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75<sup>TH</sup>  
EDITION

# COATINGS AND ANTI CORROSION ENGINEERING REVIEW

June - July 2023 | Volume 14 Issue 2 | ₹ 100



**Oil and gas pipeline construction projects to boost demand for the coatings and corrosion management sector**



Interview  
**Dr U. Kamachi Mudali**  
Chairman  
CII – Corrosion Management Committee

Technical Feature  
**Strengthening the bond with reliable structural adhesives**

New Products & Processes

Industry News

Special Feature

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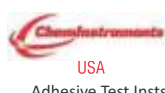
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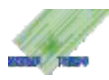
Coating Thickness & Paint Inspection Insts.



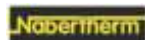
Dust Particle



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Heating & Cooling Insts.



Packaging Test



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# 75<sup>TH</sup> EDITION

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## From the Editor-in-Chief...

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Ever since we started the magazine in the year 2010, we have been coming out regularly, on time, each time, except for a few months we could not due to the Covid-19 induced lockdowns. After that, one day, we started counting how many editions we had managed so far and to our surprise, we suddenly found we were nearly reaching 75. This is the 75th Edition that you are holding in your hands and all this has been possible only because of the support of each one of you – the subscribers, readers, advertisers and well-wishers.

As India picks up pace towards being a top-notch economy, the country is among the top five developers of oil and gas pipelines, which are under construction and proposed, according to an analysis by Global Energy Monitor, a non-profit organization that tracks energy projects. The country is constructing 1,630 km long oil transmission pipelines, ranking second globally in the pipelines under construction category.

The Paradip Numaligarh Crude Pipeline (under construction) and New Mundra–Panipat Oil Pipeline (proposed) will be among the longest oil pipelines in the world. One of the longest gas pipeline projects under construction is the 2,655-km Jagdishpur-Haldia-Bokaro-Dhamra Natural Gas Pipeline (JHBDPL) in India.

In this issue, we try and discuss, how all this, together with maintenance and recoating of existing pipelines would mean a robust demand for the paint, coatings and corrosion management business.

Besides this, we have our spread of the regular technical features, product profiles, interviews, news, etc., and we hope in the coming months we can expand our horizon and add newer columns and sections to be a torchbearer of knowledge and news in this industry.

As we race forward to our Centenary edition, we look forward to your support that this journal will be able to serve you better as the main vehicle of presenting ideas, new developments and research work in this sector.

**Jolly Lonappan**  
Editor-in-Chief



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Aluma Coat® - TW



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#### Aluma Coat® - BR

A brushable / sprayable easy to apply coating designed to protect surfaces from severe turbulence, corrosion, erosion and chemical attacks. It gives a satin smooth, high-gloss surface finish and can withstand maximum service temperature up to 150°C / 302°F



Aluma Coat® - BR



Motor Shaft  
Coated with  
Aluma Coat - BR



Butterfly Valve  
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## Gerdau Graphene launches two performance-enhancing graphene additives for water-based paints and coatings

Gerdau Graphene, the nanotechnology company pioneering advanced graphene-enhanced materials for industrial applications, has announced the commercial availability of two new cutting-edge additives specifically formulated for the paint and coatings industry: NanoDUR and NanoLAV. The new additives, produced with the company's proprietary G2D technology, utilize graphene nanoplatelets to deliver unprecedented performance improvements for water-based paints and coatings — without altering pH levels. The additives also reduce or eliminate the need for some traditional manufacturing inputs, additives, and processes, which can lower production costs while improving sustainability and reducing environmental impact.



*NanoDUR and NanoLAV, the new additives utilize graphene nanoplatelets to deliver unprecedented performance improvements for water-based paints and coatings — without altering pH levels.*

“Until recently, it has been virtually impossible for coatings manufacturers to upgrade product performance, slash manufacturing costs, and improve sustainability at the same time — it simply couldn't be done. Now, the application of carbon nanomaterials, such as

graphene, in commercially available additives has made this possible and will act as a game-changer for the industry,” said Alexandre de Toledo Corrêa, CEO of Gerdau Graphene. “NanoDUR and NanoLAV represent the new performance, economic, and sustainability edge for coatings manufacturers, enabling them to leapfrog competitors across the value chain. These are the newest in our growing portfolio of graphene additives and we're excited to partner with industry leaders to develop even more novel, powerful applications for graphene.”

**NanoDUR:** enhanced durability for low- and high-traffic surfaces — NanoDUR is a water-based graphene additive that demonstrates excellent dispersion and dramatically increases paint and coating durability. NanoDUR-enhanced paints and coatings demonstrate an extraordinary ability to withstand wear and tear, weathering, and other external factors that can lead to degradation over time while maintaining physical and chemical properties, such as color, and adhesion, as well as a strong resistance to chipping, flaking, cracking, fading, and peeling.

**NanoLAV:** improved washability and moisture-resistance in tropical and subtropical regions — NanoLAV is a graphene additive specifically designed for water-based architectural paints. With excellent dispersibility, NanoLAV increases the washability and moisture-resistance of painted or coated surfaces, enabling

## PPG introduces PPG ENVIROCRON Primeron powder primer series for high-performance corrosion protection

PPG has announced the launch of the PPG ENVIROCRON® Primeron primer powder portfolio, designed to provide high corrosion resistance for metal substrates including steel, hot-dip-galvanized steel, metalized steel and aluminum.

“Protective primers are the first line of defense to protect metal surfaces from corrosion, the most significant challenge in the metal coatings industry,”

said Lorenzo Soldavini,

PPG technical manager powder, EMEA, Industrial Coatings. “Use of PPG Envirocron Primeron primer in a multi-layer system offers optimal corrosion protection and is key to extending a product's lifespan and preserving its structural integrity.”

The PPG Envirocron Primeron primer powder portfolio has been tested according to the corrosivity categories and approved by the QUALISTEELCOAT international quality label for coated steel. The series covers a wide range of requirements depending on

end use, operating environment and the substrate used:

PPG Envirocron Primeron ZINC coating is a zinc-rich primer offering strong corrosion protection.

PPG Envirocron Primeron PRO coating is a solid basic



*The PPG ENVIROCRON® Primeron primer powder portfolio is designed to provide high corrosion resistance for metal substrates.*

primer for strong corrosion protection regardless of the pre-treatment method. It offers good mechanical performance with a well-balanced property profile.

PPG Envirocron Primeron EDGE coating offers best-in-class corrosion protection for substrates with sharp edges. It is optimized for degassing substrates.

PPG Envirocron Primeron FLEX coating provides very good corrosion protection for multiple substrates including aluminum and different pre-treatment methods.

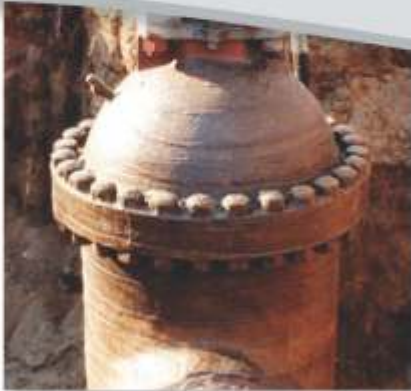
them to withstand cleaning or washing without degrading, dissolving, peeling, or fading when exposed to water, mild detergents, or other cleaning agents. The washability of a paint or coating is important in

applications where hygiene is crucial, such as hospitals, schools, and kitchens, and in locations that are prone to stains, dirt, and other contaminants that accumulate on surfaces.



# Trenton offers three Wax-Tape® brand anticorrosion wrap systems.

*High-quality, easy-to-apply wraps that protect irregularly shaped fittings and require minimal surface preparation.*



*Belowground applications*

## **Wax-Tape® #1**

### **Anticorrosion Wrap:**

A very durable wrap that uses a thick, non-stitch bonded synthetic fabric and has no clay fillers, so it stays conformed to irregular profiles. The wrap requires no abrasion blasting, can be backfilled immediately and is compatible with cathodic protection.



*Aboveground and belowground applications*

## **Wax-Tape® #2**

### **Self-Firming Anticorrosion Wrap:**

A unique, microcrystalline-wax-saturated wrap that slowly firms up to provide excellent aboveground and belowground protection. Comes in a variety of colors and usually requires no outerwrap.



*High-temperature applications*

## **Wax-Tape® HT-3000**

### **High-Temperature Anticorrosion Wrap:**

Designed for operating temperatures up to 230°F (110°C), Wax-Tape® HT-3000 wrap can be used on high-temperature oil and gas piping, on compressor station discharge piping, beneath thermal insulation and in high ambient temperature conditions.

**Only Trenton offers Wax-Tape® brand anticorrosion wrap systems, with primers, wraps and outerwraps.**

# **TRENTON**

ANTICORROSION MATERIALS

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Trenton Advisor

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## Erichsen launches the new generation 432 Smart gradient oven

The new 432 Smart gradient oven from Erichsen, makes it much easier to assess the chemical resistance or even the curing behavior of one's coatings.

The Model 432 Smart I/II gradient oven is used to evaluate the baking and drying behavior of paint and powder coatings, resins, plastics, and similar materials, notes a press communique from the company. It can simulate a

find out how different environmental phenomena will interact with a coating system.

For the development of stove enamel systems as well as for their quality testing it is of great importance to assess the temperature range and the maximum temperature limit, respectively, where the components of the lacquer formulations (and thus also potentially the properties and



The Model 432 Smart I/II gradient oven is used to evaluate the baking and drying behavior of paint and powder coatings, resins, plastics, and similar materials.

production process by programming the warm-up rate, burn-in temperature, and time intervals and allows predictions of how a particular paint reacts to a particular material at different temperatures. The excellent repeatability of the measurements allows a remarkably accurate determination of the actual limit values. Coatings can be tested up to a temperature of 250°C. If the lacquers are applied with a double doctor blade, two different lacquers can be tested simultaneously on one test sheet.

Acid rain, bird droppings, fuel, antifreeze and many other environmental factors can damage automotive finishes. Especially in summertime, some substances can be very aggressive and cause severe damage. Therefore, automotive paint manufacturers as well as auto makers need to

the quality of the whole thing) begin to change. The well-known main example for this are the yellowing of binding agents as well as the change in color of pigments

Concerning the subject of baked coatings within industrial production conditions, the accurate control of the corresponding processes is of crucial importance to achieve and continuously maintain/guarantee the specified qualitative characteristics of the coating. Due to different reasons, the actually existing conditions do not always correspond exactly to the preset process run which in the "worst case" may cause severely high non-conformity costs.

The Gradient-oven 432 Smart offers the possibility of a needs-based optimizing of the process for the product in question.

## Airless sprayers and tip extensions, newest addition to the QTech range of airless and HVLP spray machines

The QTech range of airless and HVLP spray machines and consumables from Aristospray Ltd., UK, has been carefully selected with today's

professional decorator in mind. Of particular interest are the QTech QT190 Plus and QT290

Carry, two recent additions to the airless sprayer range plus the game-changing QTech QuickConnect® tip extensions, notes a press communique from the company.

The QTech QT190 Plus takes the ongoing appeal of this entry-level, professional machine to an even broader customer base. The addition of a six-liter hopper and an analog gauge when used in conjunction with an Ultra Finish tip makes this the airless sprayer of choice for all fine finish work.

The QTech QT290 Carry is a development of the best-selling QT290 Hi-Cart. Combining the outstanding performance of that machine (2.9 l/min, max tip 0.027") with the addition of a versatile carry frame makes this the top-performing carry airless sprayer on today's

market. With its capacity to spray most architectural coatings it is anticipated that there will be a high demand for this machine.



Tip extensions have always brought another dimension to spray for the professional. They are great, they are safe, and they save a lot of working at a height.

QTech QuickConnect® tip extensions are a game-changer. Tip extensions have always brought another dimension to spray for the professional. They are great, they are safe, and they save a lot of working at a height. But they all come with one major drawback - to ensure a pressure-tight joint, they rely on a threaded connection. Not with QuickConnect® tip extensions. A patented three-pin connector is used to ensure a perfect pressure-tight joint. Total versatility is ensured with six lengths ranging from 15cm through to 90cm, plus an adapter. With its 7/8" thread the adapter is all that's required to enable the whole system to be used with any existing gun and tip combination.

The "actual condition" in the stove enameling production line, beforehand determined by means of an oven temperature recorder, can be simulated at the best via a requirement-orientated setting

of an appropriate gradient and thus allows a nearly perfect 1:1 simulation of the respective stoving condition, however on the desired laboratory scale saving time and expenses.

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- ▶ Easily Detachable Suction Port Reduces Cleaning & Maintenance Time
- ▶ Cartridge type throat Seal Housing



### SURYA 10 | Electrically Operated Airless Paint Sprayer

#### Specifications and Features :

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- ▶ Controller : Excellent Control
- ▶ Portable & Easy to Carry
- ▶ Suitable for High viscous coating material & texture
- ▶ Long length hydraulic Part to handle variety of coatings
- ▶ Direct Detachable Suction Port

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#### Features :

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- ▶ Wide Range of Applications
- ▶ Individual Solutions Through Modular System Concept
- ▶ Environmental Friendly Due To Solvent Savings
- ▶ Pre-Heating & Inline Heating to maintain viscosity of Materials



**DELIVERING ENGINEERING EXCELLENCE**

## Carboline announces the release of Hydroplate, a product line for the water and wastewater markets

Carboline has announced the release of Hydroplate linings, a new product line specifically designed for the water and wastewater markets.

Hydroplate high-performance, potable water linings are the ultra-durable solution for protecting the most valuable assets against the damaging effects of corrosion in the new



*Hydroplate high-performance, potable water linings are the ultra-durable solution for protecting the most valuable assets against the damaging effects of corrosion in the new tank construction and maintenance, repair, and operation (MRO) markets.*

tank construction and maintenance, repair, and operation (MRO) markets. These linings are designed to coat varying types of steel and concrete ground and elevated storage tanks and to provide the ultimate protection for potable water pipes, valves, and fittings. The Hydroplate series includes single and multiple coat linings that offer high solids and near solvent-free options, with high-build capabilities, fast cure properties, and the ability for rapid return to service, notes a press release from the company.

“The Hydroplate line will continue to build on Carboline’s 75-year mission to deliver innovative solutions for protecting and preserving our vital steel and concrete infrastructure assets,” said Jeremy Sukola, the Water and Wastewater Market Manager for Carboline. “They offer varying film builds, real-world application benefits, and other service life-extending attributes.”

Hydroplate linings provide superior protection while adhering to the most stringent requirements outlined in multiple AWWA standards and NSF/ANSI/CAN 61-NSF/ANSI/CAN 600 standard that significantly reduces the allowable amounts of certain extractable solvents.

Hydroplate potable water linings provide lower overall VOCs than many previous-generation linings while offering an extremely durable and sustainable option for extending asset service life.

“Hydroplate linings provide the robust chemical resistance required in the water and wastewater markets,” remarks Paul Atzemis, Carboline’s Director of Technical Service. “These products are outstanding options for water storage and the harsh environments found in water treatment plants.”

