy state.

In addition, the scientists varied the surface roughness of their SAM@SURMOF systems in the nanometer range, thereby further reducing the water adhesion strength. Even with extremely small inclination angles, water droplets started rolling off, and their hydrophobic and self-cleaning properties were significantly improved.

“Our work also includes a detailed theoretical analysis, which links the unexpected behavior shown in experiments to the high-entropy state of the molecules grafted to the MOF films,” says Professor Uttam Manna from IITG’s Chemistry department. “This study will change the design and production of next-generation materials with optimum hydrophobic properties.”

ILLUSTRATION: KARLSRUHE INSTITUTE OF TECHNOLOGY



Left: Porous substrate with a small water contact angle: The surface absorbs a lot of liquid. Right: The new material features a large water contact angle and is thus nearly completely hydrophobic.

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MECOC Expo 2025: A resounding success in shaping the future of the energy industry

The 4th Edition of the Middle East Metallurgy Corrosion and Coatings Expo (MECOC EXPO 2025) has successfully concluded, leaving an indelible mark on the energy sector. Held January 14 – 16, 2025, at the Conrad Abu Dhabi Etihad Towers, the event exceeded expectations, bringing together key industry leaders, innovators, and experts to discuss the future of energy, sustainability, and advanced materials, notes a press release from the organizers.

Under the theme “Towards a Sustainable Future for the Energy Industry,” MECOC EXPO 2025 hosted over 60 distinguished speakers who shared their expertise across three major conference tracks: Future Steel, Non-Metallic Materials, and Corrosion and Coatings. The conference covered cutting-edge solutions aimed at addressing the rapidly evolving challenges in the

energy sector.

The opening session was eloquently hosted by Mr Mamdouh Al Aidarous, a highly regarded expert in the oil and gas industry, while the exhibition was officially inaugurated by Conference Executive Chairman, Mr Juma Al Maskari, Vice President of Maintenance at ADNOC Distribution, marking a prestigious beginning to the conference.

Keynote speeches by industry luminaries such as Dr Gunther Voswinckel, President of the International Tube Association; Dr Hanan Farhat, Senior Research Director at QEERI; and Mr Hussain N. Al Binali, Manager for Non-Metallic Engineering at Saudi Aramco, captivated the audience with their insights on the future of material technologies, sustainability initiatives, and operational excellence.

The exhibition component of

the event featured over 30 leading companies, including Sigma Paints, Aspen Aerogels, and Future Pipe Industries. Exhibitors presented the latest innovations in metallurgy, corrosion management, and non-metallic materials, providing attendees with a comprehensive look at technologies poised to transform the energy industry.

MECOC Awards 2025 recognize industry excellence

A highlight of MECOC EXPO 2025 was the prestigious MECOC Awards, celebrating excellence in the energy sector across both the End user and Vendor categories. The winners were recognized for their outstanding contributions in advancing corrosion, coatings, steel, and non-metallic materials technologies.

Vendor category award winners:

- Excellence in Corrosion and Coatings Award: Horizon Case Study
- Non-Metallic Materials Industry Impact Award: PTFE Spacer Wrap
- Steel Industry Leading Contribution Award: SAP & KAPS Petroleum Services LLC

End user category award winners:

- Excellence in Corrosion and Coatings Award: Hani Sabrina Zulkafli, PTTEP
- Non-Metallic Materials Industry Impact Award: Ioannis Inepkoglou, Borouge
- Steel Industry Leading Contribution Award: Andrey Yugay, Well Integrity Specialist, ADNOC Onshore

MECOC EXPO 2025 attracted senior-level professionals from across the globe, including CEOs, Vice Presidents, Directors, and Specialists from top organizations. The event provided an invaluable platform for networking, collaboration, and forging new partnerships, solidifying its position as a pivotal event in the energy sector.

As MECOC EXPO continues to grow as the premier platform for professionals in the energy industry, the 2025 edition has once again demonstrated its vital role in driving the future of innovation, sustainability, and collaboration in the sector.

Dates for MECOC 2026 (mecocmiddleeast.com) will be announced shortly.



MECOC EXPO 2025 hosted over 60 distinguished speakers who shared their expertise across three major conference tracks: Future Steel, Non-Metallic Materials, and Corrosion and Coatings.



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SEP 23 – 25, 2025	ABRAFATI SHOW 2025	São Paulo Expo, São Paulo, Brazil	Vincentz Network	E: matthias.janz@vincentz.net W: home.abrafatishow.com.br
SEP 25 – 27, 2025	PAINT BANGLADESH 2025	International Convention City Bashundhara (ICCB) Dhaka, Bangladesh	BMPA and REEMS	E: cs2@reemsbd.com W: paintbangladesh.com
OCT 01 – 03, 2025	PAINTEXPO EURASIA	Istanbul Expo Centre, Istanbul, Turkey	Artkim	E: sales@artkim.com.tr W: artkim.com.tr
NOV 03 – 06, 2025	ADIPEC	Abu Dhabi, UAE	dmg events	E: enquiry@adipec.com W: adipec.com
NOV 12 – 13, 2025	USA COATINGS SHOW 2025	MeadowLands Exposition Centre, New York, USA	United Expo	E: unitedexpo@gmail.com W: usa-coatings-show.com
NOV 24 – 26, 2025	GULF COATINGS SHOW 2025	Expo Centre, Sharjah, United Arab Emirates	NürnbergMesse GmbH	E: matthias.janz@vincentz.net W: www.gulf-coatings-show.com
NOV 25 – 27, 2025	CHINACOAT 2025	Shanghai New International Expo Centre (SNIEC), Shanghai, China	Sinostar	E: info@sinostar-intl.com.hk W: www.chinacoat.net
MAY 05 – 07, 2026	AMERICAN COATINGS SHOW AND CONFERENCE	Indiana Convention Center, Indianapolis, Indiana, USA	American Coatings Association	W: american-coatings-show.com E: cmatthews@paint.org

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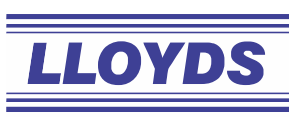
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