The Hydroplate line of materials offers a variety of film thickness options, from thin film applications under five mils DFT to higher build solutions that exceed 30 mils in a single application. With varying advanced resin technologies, Hydroplate lining options include the ability to cure down to 20°F (-6°C), fast recoat and overcoating schedules, and extended maximum recoat windows. These application benefits can help extend the painting season and limit costly project schedule delays.

## ALIT Technologies launches Drizzling, an innovative process for the application of chrome-free passivation products for all metals

ALIT Technologies, a leading manufacturer of machines and products for the surface treatment of metals, has announced the launch of their new dosing and application system Drizzling, notes a press release from the company based in Italy.



*ALIT’s Drizzling system is extremely compact and easy to install, and its main advantage is that it allows to apply a constantly fresh and contamination-free passivating solution to the products.*

The treatment of metal surfaces ensures good durability over time and provides protection against oxidation and corrosion. There are various surface treatment processes aimed at this purpose. One of the most significant and widespread is certainly coating, which is only the last (but not least) step of a chemical process that includes several intermediate stages in which parts are degreased, pickled and passivated. It is in this last phase that the Drizzling system can make a difference.

Drizzling consists of a complete dosing system capable of automatically managing the mixing of demineralized water, coming from a feed tank, with the exact quantity of passivating chemical product, thus obtaining an optimal and always fresh solution to be dispensed directly on the surface of metals. The use of special atomizing nozzles and compressed air enables the system to homogeneously produce and distribute a fine and light mist of passivating solution that completely envelops the product, even in 7-meter vertical lines for aluminium profiles.

This system is extremely compact and easy to install, and its main advantage is that it allows to apply a constantly fresh and contamination-free passivating solution to the products: a further reassurance for the customer, who can count on an improved performance of the passivating product.

Furthermore, the new dosing system developed by ALIT Technologies can be combined with chrome-free chemicals, including titanium and polymer-based ALFICOAT 748/3 from Alufinish GmbH, which guarantees excellent results in the passivation process both in terms of corrosion protection and paint adhesion.



# KOMAL Scientific International Pvt. Ltd. KOMAL Scientific Co.

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CRISIL Rating : SME 1 'Highest'

## Chemtec launches innovative technologies for the surface pre-treatment and industrial wastewater treatment

Chemtec is an Italian company specializing in the formulation, production and commercialization of technologies for the industrial finishing sector, ranging from surface to industrial wastewater treatment. The company has introduced a range of innovative chemicals with a low environmental impact developed specifically

using water curtains for overspray separation ensure an extension of the life of the water, reducing disposal costs and ensuring the high quality of the painting process. Thanks to its know-how and with thirty years of experience in the industrial coating sector, Chemtec provides cutting-edge solutions to improve the final quality of the

product, increase process efficiency and reduce costs, while minimizing the environmental impact and the consumption of water and energy.

Chemtec solutions allow companies to answer to the

new needs of the energy transition, the green economy and the circular economy while improving the quality of the process at the same time.

for the pre-treatment of surfaces. Chemtec solutions allow to replace the traditional phospho-degreasing and zinc phosphating with the latest cutting-edge processes, notes a press release from the company.

These include Toran 3<sup>®</sup>, a single-stage, room temperature pre-treatment technology suitable for a wide range of metals, and Pronortec, a nanotechnology, designed to provide a technologically innovative chemical process for the pre-treatment of metal surfaces based on the use of organic phosphorous compounds. Chemtec chemical and system solutions for the treatment of wastewater generated by painting booths



Chemtec's solutions for the treatment of wastewater generated by painting booths using water curtains for overspray separation ensure an extension of the life of the water, reducing disposal costs and ensuring the high quality of the painting process.

## Arsonsisi develops new generation of decorative thermosetting powder coatings

Arsonsisi has developed a new generation of decorative thermosetting powder coatings, which enhance thermal insulation performances, cut energy costs and improve comfort. Antherm colored paints are UV and weather resistant, they protect against infrared light and significantly increase TSR value by up to 20% in

## Self-learning painting robots from Lesta

Painting robots manufactured by Lesta, Italy, are highly sophisticated machines but at the same time easy to use and manage, dedicated to industrial painting applications. They can be programmed in direct self-learning and/or 3D point-to-point (even off-line), notes a press communique from the company.

guns are faithfully recorded and stored in the robot control. Therefore, the operator paints the desired piece, immediately evaluating the spraying result. The painter's experience thus becomes a program for the robot. In this way, in a short time, the painting program is saved and it will be ready for the production phase.

In the production phase, the



Dedicated to industrial painting applications, the painting robots manufactured by Lesta, Italy, are highly sophisticated machines but at the same time easy to use and manage.

Self-learning remains the most efficient solution in the field of industrial painting. During the programming phase, the operator moves the robot arm (properly balanced, agile and light) and acts on the opening and adjustment of the spray guns. All movements and command signals from the

robot automatically repeats the selected program, but offers the possibility to modify the process parameters completely or only in some sections. In summary, the robot offers the following main advantages: repeatability in painting processes, reduction of paint consumption, and ease of use.

dark colors. They also reduce the heat transfer to metal by 20% and contribute to



Arsonsisi's new generation decorative thermosetting powder coatings enhance thermal insulation performances, cut energy costs and improve comfort.

sustainable development, as lower heat absorption means less energy costs for air

conditioning systems, less polluting emissions and a lower impact on global warming. Antherm polyester coatings are especially designed to fulfill the highest expectations in terms of color stability, gloss retention and corrosion resistance required by the architectural and construction market, notes a press release from the Italian company.



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# Berger Paints aims at top 10 rank in global market

*Major thrust on growth and product range as company celebrates centenary year later this year*

Berger Paints, the second-largest paint company in India, is all set to begin its centenary celebrations later this year! "Berger Paints today is the 4<sup>th</sup> largest paint company in Asia, and the 14<sup>th</sup> largest paint company in the world. We have set our sights to be amongst the top-10 very soon," said Mr Sanjay

Chowdhury, Vice President & Business Head, Berger Paints Ltd.

The company also positions itself in the Top-200 on the list of Fortune 500 list of companies for 2021. Berger Paints won the Deloitte India's 'Best Managed Companies 2021' award for overall business performance and sustained

growth and has featured consistently in Forbes India SUPER-50, Business Today 'India's Most Valuable Companies' and Millward Brown Most Valuable Brands. Moreover Mr Choudhary himself was recently recognized as one of the 'Top 10 Business Leaders and Achievers' in the country by the Industry Outlook magazine.

On a growth trajectory at CAGR of 16%, Berger Paints expects to touch a turnover of Rs 10,000 crore in the fiscal 2023-24. Berger Paints invested over Rs 1,000 crore in setting up the largest manufacturing unit of Berger Paints India Limited, at Sandila, Hardoi, Uttar Pradesh. The modern and completely automated manufacturing unit, which had commenced commercial production earlier this year was formally inaugurated by the Hon'ble Chief Minister of Uttar Pradesh Shri Yogi Adityanath.

The impact of the manufactur-

ing unit in the industrial area of Sandila has been manifold. The area is witnessing huge growth – right from building roads, starting transport services to availability of essential services. Berger Paints has consistently participated and invested in education, health, and other initiatives in and around its various manufacturing locations to improve the quality of life of the local community.

Other major initiatives include setting up a production facility at Panagarh in West Bengal and expansion programs at their plant in Jejuri near Pune. "Overall, we have 17 manufacturing units all across the nation to ensure prompt logistics to any part of the country, and we are looking forward for more," said Mr Chowdhury.

"The Indian paint industry's turnover is said to range around Rs 60,000 crore to Rs 70,000 crore," said Mr Chowdhury. "Of this 70% is the decorative segment, and the remaining 30% the industrial segment which consists of various industries like automotive, white goods, powder coatings, wood coatings, pipeline coatings, GI coatings, etc."

Berger Protecton is a undisputed leader in heavy duty protective coating industry with innovative coating range of products from Berger. This division, Protecton in BERGER headed by Mr Chowdhury, who is VP & Business Head



Mr Sanjay Chowdhury, Vice President & Business Head, Berger Paints Ltd.





# Latest Generation Corrosion Testing Instruments



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Salt Spray Chamber  
FRP



Tensile  
Tester  
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Spectrometer

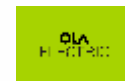
Testronix Instruments has helped me and my team control rejections worth 1.57 crores till date. All their instruments are highly accurate as per ASTM standards

Rohit Singhal  
Director  
ALS Coating



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caters to different environmental and industrial corrosion protective requirements, be it concrete or steel substrates with products that have attained instant recognition, worldwide, and continues to meet quality requirements that are demanded even today in the domestic high performance coatings market.

Berger Protecton range of coatings include chlororubber, epoxies, inorganic zincs, polyurethane, poly-siloxanes, high temperature resistant coatings, anti-carbonation coatings, road marking, airfield marking, concrete coatings, rebar coatings, floor coatings, green coatings, and has proven technology and field testimonials to relay the expertise offered to protect Indian industries and infrastructure installations. "The Protecton division has been growing at a CAGR of 30 percent in terms of value. That's the kind of growth we have got," said Mr Chowdhury, an alumnus of IIT, Kharagpur, M. Tech (Polymer Technology), MBA in Marketing from IISWBM, and PG Diploma course in International Business from Indian Institute of Foreign Trade (IIFT), New Delhi. "That's because we sell solutions, not products! We work with the customer and find an innovative solution that is affordable and made available to them."

"Our R&D is constantly developing and expanding the basket of product offerings to cater to new segments and good business opportunities with newer technologies," said Mr Chowdhury, whose professional career spans close to three decades with experience in R&D, manufacturing,



The painting system for the Vande Bharat rakes has been the result of a collaboration between Berger and the RDSO together.

business development, technology sourcing, supply chain, and management, marketing and sales management. "Our dedicated and motivated R&D continuously strives to deliver consistent quality as per specifications."

"For example," he says, "we have developed solventless coatings that have taken the WRAS (Water Regulatory Advisory Scheme) approved coatings which are for potable water contact. The other product lines are in the area of anti-fouling, gas-transmission pipe coatings, can and drum thin film coatings, and the latest fluoropolymer coatings."

"The painting system for the Vande Bharat rakes has been the result of a collaboration between Berger and the RDSO together," said Mr Chowdhury. "This fluoropolymer painting system has a life of 35 years, something unheard of in the industry. There was a lot of appreciation from the Prime Minister's Office (PMO), especially given the thrust of the Government of India's Atmanirbhar Bharat initiative."

Some of the other innovative products introduced include an universal etch primer, a unique heat-resistant primer, a thermo indicator paint and a system called the Neo-Thermolite, that is meant for the refinery and petrochemical industry in particular.

Etch Primers are intended for use as primers on new or relatively sound ferrous and non-ferrous metal surfaces. Examples of the types of surfaces on which these products would be used are lightweight tubing or thin sheet metal surfaces that cannot be prepared by abrasive blast cleaning. The Thermo-Indicator paint changes color if the temperature rises over a certain degree, so action can be taken immediately before any untoward incident happens, said Mr Chowdhury. "Another innovation, the Direct-to-Metal painting system combines the role of both the primer and the finish. This gives a high level of productivity and is available in all the chemistries – alkalyd, PU, epoxy..."

Berger Protecton has a high expansion plan and is

planning to spread its geographical presence in unrepresented areas and plans to fan out to at least 20 countries across the globe in another two years' time, said Mr Chowdhury.

"A key secret to this success is encouraging the team to work with an entrepreneurial attitude," emphasized Mr Chowdhury. "We encourage our team to work with a positive mindset and challenge our own capabilities. Earlier, people said, if a multinational company cannot do it, how can we do it? Bringing about that change in the mind set in all the levels, be it the sales, R&D, manufacturing, supply chain... Bringing about that change in mindset is a big challenge. People find it difficult to change. They are happy with a growth rate of 8% or 7%. But, why can't we aim a 35% – 40% growth. If we think we can do it, we can. Our thoughts lead to action; action leads to habit; habit to character; and the character in us takes us to our destination! That's how, we have been able to do an extraordinary job!"

PHOTO: ISTOCK



# World class testing instruments for Paint, Coating & Corrosion testing



Automatic Pendulum Hardness Tester



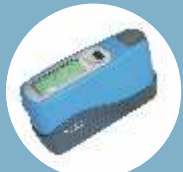
Table Water-curtain Spray Cabinet



Wet Abrasion Scrub Tester



Spectrophotometer



Intelligent Glossmeter



Digital Pull Off Adhesion Tester



Digital Cupping Tester



Automatic Scratch Hardness Tester



Versatile Sand-milling Dispersing-agitator



Lab Basket Mill



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# Caltech Instruments Pvt Ltd: Dedicated to delivering high-quality products

*With a strong focus on quality and precision, Caltech India has established itself as a trusted name in the industry*

Caltech Instruments Pvt Ltd., is a globally recognized manufacturer and supplier of a wide range of instruments and equipment for paints and coatings, corrosion testing, and welding inspection. Earlier known as Caltech Engineering Services, growth in business, and the need for a corporate makeover prompted us to adopt this new name, said Mr R. J. Chaudhari, Director of the company.

Caltech India started its journey since 1998 with innovative ideas, high quality products, supported by the best-in-class customer experience at a competitive price in India to meet most of

the national and international standards like ASTM, ISO, NACE, SSPC, DIN, BIS and many more. "We have also started identifying and representing best world class manufacturers for supplies in addition to our product range in addition to exporting to various countries around the world," said Mr Chaudhari, who along with his son Mr. Lokesh Chaudhari, also a director, runs the company. Today, with a strong focus on quality and precision, Caltech Instruments Pvt Ltd has established itself as a trusted name in the industry.

"We also provide technical support and after-sales-service for products supplied



Mr R. J. Chaudhari (left) and Mr Lokesh Chaudhari, Directors, Caltech Instruments Pvt Ltd.



by us. Our team consists of professional consultants, qualified engineers and technicians, etc., to support our activities," noted Mr Chaudhari. Headquartered in Mumbai, Caltech Instruments Pvt Ltd is an ISO 9001 certified company.

In the field of paints and coatings, Caltech India offers a comprehensive selection of instruments that enable precise analysis and evaluation of coating properties. These instruments include thickness gauges, adhesion testers, gloss meters, and color measurement devices. They are designed to ensure that coatings meet the required standards for thickness, adhesion, appearance, and durability.

Corrosion testing is a critical aspect of industries such as oil and gas, marine, automotive, and infrastructure. Caltech Instruments Pvt Ltd provides a wide range of corrosion testing equipment that allows for accurate assessment of corrosion

resistance and durability of materials and coatings. Their product portfolio includes salt spray chambers, cyclic corrosion testers, humidity chambers, and cathodic disbondment testers, rapid chloride permeability testers, rebar corrosion monitoring instruments, ultrasonic thickness gauges, stress corrosion amongst others. These instruments aid in identifying potential corrosion issues, evaluating the effectiveness of corrosion protection measures and improving the overall durability of materials and structures.

Additionally, Caltech India specializes in supplying welding inspection gauges. These gauges are used to ensure the quality and integrity of welds by measuring parameters such as weld size, throat thickness, fillet leg length, and undercut depth. By providing precise measurements and evaluations, these gauges contribute to maintaining the structural



Caltech Instruments Pvt Ltd is dedicated to delivering high-quality products that meet international standards and customer expectations.

# Delivering world class solutions in engineering instruments



**Caltech Instruments Pvt Ltd**

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*In the field of paints and coatings, Caltech Instruments Pvt Ltd offers a comprehensive selection of instruments that enable precise analysis and evaluation of coating properties.*

integrity and safety of welded components and structures. Caltech Instruments Pvt Ltd., supplies products to reputed multinational, national, government, and semi government companies in India. The company serves customers from oil and gas, refineries, petrochemicals, fertilizer, onshore, marine, offshore upstream and downstream, cross country pipeline contractors, and engineering construction companies.

Strict quality compliance and mandatory requirements have prompted corrosion control measures in process plants, general engineering, water, nuclear, marine, civil, aerospace and defense, automotive sectors, auto ancillary units, component manufacturing units, process plants, research and development departments of institutes and industries which is fueling business, said Mr Chaudhari.

Their worldwide export

operations cater to various countries like USA, Canada, Chile, United Kingdom, Spain, Germany, Italy, UAE, Oman, Saudi Arabia, Kuwait, Singapore, Indonesia, Thailand, etc.

With a global presence, Caltech Instruments Pvt Ltd has established a strong reputation as a reliable supplier of paints and coatings, corrosion testing, and welding inspection instruments worldwide. Their commitment to innovation, quality, and customer satisfaction makes them a preferred choice for industries seeking precise and reliable instruments for their testing and inspection needs.

“Exports are also growing,” said Mr Chaudhari. “buyers find instruments developed and manufactured by us are cost effective than those offered by manufacturers in advanced countries.”

Caltech Instruments Pvt Ltd, for the first time developed specialized equipment highly suitable for dedicated NACE H2S Corrosion Testing laboratory. These are

designed to provide state-of-the-art H2S testing capabilities, while providing for the safe and efficient handling of H2S. Custom designed facilities for testing in H2S environments are also available.

Similarly, they also developed testing for exposure of metals and alloys by alternate immersion in neutral 3.5% sodium chloride solution, evaluating stress-corrosion cracking resistance of low copper 7XXX series Al-Zn-Mg-Cu alloys in boiling 6% sodium chloride solution.

“We will consistently provide products and services to meet or exceed the requirements and expectations of our customers and we will actively pursue ever improving quality through training programs of employees to do their right job,” said Mr Chaudhari. “Whether you need advice on product and application, troubleshooting, training, or product service and repair, our team of technical experts is committed to providing a solution for your problem.”

“We do not just try to sell a product,” said Mr Chaudhari, “We check out the needs of the customer and in fact help

them to select the right instrument. That's why we have repeat orders and growth by word-of-mouth recommendations.”

A full range of repair and recalibration services are available at their offices or through regional distributors. Under ISO 9001 certification, accredited companies must identify in their procedures the frequency of recalibration of all test equipment. They also offer all customers a full recertification and recalibration service upon request.

Caltech Instruments Pvt Ltd is dedicated to delivering high-quality products that meet international standards and customer expectations. Engineers and managers have more than 20 years' experience in respective field. Their instruments are manufactured using advanced technology and undergo rigorous quality control procedures to ensure accuracy, reliability and durability. The company also emphasizes customer support and provides comprehensive after-sales services, including calibration, maintenance, and technical assistance.



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XP-hf



XP-hf



XM50

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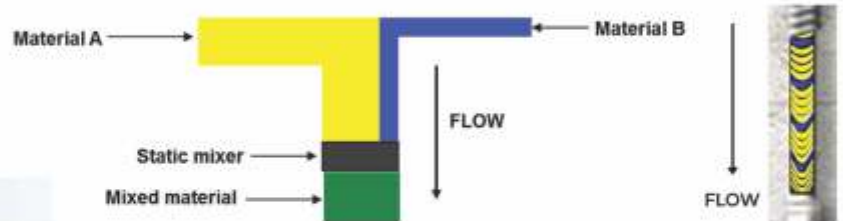
Higher flow rate to get jobs done faster

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Complete skid solution for your highest demand applications

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# Paints & Coatings for Sustainability

*By embracing sustainability as a core value, the industry can contribute to a more sustainable future by minimizing environmental impact, improving indoor air quality, and promoting responsible and ethical practices throughout the value chain, notes Dr. U. Kamachi Mudali, Chairman, CII-Corrosion Management Committee & Vice Chancellor, Homi Bhabha National Institute, deemed to be University of Department of Atomic Energy, Mumbai in a chat with C&ACER.*

## How would you define sustainability?

Sustainability, in a general sense, refers to the ability to meet the needs of the present generation without compromising the needs of future generations to meet their demands. It involves finding a balance between economic growth, environmental protection, and social progress. When applied to paints and coatings, sustainability entails adopting practices that reduce the environmental footprint, conserve resources, minimize waste, and promote human health and well-being.

The focus on sustainability in the context of paints and coatings has gained prominence in recent years due to increasing awareness of environmental concerns and the need for more responsible and eco-friendly practices across industries. The paint and coatings industry is a significant contributor to environmental impacts, including air and water pollution, waste generation, and the use of non-renewable resources. As a result, there is a growing demand for sustainable alternatives that minimize these negative effects and promote long-term environmental, social, and

economic well-being. In the context of paints and coatings, sustainable practices can include:

1. Using environmentally friendly raw materials: Choosing raw materials that have a lower impact on the environment, such as using bio-based or renewable ingredients instead of fossil fuel-derived components.
2. Minimizing volatile organic compounds (VOCs): VOCs are harmful chemicals that evaporate into the air, contributing to air pollution and health issues. Sustainable coatings aim to reduce VOC emissions by using low-VOC or zero-VOC formulations. Energy efficiency: Implementing energy-efficient manufacturing processes and reducing energy consumption during production can help lower greenhouse gas emissions and minimize the environmental impact.
3. Waste reduction and recycling: Developing coatings with longer lifespans and promoting recycling and proper disposal practices can reduce waste generation and conserve resources.
4. Life cycle assessment (LCA): Conducting a comprehensive evaluation of the environmental impacts of a coating throughout its entire life cycle, from raw material extraction to disposal, can help identify areas for improvement and guide sustainable decision-making.

By incorporating these

sustainable practices, the paint and coatings industry can contribute to a more environmental friendly and socially responsible future, while still meeting the needs of customers with required product quality.

## What is our industry sector doing for sustainability?

The Indian paint and coating industry has been taking steps towards sustainability to address environmental, social, and economic concerns. Here are some initiatives and actions taken by the Indian industry sector to promote sustainability:

1. Reduced VOC Formulations: Many paint manufacturers in India have been developing and promoting low-VOC and zero-VOC paint formulations. These formulations help minimize harmful emissions, improve indoor air quality, and reduce the environmental impact of coatings.
2. Water-Based Paints: Water-based paints are gaining popularity in India due to their lower VOC content and reduced environmental impact compared to solvent-based alternatives. Several companies have been actively promoting water-based paints as a sustainable choice.
3. Renewable Raw Materials: Some paint manufacturers in India have started incorporating renewable raw materials, such as plant-based ingredients or bio-based resins, in



Dr. U. Kamachi Mudali, Chairman, CII - Corrosion Management Committee & Vice Chancellor, Homi Bhabha National Institute, deemed to be University of Department of Atomic Energy, Mumbai.





**MAKSUR**  
ANALYTICAL SYSTEMS

# Corrosion Monitoring System

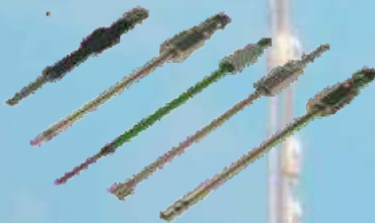


CORROSION COUPONS AND COUPON

HOLDER



INJECTION QUILL



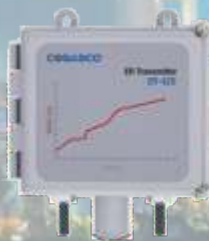
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their paint formulations. These materials offer a more sustainable alternative to traditional fossil fuel-derived components.

**4. Waste Management and Recycling:** Paint manufacturers are increasingly focusing on proper waste management practices. This includes implementing recycling programs for paint cans/containers and packaging materials, as well as promoting responsible disposal of paint-waste to minimize environmental impact.

**5. Energy Efficiency Measures:** Companies are adopting energy-efficient manufacturing processes, optimizing energy consumption, and exploring renewable energy sources to reduce their carbon footprint. This includes investing in energy-efficient equipment, implementing energy management systems, and promoting energy conservation practices.

**6. Social Initiatives:** Paint manufacturers are taking steps to support social sustainability. Some companies are engaged in community development programs, supporting education and skill development, and providing employment opportunities for local communities.

**7. Certification and Standards:** Indian paint manufacturers are increasingly seeking certifications and adhering to international standards to demonstrate their commitment to sustainability. Certifications such as GreenPro, Ecolabels, and Leadership in Energy and Environmental Design (LEED) provide a framework for assessing and recognizing sustainable practices in the industry.

**8. Research and Develop-**

**ment:** Research and development efforts are focused on developing innovative and sustainable coatings with improved performance, durability, and environmental profiles. This includes exploring new raw materials, eco-friendly technologies, and advanced coating systems.

While progress has been made, there is still scope for further improvement in the Indian paint and coating industry's sustainability practices. Continued collaboration among manufacturers, government bodies, and other stakeholders is crucial to drive sustainable innovation, awareness, and adoption throughout the sector.

**Any new products launched, or coming out in the market that go with sustainability?**

Yes, there have been several new products launched and upcoming developments in the paint and coatings market that align with sustainability. Here are some examples:

**1. Low-VOC and Zero-VOC Paints:** Many manufacturers have introduced low-VOC and zero-VOC paint formulations that significantly reduce volatile organic compound emissions. These products contribute to better indoor air quality and minimize environmental impact.

**2. Bio-based and Renewable Coatings:** There is an increasing focus on developing coatings using bio-based or renewable raw materials. These coatings utilize ingredients derived from renewable sources such as plant oils, natural resins, and bio-based polymers. They offer a more sustainable alternative to traditional coatings derived from fossil fuels.

**3. Water-Based and Solvent-Free Coatings:** Water-based



PHOTO: 12RF

*The focus on sustainability in the context of paints and coatings has gained prominence in recent years due to increasing awareness of environmental concerns.*

coatings, which have lower VOC content and reduced environmental impact compared to solvent-based alternatives, continue to gain popularity. Additionally, there is a growing interest in solvent-free coatings, which eliminate the need for organic solvents altogether.

**4. Recyclable and Biodegradable Coatings:** Coatings that are designed for recyclability or biodegradability are being developed to address the issue of coating waste. These coatings are formulated to allow for easier separation and recycling at the end of their life cycle or to break down naturally in the environment.

**5. Cool Roof Coatings:** Cool roof coatings are designed to reflect more sunlight and absorb less heat, helping to reduce the urban heat island effect and lower cooling energy demand in buildings. These coatings can contribute to energy efficiency and reduced environmental impact.

**6. Self-Cleaning and Anti-Microbial Coatings:** Coatings with self-cleaning properties, such as superhydrophobic coatings, can help reduce the need for frequent cleaning and maintenance. Additionally, anti-microbial coatings

are being developed to provide enhanced hygiene and protection against microbial growth.

**7. Smart Coatings:** Smart coatings are being developed with properties that respond to external stimuli or provide additional functionalities. These coatings can contribute to energy savings, improved durability, or enhanced performance, thereby promoting sustainability in various applications.

It's important to note that the availability and adoption of these sustainable coatings may vary across regions and markets. However, the industry's ongoing focus on sustainability has led to continuous research and development efforts to introduce innovative and eco-friendly products into the market.

**Is there a demand for sustainable products even though they may be costlier?**

Yes, there is a growing demand for sustainable paint and coating products, even if they come at a higher cost. The increased awareness and concern for environmental and social issues have led to a shift in consumer preferences towards more sustain-



**Saudi Abrasives**  
Steel Shot & Grit

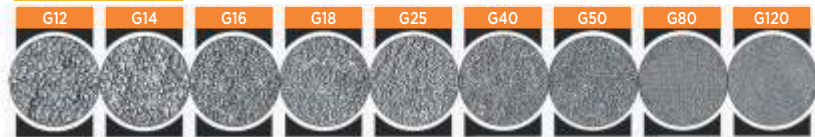


SA GRIT



## Saudi Abrasives: Reducing Costs, Enhancing Efficiency

### STEEL GRIT



### STEEL SHOT



Steel Shot



Steel Grit



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able and eco-friendly options across various industries, including paints and coatings.

While cost is a factor considered by consumers, many are willing to pay a premium for sustainable products that align with their values and contribute to a healthier environment. Here are some reasons why there is a demand for sustainable paint and coating products despite their higher cost:

**1. Environmental Consciousness:** Consumers are increasingly aware of the environmental impact of their purchasing decisions. They are seeking products that have a reduced carbon footprint, minimize pollution, and conserve natural resources. Sustainable coatings fulfill these criteria, and consumers are willing to invest in them to support sustainable practices.

**2. Health and Safety:** Sustainable coatings often have lower levels of volatile organic compounds (VOCs), which are known to contribute to indoor air pollution and can have adverse health effects. Consumers are willing to pay more for coatings that promote healthier indoor environments for themselves and their families.

**3. Regulatory Compliance:** Governments and regulatory bodies in many countries are implementing stricter environmental regulations, including restrictions on VOC emissions. This drives the demand for low-VOC and environmentally friendly coatings that meet or exceed these regulatory requirements.

**4. Corporate and Institutional Demand:** Businesses, organizations, and institutions are increasingly incorporating sustainability goals into their operations and procurement

strategies. They may have sustainability targets or certifications to achieve, which require the use of sustainable products. This creates a demand for sustainable coatings in the commercial sector.

**5. Brand Reputation and Marketing:** Companies that prioritize sustainability and offer eco-friendly products can benefit from improved brand reputation and customer loyalty. Consumers are more likely to choose brands that demonstrate a commitment to environmental responsibility, even if it means paying a higher price.

**6. Long-Term Cost Savings:** While sustainable coatings may have a higher upfront cost, they can provide long-term cost savings through improved durability, reduced maintenance requirements, and energy efficiency benefits. This perspective encourages consumers to view sustainable coatings as a worthwhile investment.

As the demand for sustainable products continues to grow, it also promotes economies of scale and encourages further innovation and research in sustainable coating technologies. This can ultimately lead to cost reductions and increased affordability of sustainable paint and coating options in the future.

#### **What is the awareness level on sustainability within the industry - both producers and users?**

The awareness level on sustainability within the paint and coatings industry varies among producers and users. While there is an increasing focus on sustainability, it's important to note that the level of awareness and commitment can differ based on factors such as geograph-

ical location, company size, market segment, and industry maturity. Here's an overview of the awareness level within the industry:

**1. Producers/Manufacturers:** Paint and coating manufacturers have generally shown a higher level of awareness regarding sustainability compared to other stakeholders in the industry. Larger companies and multinational corporations, in particular, have been actively addressing sustainability concerns and integrating sustainable practices into their operations. They are often more aware of the environmental impact of their products and are taking steps to develop sustainable coatings, reduce emissions, optimize resource usage, and invest in research and development for eco-friendly solutions.

**2. Users/Consumers:** The awareness of sustainability among users and consumers of paints and coatings is also growing. There is an increasing demand for sustainable products, driven by environmental consciousness, health concerns, and regulatory requirements. Consumers are seeking coatings with lower VOC content, eco-friendly ingredients, and certifications or labels indicating sustainable attributes. However, the level of awareness and understanding can vary among different user segments, such as commercial and industrial users, professionals in the construction sector, or individual consumers.

**3. Industry Associations and Regulatory Bodies:** Industry associations and regulatory bodies play a crucial role in promoting sustainability within the paint and coatings industry. They often provide guidelines, standards, and

certifications that help raise awareness and drive sustainable practices. These organizations facilitate knowledge sharing, conduct research, organize events, and promote sustainability initiatives that benefit both producers and users.

**4. Education and Training:** Increasing awareness of sustainability in the industry is also being supported through education and training programs. Training initiatives focused on sustainable coatings, environmental regulations, and best practices are helping to enhance awareness and knowledge among industry professionals. These programs aim to empower producers, users, and other stakeholders with the necessary information and skills to make informed decisions regarding sustainable coatings.

While there is a positive trend towards greater awareness and adoption of sustainability within the paint and coatings industry, it is an ongoing process. Continued efforts in education, collaboration, and communication are essential to further raise awareness, disseminate best practices, and encourage the industry's sustainable transformation.

It's important to note that sustainability is a journey, and the paint and coatings industry is continuously evolving its practices and technologies to meet sustainability goals. By embracing sustainability as a core value, the industry can contribute to a more sustainable future by minimizing environmental impact, improving indoor air quality, and promoting responsible and ethical practices throughout the value chain.

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# The why's and how's of protective coatings: An overview

*Prof A. S. Khanna discusses the importance, purposes and various classifications of protective coatings*

Protection by coatings is one of the five methods of protecting a metal from corrosion. The other four methods are: better material selection, anodic/cathodic protection, better design and last but not least protection by inhibitive chemicals. Coming to protective coatings, there is broad classification of different coatings, based upon the method of application: brush/roller, spray method, hot dip, thermal spray, PVD/CVD, chemical conversion, laser surface modifications etc. Out of all these, the paint coating, appears to be the most trivial method of surface modification. It is usually applied using a brush to give a barrier coating of paint which is generally an insulating coating, and helps in preventing corrosion. However, paint coatings cannot be considered as a very simple technique when applied on industrial systems,

where durability and its functionality become very important. There are various varieties of paint coatings based upon its utility, purpose and function. In a very simple classification, it can be divided into two main types: decorative and industrial. Decorative paints are usually applied to enhance the aesthetics of the object while industrial paints are mainly for corrosion protection. But there are several new requirements for decorative paints: long durability and stability from UV light, anti-dust, hydrophobic, anti-fungal and anti-graffiti. Thus many decorative coatings require one or more additional features in to serve the purpose of protecting, concrete buildings, flyovers, bridges and multiplexes.

The industrial paint coatings, however, are mainly selected for their strong corrosion protection, strong adherence



PHOTOS: 123RF

*An important requirement of industrial coatings is their ruggedness and high performance.*

and strength, chemical stability from polluted environment, acids/alkali fumes, heat etc. Today many industries require coatings which perform a special function, such as resistance from heat, anti-fouling properties, conductivity and many other functions. There is also special requirement for 'smart' coatings which perform special action such as self-cleaning, self-healing, reflecting solar radiation to cool the surface etc. Another important requirement of industrial coatings is their ruggedness and high performance. For example you need a special coating for application on a splash zone which can be of high chemical resistance, can be applied in high humid environment of RH above 90%, erosion resistance, quick drying, long durability and giving high thickness per coat. One such coating recommended in Indian offshore platforms is polyester

glass-flake, isophthalic coating, which possesses all such properties.

Second best classification of paint coatings is based upon the type of resin [binder] it uses. Based upon the resin type, such as epoxy, urethane, vinyl, alkyd or polyester, it is designated as epoxy coating, urethane coating, vinyl or alkyd, or polyester based coatings respectively. The main components of a paint coating are: solvent, binder, pigment and additives. A proper mixture of all these four makes a paint coating. The paint manufacturing is a simple mixing process where first the binder is added into the solvent and nicely dispersed. It is then followed by systematic addition of pigments and additives till a uniform mixture is obtained. The quality of paint depends upon the types of mixing methods used such as agitation, blending, attritions, bead or ball mill etc.



*Industrial paint coatings are mainly selected for their strong corrosion protection, strong adherence and strength, chemical stability from polluted environment, acids/alkali fumes, heat etc.*

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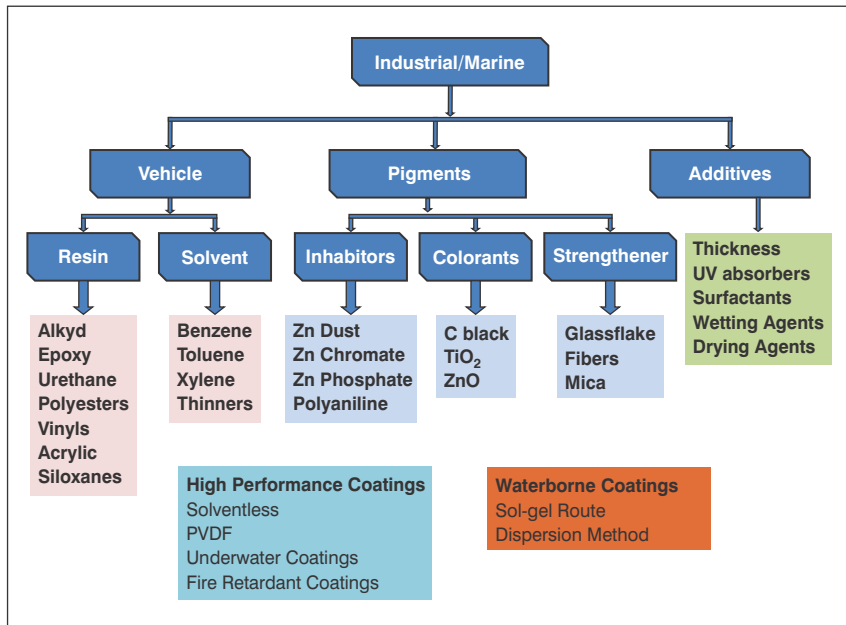


Fig 1: Coatings classifications.

The paint coatings are of single component or of two components. Single component paints are usually a mixture of solvent, resin and some pigments and additives, while two component paint system have a resin part which is made using solvent, resin, pigments and additives and the second component is called catalyst or hardener which is mixed just before application. The role of

catalyst/hardener is to harden the coating with time till it fully dries. This is achieved by chemical reaction between the resin and the hardener, leading to a high level of crosslinking which provides superior anti corrosion properties to paint coatings, especially low permeability and strong barrier protection. For example for epoxy resins, amines or amides are used as hardeners. For two compo-

in the solvent and pigment and additive concentration, the paint has a volume solid percentage which decides the thickness of the coating after drying. As per the simplest mechanism of paint drying process, the solvent which are mostly volatile in nature evaporate and leave the dried coating on the substrate. Since, the most common solvents are: benzene, xylene and toluene, which are all

nents polyurethane coatings, cyanates are used as hardeners.

Another important classification of paint coatings is eco-friendliness of paint coatings. As discussed above the main components of paint coatings are solvent, binders, pigments and additives. Based upon the amount of resin

toxic in nature and hence when they evaporate they pollute the environment and especially affect the health of the paint applicator. Thus, a better paint system is that which either has very low quantity of solvent or uses no solvent or alternative solvent such as water. This results in two additional types of classifications: Solventless coatings and waterborne coatings. There are two additional advantages of solventless coatings: apart from eco-friendliness they can give high thickness from 500 to 2000 microns in one or more coats, secondly, several high performance and functional coatings used in industry are solvent less with addition of several pigments such as fibres, glass-flakes which enhance the strength and durability of such coatings and also reduce the permeability of the coating. All these coating classifications are summarized in Fig. 1.

Another classification of the coatings can be of its functional action and its smart



Proper application includes suitable surface preparation, selection of proper primer, intermediate and top coat which can give high durability in a chosen environment.





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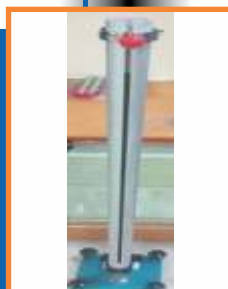
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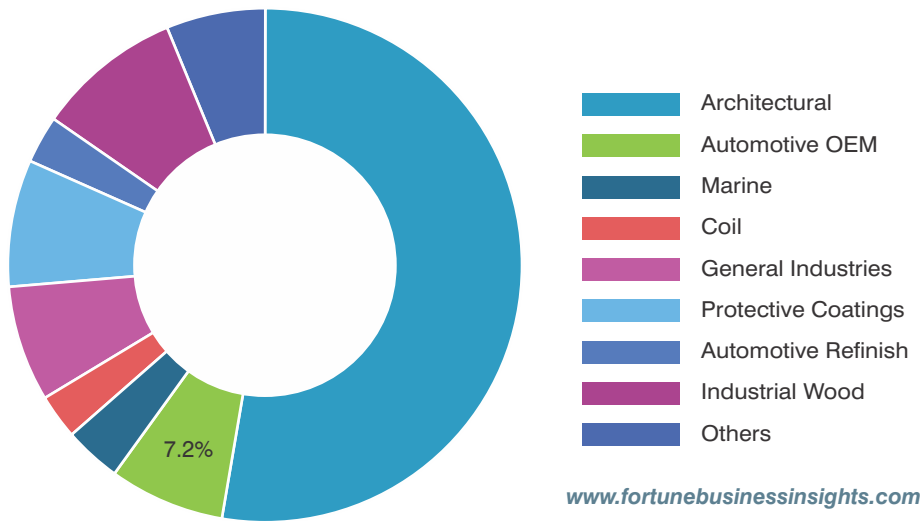
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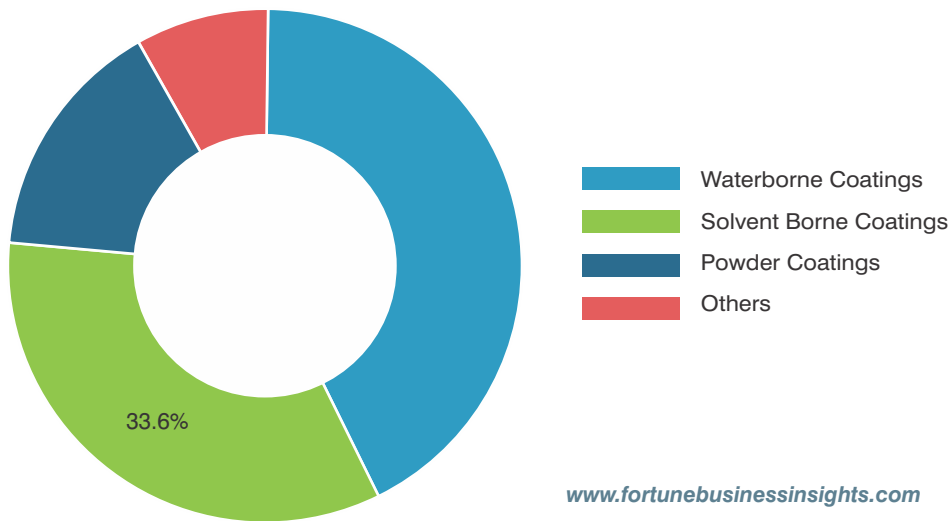
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**Global Paints and Coatings Market Share, By Application, 2021**



**U.S. Paints and Coatings Market Share, By Technology, 2021**



environment. Use of quality assurance and quality control methods with site supervision and daily inspection helps to provide a flawless coating, meeting the paint specified design life. One advantage of paint coatings is that all paint application processes are supported by process standards, which must be strictly followed in order to get best results.

Let me finish this chapter by talking about the coating market. The world coating market as estimated by Fortune Business Insights is projected to grow from \$167.04 billion in 2022 to \$235.06 billion by 2029, at a CAGR of 5% in forecast period. There is a marginal increase in the trends in the paint coating market of Asia-pacific from 81b US\$ in 2021 to just 82b US\$ in 2022.

The report has also given the global market details of various coatings share in different industries and also a very important trend in the comparison of conventional solvent borne coatings with the advanced and eco-friendly waterborne coatings.

**References:**

<https://www.fortunebusinessinsights.com/industry-reports/paints-and-coatings-market-101947>

behaviour. We have several coatings which come under the heading of 'smart' coatings. These coatings, in addition to doing the normal function of anti corrosion also do a specific function, such as self cleaning, self healing, anti graffiti, creating conducting surface and perhaps many more. The biggest role played to make a coating smart is by the addition of nano-particles or to make a nano-coating.

Nano-technology can play a very important role in coming years, not only to enhance the properties and capabilities

of paint coatings but can also help in conserving the paint raw materials, especially pigments and additive concentration. As the name suggests, use of nano-particle pigments and additives provide two benefits: large surface area and optimum distribution, which helps to save the resin matrix from deterioration by chemicals and intense UV light. Secondly, it also helps in delaying the moisture and pollutants to reach from the surface to the metal paint interface, thus reducing the permeability of

the coating and thus enhancing the durability. The optimum distribution of the particles and its shape also helps in enhancing the mechanical properties, especially the tensile strength without affecting the elongation.

Another important aspect of paint coatings is proper application. Proper application includes suitable surface preparation, selection of proper primer, intermediate and top coat which can give high durability in a chosen



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

He is now Chairman SSPC India, a professional body focusing on surface engineering and coatings. Post retirement Prof Khanna is now involved in various professional activities which include: Proprietor, Surface Engineering and Coating Consultant, an NABL accredited paint testing and evaluation laboratory; Director, Thermogreen Cool Coat Pvt Ltd; Chairman, Graphene Tech Pro Pvt Ltd, a company which manufactures graphene.

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# Oil and gas pipeline construction projects to boost demand for the coatings and corrosion management sector

*Increasing pipeline business worldwide and escalating technological developments in the pipeline coatings industry to fuel a robust demand*

India is among the top five developers of oil and gas pipelines, which are under construction and proposed, according to an analysis by Global Energy Monitor, a non-profit organization that tracks energy projects. The country is constructing 1,630 km long oil transmission pipelines, ranking second globally in the pipelines under construction category. With 1,194 km long proposed pipelines, India secured the 10<sup>th</sup> spot, the analysis showed. Along with India, the other top countries with pipelines under construction and proposed include the United States, Iraq, Iran and Tanzania.

In India, Paradip Numaligarh Crude Pipeline (under construction) and New Mundra–Panipat Oil Pipeline (proposed) will be among the longest oil pipelines in the

world. The Paradip Numaligarh Crude Pipeline will begin in Paradip port. It will pass through Odisha, West Bengal, Jharkhand, Bihar and Assam and end in the Numaligarh refinery in Assam. The project is owned by Numaligarh Refinery Ltd, a public-sector oil company in Assam. It is expected to start functioning in 2024.

The proposed New Mundra–Panipat Oil Pipeline will begin in Chudva in Kachchh district, Gujarat and pass through Nagaur, Jalore, Jhunjhunu, Sikar, Jodhpur and Pali districts in Rajasthan, before terminating in the Indian Oil Company Ltd's Panipat refinery in Haryana, India.

But as of now, Africa and the Middle East are home to 49% of all oil transmission pipelines under construction



PHOTO: ISTOCK

globally at a cost of US\$25.3 billion, according to new data from Global Energy Monitor.

The 2023 annual survey of data in the Global Oil Infrastructure Tracker shows that these regions together are building 4,400 km of crude oil transmission pipelines at an estimated capital expenditure of

US\$14.4 billion. An additional 10,800 km are proposed in these regions at an estimated cost of US\$59.8 billion.

Globally, there are 9,100 km of oil transmission pipelines under construction and an additional 21,900 km of proposed pipelines. These pipelines in development are estimated to cost US\$131.9 billion in capital expenditure.

China and India are also building more gas transmission pipelines than the rest of the world combined, spearheading a 9% year-on-year increase in the length of pipelines under construction globally, according to data from Global Energy Monitor.

The 2022 year-end survey of data in the Global Gas Infrastructure Tracker shows that 17,800 km of gas pipelines are under construction in China at an estimated cost of US\$21.9 billion and 14,300 km in India at US\$20.7 billion, a distance circling over three-quarters of Earth. Iran, Russia and Pakistan follow China and India as the countries with the most gas pipelines under construction.

Globally, there are 59,100 km of gas transmission pipelines under construction and an additional 151,300 km of proposed pipelines. These pipelines in development are



PHOTO: 123RF

estimated to cost US\$533.6 billion in capital expenditure.

The total 210,400 km of gas pipelines in development globally is an increase of roughly 9% from this time last year. The leading five countries in terms of in-development pipelines (proposed and under construction) are China, Russia, India, Australia, and the United States.

The longest pipeline projects under construction are the 2,775-km Iran-Pakistan Pipeline and the 2,655-km Jagdishpur-Haldia-Bokaro-Dhamra Natural Gas Pipeline (JHBDPL) in India.

China is home to the largest pipeline networks in various stages of development, including the Anhui Gas Pipeline Network and the Guizhou Gas Pipeline Network. Through its 14<sup>th</sup> Five-Year Plan, the republic intends to double the length of gas transmission pipelines by 2025, largely through expanding provincial networks.

All this, together with maintenance and recoating of existing pipelines would mean a robust demand for the paint, coatings and corrosion management business. According to Market Data Research, the pipe coatings

market is expected to rise from US\$8.3 billion in 2022 to reach US\$10.6 billion by 2028 at a CAGR of 6.8% during the forecast period 2023-2028. The high call in the target market is credited to the increasing pipeline business worldwide. Also, the call is driven by the escalating technological developments in the pipeline coatings industry.

Corrosion is one of those aspects that affect the safe and efficient running of the pipelines with the costs for shutdowns, loss of production, environment containment and loss of customer confidence running into millions of dollars.

Environmental conditions such as soil chemistry, humidity and salt water are the major contributing factors to corrosion, but velocity and pressure as well as the type of gas and liquid being transported can have an impact as well.

While there are traditional

methods such as coatings and cathodic protection to prevent corrosion, researchers in universities as well as corporates are constantly working on new ways to monitor and prevent corrosion in pipelines. In this issue, we try and bring together some of the latest developments happening in this sector.

#### **Pipeline low energy coating study kicks off**

Floating production and subsea specialist Crondall Energy recently kicked off a study looking at pipeline coatings with the aim of advancing industry understanding of the potential flow assurance benefits of internal coatings.

The study is in partnership with Heriot-Watt University, The Oil & Gas Technology Centre (OGTC) and The Oil & Gas Innovation Centre (OGIC) and will be led by Crondall Energy's in-house Flow Assurance team in Aberdeen.

The methodology for the project will consist of a three tiered approach. Initially data mining will be used to exploit existing published data coupled with expert knowledge to develop computa-

tional models of the polymeric coating behavior, which will be analyzed and evaluated in the subsequent experimental phase. This will be followed by the experimental phase which will focus on correlating wax deposition behavior with coating surface parameters and flow characteristics. These experiments will use in-situ monitoring of the coatings under operating conditions. The final stage of the project will establish potential alternative polymer materials for improved internal coatings.

Crondall Energy Subsea Director and Flow Assurance expert Murray Anderson explains the reasoning behind this study: "Commercially acceptable pipeline internal coatings are available and employed in the prevention of deposit build up, as well as corrosion prevention. However, the behavior of these coatings in the harsh conditions experienced in oil and gas pipelines is poorly understood. Consequently, the polymers currently used in such organic-based coatings are compromised due to the lack of fundamental knowledge of their performance at



PHOTO: 123RF



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operating conditions. Our study aims to evaluate current internal pipeline coatings, identify potential novel solutions and systematically test them in laboratory equipment at simulated pipeline conditions.

“Internal pipeline coatings offer significant opportunities for the development of small pools in potentially eliminating the need for the major elements of conventional flow assurance solutions, including chemical, heat and insulation requirements. However, there is currently no significant experimental evidence that allows a robust estimate of how a coated system might perform under oil and gas pipeline operating conditions.”

Chris Pearson, Marginal Development Solution Centre Manager at The Oil and Gas Technology Centre, added: “The OGTC is delighted to support a project that could lead to innovation in the field of flow assurance. By delivering key improvements in this area we can reduce the need for intervention, lower the cost for marginal field developments and maximize economic recovery. We look forward to seeing the outcome of this study and potential benefits for the oil and gas industry.”

The results of the study will be



PHOTO: ISTOCK

available to market and will present the laboratory testing data, thus allowing any subsequent projects to more confidently assess the use of internal coatings and the potential cost benefits of doing so in an oil and gas pipeline environment.

#### **New pipe coating suitable for cold weather installation**

Earlier this year, Pipeline Coatings Systems LLC (Pittsburgh) announced a new pipe coating suitable for cold weather installation, PCS200-35 Cold Weather Epoxy.

The cold application 100% epoxy coating is a part of PCS's new PCS200 epoxy coating line and is reportedly capable of curing down to 20 degrees Fahrenheit. The new coating arrives following a request made to PCS for a 100% epoxy coating for cold weather installation specifi-

cally for the pipeline industry.

“The additional time we spent in development has paid dividends,” said John Gillen, President of PCS. “We have been able to achieve the longer pot life, faster cure and better performance that were our objectives for development. We were not interested in introducing just another product line to the marketplace, but a better epoxy coating, one that offers the pipeline industry longer pot life during application, faster curing times and better performance.”

According to PCS, the company developed, tested and refined the 200 Series formulation while capitalizing on its knowledge and experience behind the scenes in product development, eventually creating not just the PCS200-35, but the complete Inaugural 200 Series Pipeline Coatings System and its chemistry, which PCS is introducing as the “True Epoxy” pipeline coating for cold weather.

The epoxy coating is non-flammable, free of volatile organic compounds and contains no peroxide cured/vinyl ester. The product was developed for applications temperatures of 20° to 55°F and services temperatures of -40° to 190°F.

In addition to the cold weather epoxy, the coatings line also includes PCS200-65 Epoxy Pipeline Coating; PCS200-95 Hot Weather Epoxy and ARO200-1 Abrasion Resistant Outer Layer.

#### **Winn & Coales (Denso) Ltd announce the launch of Denso Bore-Wrap™**

Winn & Coales (Denso) Ltd recently introduced a new addition to the Denso product line – Denso Bore-Wrap™. Denso Bore-Wrap is an Abrasion Resistant Outerwrap (ARO) which has outstanding performance against impact, gouge, abrasion, and fracture. Denso Bore-Wrap creates a superior sacrificial outer laminate layer, which protects both pre-approved field joint coatings and mainline coatings (such as, liquid epoxy coatings, heat shrink sleeves, 3LPE, 3LPP and FBE coatings) from damage during pipeline installations, in difficult terrain or by means of trenchless installation methods, such as directional drilling, HDD or boring.

Denso Bore-Wrap is easily applied in the field; there is no mixing required, it is simply wrapped over the existing pipeline coating and cured with water. Due to its flexibility and exceptional level of mechanical protection, Denso Bore-Wrap minimizes the need for costly spot repairs or



PHOTO: ISTOCK

re-pulling pipe from damage. Chairman of Winn & Coales (Denso) Ltd, Chris Winn, is excited about the introduction of Denso Bore-Wrap and the potential that this new development will bring. He said, "At Winn & Coales (Denso), we are always striving to innovate and provide our customers with the most up-to-date solutions for their corrosion prevention problems. The introduction of Denso Bore-Wrap to the Denso product range is an exciting development, and really cements our position as market leaders."

#### **Protect assets with a sustainable and durable solution**

Using traditional methods of corrosion protection like blast and paint usually requires more frequent regular maintenance intervals. Protecting assets with STOPAQ® environmentally friendly visco-elastic corrosion prevention will protect assets for decades.

"We offer a wide range of environmentally friendly solutions to protect assets from corrosion and water ingress. The technology doesn't involve big investments, the product has unlimited shelf-life and training sessions are executed in a day. Corrosion prevention specialists are amazed by the performance of our simple and fuss free solution," says Thomas Merenyi, Technical Manager of Presserv, a leading specialist in the preservation and corrosion protection market since 1996.

As an added bonus, carbon

emissions, total costs and total carbon footprint are greatly reduced. Making things last longer also makes customers profitable by reducing production downtime and the need for new investments.

"STOPAQ® visco-elastic corrosion prevention system basically removes the need for tarpaulins and sandblasting as preparation for corrosion treatment, resulting in significantly reduced waste emissions," says Merenyi.

He points out that the garnet sand used in traditional corrosion protection work is transported long distances on large bulk carriers before being used once and then disposed of, sometimes as hazardous waste.

"STOPAQ® products are built on a technology which eliminates all of this. Not only is the need for sandblasting reduced, but it is also eliminated entirely! No need for sand, masks or other protective equipment which means the carbon footprint is massively reduced. The same is true for costs, noise, labor some processes and massive pollution," he points out.

#### **Ground-breaking robot that can internally rehabilitate existing pipelines**

PLUTO is a ground-breaking robot that can internally rehabilitate existing pipeline without the extensive digging, cutting, and extraction that is typically required to replace aging pipes.

PLUTO has the potential to slash the cost of pipe rehabilitation from an estimated \$1-10 million per



PHOTO: 123RF

mile of pipeline that is typical for open cut replacement to as low as \$200,000 to \$500,000 per mile.

Alexander Duncan, Robotics Engineer and PLUTO System Project Leader at GE Research, said, "The PLUTO system is poised to revolutionize natural gas pipeline rehabilitation with a highly intelligent, state-of-the-art robotics-based solution that could reduce rehabilitation costs by a factor of 5-20X vs. conventional methods used today. At the same time, this new system could significantly reduce the carbon footprint of the overall pipeline infrastructure by more easily addressing the oldest, hardest-to-reach natural gas pipeline infrastructure that is believed to account for up to 50% of the methane emissions coming from these pipelines."

Duncan explained that pipeline replacement today is a very tedious and costly process. Sections of steel and iron pipeline due for replacement typically must be dug out, removed, and then replaced with fresh new pipe. And as mentioned earlier,

trenchless-based methods such as CIPP liners are used today as well, but they too face challenges with installation and the liners needing to be prefabricated. GE's PLUTO System would dramatically streamline this process by deploying a highly dexterous, compliant robot that is capable of molding or forming new pipe from within the legacy pipe.

To perform this rehabilitation work, the robot itself conveys a ready supply of epoxy material through a spray head to form new pipe with the material applied inside the pipeline itself. The new pipe will provide a structural replacement that is designed to be independent of the host pipe and will have a service life exceeding 50 years.

The supply of epoxy material applied by GE's robot is manufactured by Warren Environmental. And for the design of the spray head, GE's robotics team was able to draw from decades of experience developing and deploying various thermal barrier and other coatings to protect jet engine and gas turbine components.

# Co-blending phosphate inhibitors for innovative, sustainable corrosion control

*This article highlights a step-change alternative that can offer REACH compliant inhibitors with a unique protection mechanism that can offer potential cost savings to coatings manufacturers in India*

## Introduction

As professionals working within the coatings industry, we are all acutely aware of the issues that corrosion poses and want to provide our customers and end-users with the best quality products to tackle this \$2.2 trillion global issue (NACE 2016). Anti-corrosion coatings have become a necessity for industries to safeguard the huge investments they make in terms of money, property and safety of workers. Whether coating to protect pipelines, aeroplanes or computer gadgets – customers are united in their battle against corrosion!

Historically, some of the most effective corrosion inhibitors have been based on chro-

mium. However, these chemistries are currently being phased out globally – leaving a gap in the market for a highly effective inhibitor that is non-toxic and non-carcinogenic.

Following strong R&D efforts and lengthy extended testing, many coatings companies have turned to phosphate-based systems. This article highlights a step-change alternative that can offer REACH compliant inhibitors with a unique protection mechanism that can offer potential cost savings to coatings manufacturers in India.

### Why phosphates are popular:

Currently, 45% of the corrosion inhibitor market is

currently dominated by phosphates.

Industry testing and academic research show that adding zinc phosphate can inhibit the anode process of metal corrosion and consequently prevent the horizontal diffusion of the corrosive medium into the coating/metal interface and slow down the disbonding of the coating (Hongxia Wan, 2017).

Additionally, phosphates don't pose the same health and environmental hazards as chromates, however, they do still present environmental issues through leaching. In its form as an inhibitor – it is classed as a Category 1 Environmental Hazard. Within the coatings system, at loadings of 2.5% and above, the paint will be classed as a Category 2 Environmental Hazard so will still require environmental labelling (United Nations, 2021).

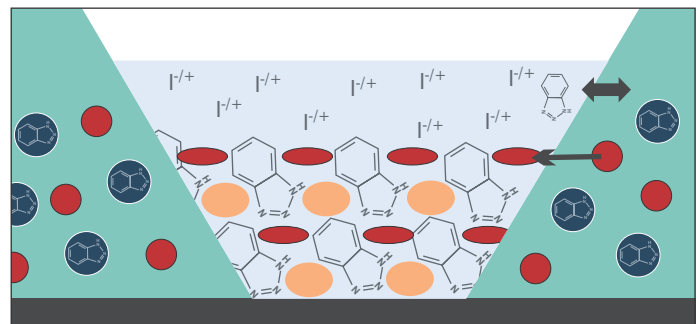
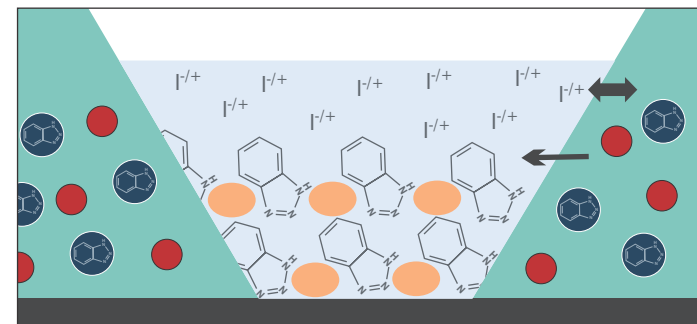
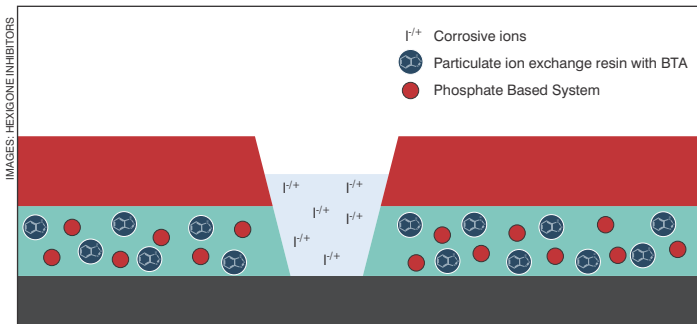
### Why choose a phosphate / Intelli-ion® “co-blend?” Innovative and trusted technology working together

Zinc phosphate salts on their own are not initially very

effective due mainly to their low solubility. As a result, in a corrosive environment, significant amounts of time must pass before there are sufficient concentrations of phosphate anions to react with the metal surface cations to form an anti-corrosive precipitative layer. This leads to a time delay where corrosion can proceed unimpeded (M. Cohen, 2022).

Intelli-ion® uses 'smart release' technology which senses and reacts to corrosive ions very quickly – buffering the time delay seen with phosphate inhibitors. It sequesters corrosive ions which triggers the release of the 'active ingredient' to form a very fast inhibitive layer at the site of corrosion. Phosphate inhibitors then fill the gaps to form a strong polymeric layer with the metal ions and metal surface. Intelli-ion® provides the initial protection backed up by the zinc phosphate precipitate layer to provide an optimised co-blend anti-corrosion solution.

Additionally, like highly effective chromates,



Figures 1 – 3: Depicts the protection mechanism of a co-blended primer coating following the detection of corrosive ions.



Intelli-ion® is both an anodic and cathodic inhibitor. This ensures that the technology can reduce the rate of metal dissolution at the anode and simultaneously decreases the rate of reduction reaction (both oxygen reduction and water reduction), via blocking the interfacial transfer of electrons.

**Removal of environmental warning labels from packaging**

Sustainability is a key market driver within the coatings industry. In the past, mandatory regulation was the most important factor, but now, we are seeing a fundamental shift in the societal demand with respect to sustainability and responsible business behaviour (Cynthia Challener, 2018). In short, customers are looking for products that are environmentally sound (i.e.

REACH and TSCA compliant).

Co-blending existing phosphate-based anticorrosion systems with Intelli-ion® at loadings less than 2.5% by weight in a paint moves a coating from Environmental Hazard Classification 2 (H411) to Classification Category 3 (H412). Category 3 presents a lower risk to aquatic life so no warning label is required on the paint packaging. In turn, this has storage, transportation, and disposal benefits – not to mention the environmental advantages.

**Anticorrosive cost savings**

Due to the high efficacy and lower loadings – ‘smart’ co-blend formulas with other phosphate containing metal salts can deliver potential cost savings per liter of paint (dependent on current loadings / price).

In addition, Intelli-ion® also has a significantly lower Specific Gravity than ZnP which means lower volumes of anticorrosive additives are required. This provides cost savings to the business through less hazardous chemical storage and transportation.

**Evidence of Intelli-ion® & phosphate compatibility**

*Independent academic research at Swansea University, United Kingdom*

The above research was conducted by Dr Phil Ansell of SPECIFIC Innovation & Knowledge Centre, Swansea University, UK. The independent research aimed to understand the relationship and optimal loadings between Intelli-ion® and zinc phosphate (ZnP) corrosion inhibitor co-blends. Various volume combinations (PVF – pigment volume fractions) of Intelli-ion® and ZnP were applied to a steel substrate, and timelapse photography was used to measure the combined inhibitor effect on the rate of cathodic disbondment ( $K_{del}$ ) over 24 hours.

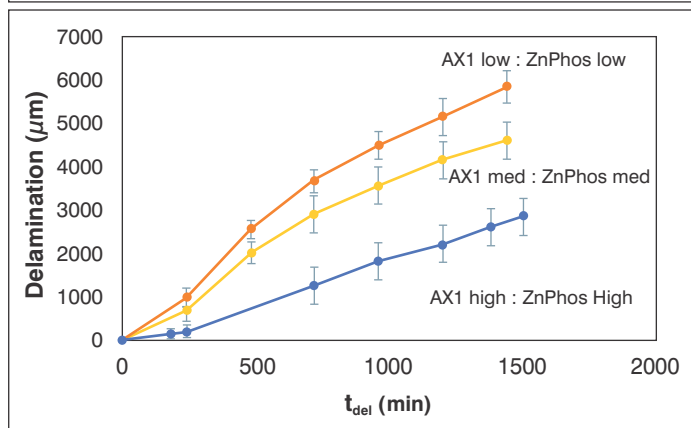
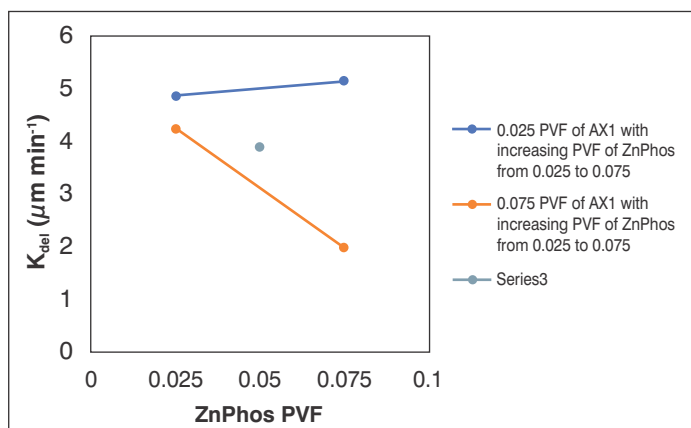
In Figure 1, the blue line represents the rate of coating delamination when Intelli-ion® is held at a low PVF (0.025) and the PVF of zinc phos-

phate is increased from 0.025 to 0.075. Coating delamination increased with higher concentrations of ZnP. Conversely, the orange line shows that when the PVF Intelli-ion® is kept high and constant (0.75 PVF) and the amount of ZnP varies from low (0.025) to high (0.075) – disbondment dramatically decreases. This demonstrates the synergistic effect of the co-blend is optimised when there is a higher loading of Intelli-ion® within the coating system. Figure 2 shows the best performing co-blend combination where Intelli-ion® and ZnP are both at higher levels.

**Industry-standard salt-spray testing**

Industry standard accelerated weathering tests with on-the-market phosphate-based coatings vs. Intelli-ion®-containing primers also demonstrate comparable or better performance.

The above mild steel samples were coated with an alkyd primer plus topcoat and then scribed using an Elcometer 1638 DIN scratching tool fitted with a 1 mm cutter. The samples were then placed in a salt spray chamber (at 45° angle) and run-in accordance with ASTM B117 continuous salt spray fog testing.



Figures 4 and 5 demonstrate Dr Phil Ansell's independent research aimed at understanding the relationship between Intelli-ion® and ZnP.

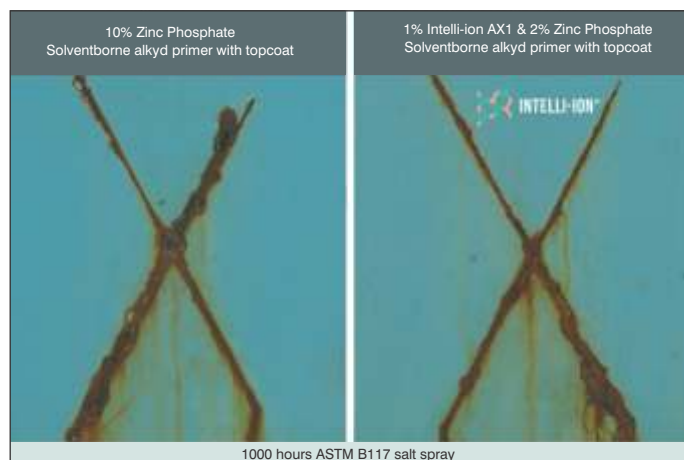


Figure 6: industry standard salt spray testing (ASTM B117) of phosphate-based systems (left) vs. Intelli-ion® co-blend (right).

Following 1000 hours, the samples were rinsed using distilled water and dried using lint free cloth before being analysed.

The inhibitor loading level was optimised for environmental and cost benefits - to lower the phosphate content to below 2.5% and remove environmental warning labels from packaging. The imagery clearly demonstrates that Intelli-ion® offers has a synergistic relationship with the zinc phosphate inhibitors - as far lower loadings of inhibitors gives comparable or better performance.

**To conclude:**

In 2021, the top 15 paints and

coatings companies accounted for a total market share of approximately 58.52%. In an industry dominated by so few – its increasingly important to differentiate your coatings and offer customers quality at a cost they can afford.

Co-blending Intelli-ion® anti-corrosives with phosphate-based systems offers a step-change alternative that enhances current coating systems without changes to the manufacturing process. Through the co-blend approach, coatings manufacturers can incorporate innovative technology, remove environmental warning labels from their

packaging – all whilst benefiting from comparable or better performance.

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**Hexigone's award-winning technology is distributed in India by Ankush Enterprise, go to [www.hexigone.com](http://www.hexigone.com) to contact them directly.**

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# Sustainable C5 corrosion protection for primer coatings

Hexigone's latest test results prove that their sustainable corrosion inhibitors – Intelli-ion – can reach C5 levels of corrosion protection in both waterborne and solventborne coatings. This presents the global coatings industry with the highest level of corrosion protection that is heavy metal and chromate-free, notes a write-up by Ella Newington, Marketing Manager and Catherine Friar, Business Development Manager at Hexigone.

C1-C5 are classifications used to describe the level of corrosion resistance required for aggressive environments and applications. C5 refers to highly corrosive environments, where the steel structure is exposed to high

levels of humidity, saltwater spray, and other corrosive substances. Many coatings manufacturers formulate coatings to provide protection in these conditions – such as offshore oil and gas platforms, coastal areas, and chemical plants.

The coatings that have been tested were formulated at the PRA (Paint Research Association) - a UK-based organization that provides technical and scientific support to the global coatings industry. The REACH compliant inhibitors were added to both waterborne (WB) and solventborne (SB) 2 pak epoxy coatings - with primer only as well as top-coated systems tested.

The panels used for testing were shot-blasted to Sa2.5 as per C5 specification. Each primer layer had an average dry film thickness (DFT) of 120 µm and the topcoat was applied at approx 60 µm. After 1440 hours salt spray testing (SST) to ASTM B117 both the primer and full system for our WB Epoxy and SB Epoxy displayed zero signs of blistering in the coating system. To demonstrate the full performance of both systems with AX1 in, we removed half of the paint system to view the substrate underneath. The WB Epoxy system after 1440 hours shows minimum corrosion at the scribe – evidencing Intelli-ion's excellent performance in WB systems. The SB Epoxy system also meets specifications with no blistering, minimum cross scribe corrosion, and no undercoat corrosion present on the full substrate.

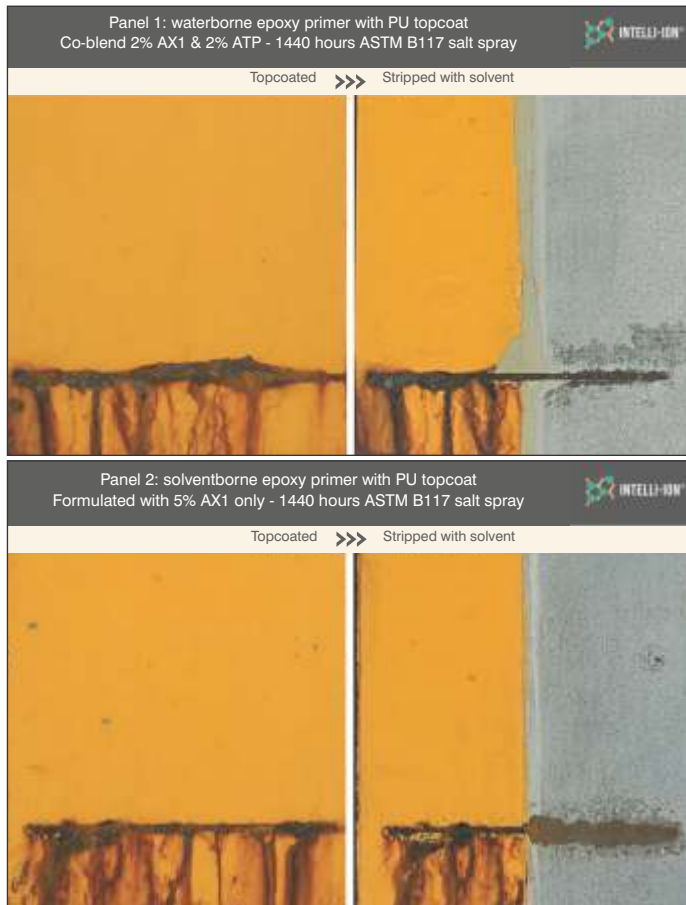
Dr Catherine Friar, Business Development Manager at Hexigone Inhibitors, commented: "Our award-winning technology provides exceptional protection to infrastructure in key sectors as well as helping to address environmental challenges faced by the coatings industry. Reaching 1440 hours allows existing manufacturers of C5 standards of paint to switch to more sustainable inhibitors; or facilitate new C5 REACH compliant product lines through sustainable waterborne or low VOC solvent borne coatings. These preliminary results indicate that the coating systems would meet the High Durability requirements of the

ISO 12944:2018 C5 Corrosivity Category. Further testing is ongoing."

Unlike zinc phosphate, which primarily provides anodic protection via precipitation, Intelli-ion offers both anodic and cathodic corrosion protection. The technology is released in a smart way and works by forming a protective nano layer on the metal surface, which provides a physical barrier to corrosion-inducing substances. Intelli-ion also has unique electrochemical properties that enable it to donate, or accept a proton, moderating under-film pH. The final mode of protection happens once it has donated a proton to OH-ions resulting from the cathodic oxygen reduction reaction, it forms a lone pair bonded layer over the metal surface at the cathode, blocking interfacial electron transfer.

The three modes of electrochemical protection are unique on the market and have received recognition through winning the British Coatings Federation's 'Sustainable Innovation – Supplier' category in 2022. The company have also been awarded an EcoVadis Gold rating for their sustainable business practices. Hexigone invites coatings manufacturers worldwide to join forces and co-create high-performance, sustainable, smart coatings.

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# Strengthening the bond with reliable structural adhesives

*This paper introduces a novel, two-component, solvent-free toughened epoxy adhesive material that provides high adhesion to metallic substrates.*

## Abstract

When identifying solutions that can offer assurance and longevity, the maintenance and reliability of assets repairs can be challenging, this white paper will look into the use of structural adhesives as the first-choice solution.

Structural adhesives can be used for affixing metal substrates or components as they provide high modulus and high strength. However, they are not currently internationally recognised like the traditional methods even though adhesives are already used in a wide range of industries, such as aerospace, rail, and construction.

Traditional practice such as welding, riveting, nuts and bolts and mechanical fixing are perceived as the go to method. However, they all have their inherent inadequacies. Welding can be hazardous to health, riveting, nuts and bolts concentrate the stress locally while mechanical fasteners can concentrate stress.

This paper introduces a novel, two-component, solvent-free toughened epoxy adhesive material that provides high adhesion to metallic substrates while also being able to withstand high movement or cyclic fatigue in comparison to general epoxy materials.

As well as potential applica-

tion areas, the article also discusses a number of benefits, including ease of use, load bearing and impact resistance properties.

## Introduction

Most industrial maintenance or repair procedures can either involve welding or use of mechanical fasteners as these can be perceived as easy and quicker, however, these procedures might initially seem to correct the issue but may cause more harm than good. Depending on the repair situation for instance welding or drilling to connect mechanical fasteners on a storage tank containing flammable liquid is not recommended for obvious reasons this is where a structural adhesive can really offer a solution for that maintenance repair.

There are many structural fixings used across a whole range of industries that may be part of any maintenance or repair. These include support brackets such as cable trays, antennas, heating coils filter pans or any other internal fixtures in vessels that suffer from corrosion, impact or vibration damage. Within construction there are fire water deluge systems, nozzles connections, facades panels and signs which can require maintenance overtime or adverse weather conditions.

Process equipment or piping can suffer from thinning or the steel or even through wall defects which will need either monitoring or repairing depending on whether the integrity of the equipment has been lost.

Structural fittings are generally for fixing of static members but maybe subjected to forces unbeknown at time of installation this could include thermal cycling of the joints, cyclic loading or vibration due to fatigue of a component.

If there are repairs due to the above, the contractor maybe in a situation where a choice of solution can be made, then the strengths and weaknesses need identifying.

Welding is regularly used for repairs as it is widely available while being well regulated with high customer confidence and high strength of the repair it does come with its inherent risks both the use, the material by heat stressing and the user as welding can cause both acute and chronic health risks<sup>1</sup>. Application of welding repairs onto live piping sections, storage tanks or process systems and equipment should not be undertaken due to the high temperatures involved and not forgetting the combustible nature of the process fluid or gas running through or being stored in these components.

Bolted joints are seen as simple and low cost due to the ease of disassembly and reassembly and these can be dissimilar metals, but the use of dissimilar metals will contribute to galvanic corrosion, add weight to the joint, requiring routine inspection and tensioning while the drilled holes in the support material, stress distribution is not uniform and concentrated at the holes.

Structural adhesives have high bond strength whilst being lightweight, adhesive applied to cover the entire joint, resulting in uniform stress distribution, reducing metal distortion under strain.

## Importance of a strong bond

Adhesive bonding is the joining of similar or dissimilar members together while creating permanent high strength bonds which can transfer structural stress without loss of structural integrity.

Regardless of the joint type used, it is important to understand the different stresses that are imparted onto a bonded assembly. Adhesives perform the best when the stress is two-dimensional to the adhesive, allowing the force to be applied over the entire bond area.

Joints that are well designed

Type	Strengths	Weaknesses
Standard epoxies	Lap shear adhesion Temperature resistance	Peel and cleavage forces
Toughen epoxies	Highest bond strength metal-metal	Temperature resistance

Table 1: Types of structural adhesives.

for adhesives place most of the stress into compression or shear modes, adhesives perform the worst when stress is one-dimensional to the adhesive, concentrating the load onto the leading edge of the bond line. Joints placing stress into cleavage or peel concentrate the stress onto the leading edge, which may lead to premature bond failures, especially if subjected to vibration, impact or fatigue.

Bonds of high strength are obtained after cleaning of the substrate by removal of any contaminants followed by the roughening of the substrate generally in the form of grit blasting to international recognized standards, this is why surface preparation is critical to success regardless of what type of adhesive is used.

There are three types of bonding that are important to

achieve to ensure good adhesion. These are: adhesive, chemical, and mechanical.

Adhesive relies on surface energy to generate adhesion to the substrate. While chemical relies on chemical bond formation and electronic bonding to produce adhesion. Mechanical adhesion is due to the creation of an irregular profile that allows a deeper profile to be produced.

The types of structural adhesives available have been summarised in Table 1.

There are two types of failure mechanisms associated with structural adhesives:

1. Cohesive failure occurs in the bulk layer of the adhesive material. This failure mode is limited by the strength of the adhesive material and can be caused by insufficient curing

of the adhesive and applications at a greater thickness than that recommended among others.

2. Adhesive failure occurs when the mechanical adhesion between the adhesive and the parts being joined is overcome by the loading. This failure mode is associated with inadequate surface preparation, presence of contaminants, or insufficient curing of the adhesive among others.

**Background**

Design considerations for Belzona 7311 were based on both technical target requirements and a practicality approach, as summarised in Table 2.

Belzona 7311 was subjected to at least the following tests and evaluation protocols in to ensure that it met the design criteria previously discussed.

Where possible, internationally recognised standards were used.

1. Cleavage Adhesion – ASTM D1062<sup>3</sup>
2. Tensile Shear Adhesion – ASTM – D1002<sup>4</sup>
3. Tensile Fatigue Resistance – ISO 9664<sup>5</sup>
4. Impact Resistance – ASTM D256<sup>6</sup>

**Experimental procedure**

1. *Cleavage adhesion – ASTM D1062*

Cleavage adhesion is used to assess the strength of an adhesive bond between two substrates when exposed to cleavage stress.

Belzona 7311 was applied between two identical grit blasted metallic cleavage test pieces to create a fixed bond area of 125mm<sup>2</sup> of minimal bondline thickness.

The specimen was allowed to cure then attached to a 25kN tensometer using suitable grips. The tensometer then applies a load at a fixed rate of 1.3mm/min exerting a cleavage force on the specimen until bond failure. This test is repeated five times so an average force can be calculated.

DESIGN CONSIDERATIONS		
Technical	Excellent adhesion to metallic substrates	An adhesive which has been optimised for metal-to-metal adhesion
	Suitable service temperatures	An adhesive that can be withstand between service temperatures of -30°C and 60°C
	High resistance to peel /cleavage forces	Standard epoxies don't generally perform when subjected to peel or cleavage forces. A toughen epoxy which can withstands these forces would be advantageous
	Superior resistance to cyclic fatigue	An adhesive which can show no signs of deterioration or cracking when subjected to cyclic loading
	Data package for engineering design	Collect the precise performance data required for the adhesive to be modelled through Finite Element Analysis (FEA)
	Solvent free	Solvent free epoxy systems show greater mechanical properties when compared to solvented formulations. Experimental work has shown that solvent remaining within the epoxy can hinder the cross-linking process resulting in lower exotherm, initial curing rate reaction order and glass transition temperatures
Practical	Hi-build paste structure	A structural adhesive which could hold its own structure and not slump in vertical applications
	Ease of application	A system that could be conveniently applied by brush, applicator, or cartridge injection
	Fast return to service	A structural adhesive with shorter curing times to provide appeal for asset owners

Table 2: Design considerations.

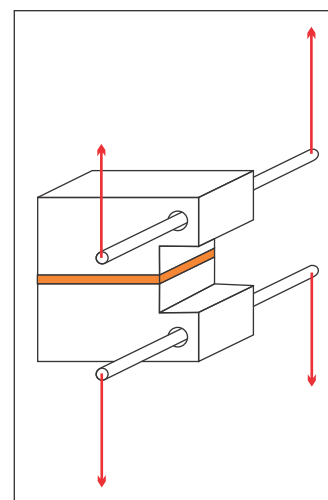


Figure 1: Cleavage adhesion test.

2. Tensile shear adhesion – ASTM – D1002

Tensile shear adhesion or lap shear adhesion is used to determine the adhesive strength of a material when bonded between two ridged metallic substrates.

Samples are 100 x 25.4 x 2mm and are overlapped lengthwise by approximately 12.7mm and bonded to a minimal bondline thickness with Belzona 7311.

The specimen was allowed to cure then attached to a 25kN tensometer using suitable grips. The tensometer then applies a load at a fixed rate of 1.3mm/min exerting a cleavage force on the specimen until bond failure.

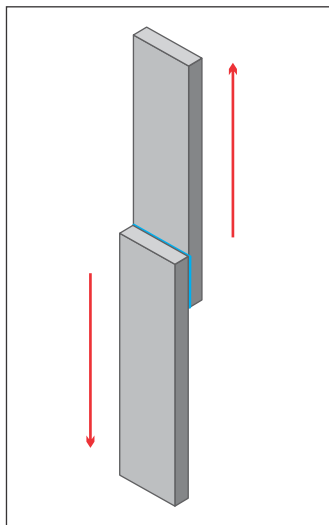


Figure 3: Tensile shear adhesion test.

fatigue testing - 35% mean shear stress = 8.461 MPa (24.17 MPa x 35%)

At four different alternating stresses, fatigue testing was conducted at 30Hz until failure:

1. 80% = 6.8 MPa (8.461 MPa x 80%) Stress amplitude cycles between
2. 60% = 5.1 MPa (8.461 MPa x 60%) Stress amplitude cycles between
3. 57.5% = 4.9 MPa (8.461 MPa x 57.5%) Stress amplitude cycles between
4. 55% = 4.7 MPa (8.461 MPa x 55%) Stress amplitude cycles between

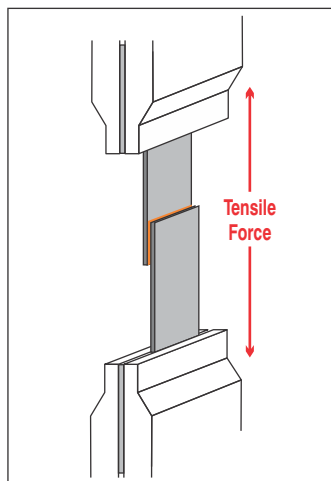


Figure 2: Tensile force.

3. Fatigue resistance – ISO 9664

Fatigue resistance is the highest stress that a material can withstand for a given number of cycles without breaking.

A standard static tensile shear adhesion test was conducted to determine the mean breaking stress – 24.17 MPa following this 35% of the mean breaking stress value is used as the mean stress in

4. Impact resistance – ASTM D256

Impact tests can be used to assess the toughness of a material, a material's toughness is a factor of its ability to absorb energy during plastic deformation. Brittle adhesives have low toughness as a result of the small amount of plastic deformation that they can endure. Tougher materials on the other hand can absorb greater energy during

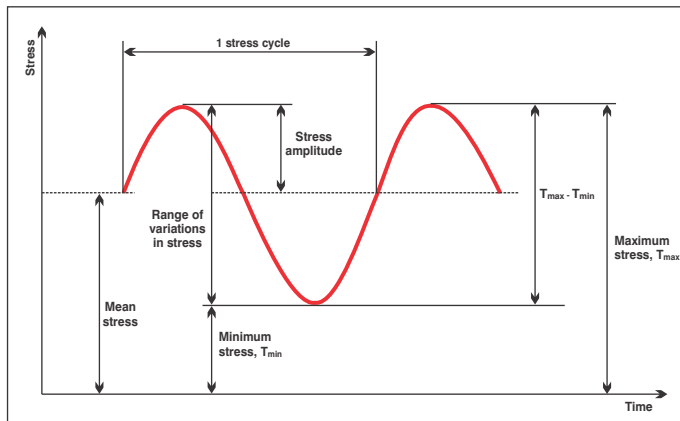


Figure 4: ISO 9664 fatigue stress cycle.

fracture and thus, have improved impact resistance.

The Izod impact test allows for samples to be tested in two forms: either 'notched' or 'un-notched' in our case the testing will be notched which has a V-shaped notch of approx. 2.5mm in depth with a total defect angle of 45° in the centre of a specimen sample with dimensions of 12.7 x 12.7 x 65mm. The notch concentrates stress and allows measurement of crack propagation.

Non-standard testing:

5. 3-point load test

This comparative technique is used to assess the relative flexibility of adhesives when applied to a metallic substrate. In this test a mild steel panel of dissimilar dimensions

Plate 1 550 x 50 x 10mm thick

Plate 2 225 x 50 x 10mm thick

are stressed to the point the adhesive fails. The panel is held in position at two points, one at either end of the sample and is gradually stressed at a single point in the centre of the specimen via a hydraulic press as seen in figure 3. The greater the displacement i.e., the further the press travels until failure the more flexible the adhesive. The thickness of the adhesive will influence the degree of flexibility so analysis should be duplicated for repeatability purposes. In the case of this testing at the manufacturing stage the specimens were compressed by hand pressure only, to try and replicate 'in field' applications of achieving below the maximum bondline thickness of 2mm.



Figure 5: 3-point load testing.



## Testing results and discussion

### 1. Cleavage adhesion – ASTM D1062

Grit blasted (ISO 8501-1 Sa 2.5)	Cleavage adhesion
20°C/ 68°F applied, cure and test	360 N/mm / 2060 pli
20°C/ 68°F applied, 60°C/ 140°F cure and test	300 N/mm / 1700 pli
60°C/ 140°F applied, cure and test	330 N/mm / 1880 pli

Table 3: Cleavage adhesion results - ASTM D1062.

### 2. Tensile shear adhesion – ASTM – D1002

Grit blasted (ISO 8501-1 Sa 2.5)	Tensile shear adhesion
20°C/ 68°F applied, cure and test	33.4 MPa / 4840 psi
20°C/ 68°F applied, 60°C/ 140°F cure and test	20.9 MPa / 3030 psi
60°C/ 140°F applied, cure and test	24.8 MPa / 3600 psi

Table 4: Tensile shear adhesion results– ASTM D1002.

### 3. Tensile fatigue resistance – ISO 9664

Cyclic fatigue testing		
	Stress amplitude cycles	Results
1	80% = 6.8 Mpa (8.461 Mpa x 80%) Stress amplitude cycles between	15.23 Mpa - 1.69 Mpa
2	60% = 5.1 Mpa (8.461 Mpa x 60%) Stress amplitude cycles between	13.54 Mpa - 3.38 Mpa
3	57.5% = 4.9 Mpa (8.461 Mpa x 57.5%) Stress amplitude cycles between	13.33 Mpa - 3.6 Mpa
4	55% = 4.7 Mpa (8.461 Mpa x 55%) Stress amplitude cycles between	13.11 Mpa - 3.81 Mpa

Table 5: Cyclic fatigue testing results.

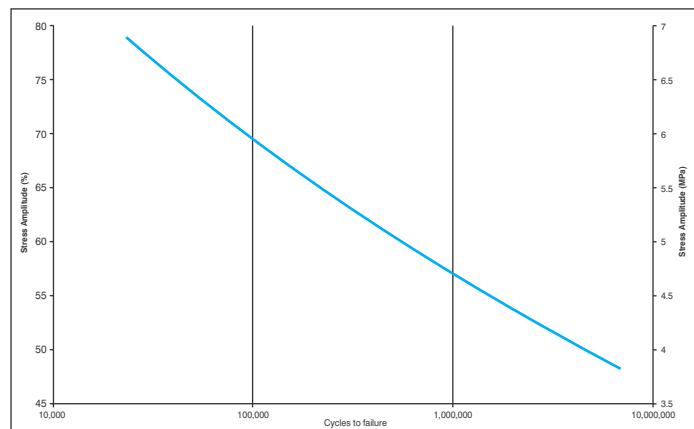


Figure 6: Belzona 7311 SN curve.

From a mean breaking stress of 35% (8.461 Mpa), Belzona 7311 will survive 106 cycles at 56.6%, with an alternating stress amplitude of  $\pm 4.791$  Mpa = 13mpa to 3.67 Mpa

### 4. Impact resistance – ASTM D256

	Revised notched Izod Impact Strength
20°C/ 68°F applied, cure and test	15.9 KJ/m <sup>2</sup> 165.2 J/m
20°C/ 68°F applied, 60°C/ 140°F cure and test	16.2 KJ/m <sup>2</sup> 171.4 J/m
60°C/ 140°F applied, cure and test	9.7 KJ/m <sup>2</sup> 100.5 J/m

Table 6: Impact resistance results – ASTM D256.

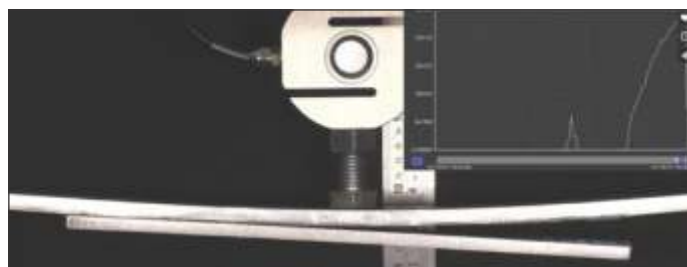


Figure 7: 3-point load specimen testing.

## Conclusions

Several conclusions can be drawn from the use of Belzona 7311 as a solution for the repair or maintenance of assets:

1. Belzona 7311 offers high resistance to structures that are subjected to forces such as peel, cleavage, vibration, or cyclic loading. These include, but are not limited to, support brackets for fire deluge systems, internal and external fixtures on process equipment, wear pads and wind girders on storage tanks.

2. As Belzona 7311 offers an array of additional practical features including ease of application, ability to hold its own structure when placed in vertical applications and superior adhesion to metallic substrates, the toughened epoxy can be used on structural support reinforcements, load transfer supports and metallic staircases and ladders.

3. Plate bonding to repair thinning or through wall defects on areas such as pipe/piping, process equipment, storage tank floating roofs and platform decks can utilise Belzona 7311 as it offers high impact resistance and flexural properties.

Belzona 7311 has been optimised for metal-to-metal adhesion and exhibits an extensive data list with over



Figure 8: Structural adhesive, Belzona 7311, used to bond bracket.

20 tests solely based on adhesion. The performance data can be used for Finite Element Analysis (FEA) or simulations to aid in bond designing or qualification of the adhesive in areas that would normally be seen as high risk for standard epoxies such as handrails and walkways.

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Author:  
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# Researchers develop new metal matrix heat resistant coatings

South Ural State University (SUSU) researchers are developing new compositions and methods for obtaining composite coatings with non-metal and intermetal high-entropy compounds as part of the New Non-conventional Materials project of the Priority 2030 program. Using additive manufacturing technologies makes it possible to create coatings with a unique composition, which give such material properties as heat resistance, corrosion resistance, ionizing radiation resistance, and the ability to absorb or reflect electromagnetic radiation, notes a press release from the University.

In the last decades, a new technology to produce parts using additive layering of material has been actively developed. This method of synthesizing products is called additive manufacturing

and is used to manufacture products from various materials: plastic, metal, concrete, etc. Currently, this technology is widely used to create metallic and non-metallic prototypes and functional products.

The applied aspects of additive manufacturing technologies have been of interest to SUSU scientists for a long time. With the support of a grant from the Russian Science Foundation, it became possible to apply additive technologies (laser cladding and detonation spraying) to obtain metal matrix composite coatings with a fundamentally new composition. The coatings consist of particles of nonmetallic and intermetallic high-entropic compounds.

This project is unique in that additive technologies are used to create coatings with

high-entropy phases from powders consisting of a mix of pure components or from powders of low-entropy alloys.

"To create the coatings, powder mixture compositions are pre-created using thermodynamic and kinetic simulation methods. The programs FactSage 8.0 and Thermo-Calc help in this. These mixtures form non-metallic and intermetallic high-entropic phases in the coating matrix," says Natalia Shaburova, project head and Associate Professor of the SUSU Department of Materials Science, Physical and Chemical Properties of Materials.

The adhesive properties, corrosive resistance in an electrolyte, and gas corrosion of the obtained coating samples are analyzed. The researchers also plan to conduct structural studies of the material.

The new coatings, thanks to their unique combination of performance properties, could be in high demand in several industries including engine manufacturing, rocket engineering, and others in which surfaces are subjected to heat.

To date, papers on this method of manufacturing coatings have not been published. The project received support from the Russian Science Foundation (RSF) to the tune of 1.5 million roubles for the first year of research. In total the project includes two years of research.

"For a researcher, grants are above all an opportunity to continue their research, a confirmation that the topic of their research is relevant, promising, and has value not only for themselves, but also for the future of the entire country. Working in small research groups, in addition to the increase in scholarship, allows undergraduate and graduate students to acquire the necessary skills and knowledge that will be useful in further independent work," says the scientist.

The SUSU research team uses a modern computerized FL-Clad-R-4 laser cladding complex and CCDS2000 detonation sputtering unit at the SUSU Laboratory for Mechanics, Laser Processes and Digital Production Technologies, founded in 2017. The laboratory has already been used for a number of research projects ordered by industrial companies and state corporations including Roscosmos, Transneft, SMS-group, Chelyabinsk Tube Rolling Plant, and AO KONAR.



Using additive manufacturing technologies makes it possible to create coatings with a unique composition, which give such material properties as heat resistance, corrosion resistance, ionizing radiation resistance, and the ability to absorb or reflect electromagnetic radiation.

PHOTO: SOUTH URAL STATE UNIVERSITY

# Herts researchers develop building coating that uses bacteria to protect and self-repair against erosion

An innovation for a pioneering new limewash for building surfaces, which uses bacteria to form a barrier against erosion damage, has been developed by University of Hertfordshire researchers.

The limewash contains non-pathogenic bacteria, which increase the amount of CO<sub>2</sub> that a building surface can absorb through photosynthesis. This, in turn, generates additional calcium carbonate that forms a more robust barrier against erosion, as well as encouraging self-repairing mechanisms, notes the press communique from the University.

Believed to be the first of its kind, a pre-production prototype is now being developed by the team, based on research by the University's Zero Carbon Lab and the manufacturing expertise of UK Hempcrete Ltd, funded by the Arts and Humanities Research Council (AHRC) through the Design Exchange Partnership program.

Both organizations are partnering with whisky makers Whyte & Mackay Ltd, who have agreed to trial the prototype at their distillery on the Isle of Jura off the west coast of Scotland. Currently, wind-driven rain on the island damages the building surfaces of the distillery, resulting in the need for annual re-coating. This not only disrupts production and tourism but increases the company's carbon emissions,

as they transport materials to the island and carry out maintenance works.

The new, more robust self-repairing surface is expected to lower the frequency of maintenance, reduce

disruption to the distillery and to tourism, and lower carbon emissions caused by frequent maintenance, whilst also actively absorbing carbon, thus supporting Whyte & Mackay's zero-carbon commitments. Over time it will improve the carbon absorption of the building surface, strengthening the outer layer and reducing maintenance requirements.

Professor Ljubomir Jankovic, Professor of Advanced Building Design and founder of the University of Hertfordshire's Zero Carbon Lab, said: "We are excited to see the potential impact that our research will have on the resilience and maintenance of the distillery. Following the planned field trials, there is scope for this method to be used on a much wider scale. As well as supporting Whyte & Mackay's zero-carbon aims, we also intend to give local community, trade and homeowners the opportunity to use the product. This will help them to lower traditional



Whisky makers Whyte & Mackay Ltd, have agreed to trial the new limewash prototype for building surfaces, which uses bacteria to form a barrier against erosion at their distillery on the Isle of Jura off the west coast of Scotland.

PHOTO: WHYTE & MACKAY LTD.

maintenance costs, supporting environmental goals and the local tourism economy."

Jamie Muir, Jura Distillery Manager for Whyte & Mackay, said: "The Isle of Jura is a beautiful place to make Scotch Whisky, but it is not necessarily the easiest place to be a whisky maker. When we created our sustainability plan The Green Print, we laid out our commitment to make a positive impact to the local community where we make our whisky. This partnership with our friends at UK Hempcrete and the University of Hertfordshire will deliver a pilot, which we believe could make a significant impact across the Scotch Whisky industry and beyond."

Alex Sparrow, UK Hempcrete's Managing Director, added: "This collaboration with the University of Hertfordshire and White & Mackay is a perfect fit for UK Hempcrete. This is an opportunity to develop an innovative new low-carbon product in tandem with the development of primary research at the University, and simultaneously see its application in a real-world context. This fits exactly with our ethos of improving the technical performance of buildings in the real world, whilst lowering their carbon footprint."

The team are aiming to have the prototype in place by July for a 3-6 month testing period.

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# Paintable proteins provide environmentally friendly way to protect ship hulls at sea

Within minutes of a ship's hull being submerged in seawater, a complex web of life starts to develop: bacteria, algae, tube worms, barnacles and mussels. This adhesion of organisms, known as biofouling, increases drag and fuel consumption and leads to costly corrosion — but many of the existing methods to prevent it are toxic.

Antifouling coatings, which slow the growth of organisms, typically rely on the toxicity of copper and small-molecule additives that act as pesticides in the water near a ship's hull. These poisonous paints leach into the seawater and destroy aquatic life.

Now, researchers at the Johns Hopkins Applied Physics Laboratory (APL) in Laurel, Maryland, have developed a nontoxic, environmentally friendly paintable protein that inhibits fouling. The APL team published its results in the *Journal of Coatings Technology and Research*.

Researchers have identified active proteins, or enzymes, as potential nontoxic antifouling agents. But no one had developed an effective way to bind enzymes onto a specific location while maintaining their functionality. Enzymes must be covalently, or chemically, attached to a surface to maintain their antifouling properties.

“Many marine animals do not want to be covered in biofouling and have developed enzymes to protect themselves,” said project lead Reid Messersmith, a molecular engineer in APL's Research and Exploratory

Development Department (REDD). “Taking inspiration from animals, we developed an enzyme coating that could be applied directly to surfaces.”

Biological scientist Ryan Baker-Branstetter, who led the enzyme and antifouling research, added that biofouling develops from bacteria settling on a surface. So, if the team could prevent small bacteria from forming, larger organisms would not follow.

“It's difficult to get enzymes to stick to just anything and remain active in the process. Bioconjugation is a technique to couple naturally occurring biomolecules and synthetic compounds. There have been promising laboratory results proving that certain enzymes can be attached to certain surfaces, but those results have not translated into real-world applications,” said Messersmith. “We wanted to create a paint bucket approach, where someone could walk up and efficiently and effectively slap the coating on a surface.”

To do that, they needed to identify an effective “linker” — an agent capable of bonding an enzyme to a synthetic compound.

APL researchers developed an enzyme-based polymer coating with an ortho-phthaldialdehyde (oPA)-based linker, which is capable of bonding enzymes onto surfaces, and doing so rapidly — taking less than five minutes to form a layer of material.

“The first protein we painted



A graphical abstract of the antifouling enzymes tethered to surfaces.

in 2021, red fluorescent protein, established that the chemistry behind the coating system and our linker worked. This allowed us to revisit which proteins would effectively prevent biofouling in our latest research,” said Messersmith.

When APL staff members turned their attention toward antifouling, they reviewed the literature to understand which enzymes would prove effective and compatible with the coating system. They settled on xylanase — a naturally occurring enzyme produced by fungi, bacteria, marine algae and many other organisms, often used in commercial baking — and a mixture of lysing complex enzymes — a molecule extracted from a fungus.

The team used a method called click chemistry, which enabled them to attach the coating without any catalyst or heat. After two months submerged in artificial seawater, the xylanase and lysing complex coatings proved highly active, demonstrating the material's longevity and potential for

eco-friendly antifouling. Remarkably, the approach was successful on the first try.

“I have worked on a lot of projects, and typically the tenth thing you try works. But it is very rare for the first approach to work out,” said Baker-Branstetter. “Having early success with the enzymes allowed us to look further into other interesting questions, such as the paints' longevity and activity across a range of environmental conditions.”

Additionally, the team found not only that their coatings prevented the bacteria from adhering to a surface but that they were also able to remove bacteria that had already settled.

Beyond their antifouling potential, paintable proteins could have a variety of applications. The oPA linker can work with a wide variety of proteins because it acts on the exterior of proteins without interfering with their functioning. As one example, Messersmith said this approach might be used to create a paint-on sensor for detecting toxic gas in the air.

IMAGE: JOHNS HOPKINS APL

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# The empty quart paint cans market has a favorable impact on the global business

Future Market Insights (FMI) in its latest market analysis forecasts that the paint cans market is likely to manifest a Y-o-Y growth rate of 4.2% in 2023.

Between 2023 and 2033, the market is expected to expand at a CAGR of 4.1%, valuing the market at \$7,680.93 million. The paint cans sector has an expected worth of US\$ 5,117.84 million in 2023 due to outstanding global sales.

A significant boost to the paint cans adoption is from the fact that packaging is no longer about the look, but about the value of convenience, transportation, and storage. As a result, steel and aluminum remain highly sought-after materials for the manufacturing of painting cans.

The market is expanding due to increasing demand for PVC paint cans from various end-use sectors, including automotive, construction, industrial, and marine.

Due to their exceptional qualities, such as outstanding weather ability, good scrub resistance, and high durability, the PVC paint cans market expects a CAGR of 6.7% by 2033. Moreover, the industry is expanding as a result of rising environmental consciousness and the introduction of water-based PVC paint cans.

Growth in the demand for spray paints has been recorded in the automotive industry, on the back of the increasing inclination for personalization and maintenance activities.

The rising demand for paint

cans from the eCommerce portals further requires cans that are transportation-friendly. Since paint cans are more convenient to transport than their counterparts, their sales are likely to gather momentum.

An increase in construction, as well as industrial spending, could lead to an uptick in sales. Besides this, manufacturers are trying to use different materials to offer the convenience of packaging to the end-use industries.

Recently, the rising demand for empty paint cans from the residential and commercial sectors contributed highly to the market. Moreover, the rising environmental consciousness and the introduction of eco-friendly paints act in favor of paint cans sales.

The empty quart paint cans market has a favorable impact on the global business. The need for empty quart paint cans is anticipated to increase, as digital printing technology is rising used to label cans. According to this demand, the market size for paint cans increased significantly during the forecast period.

According to the study, there are more manufacturers of metal paint cans than plastic paint cans, despite the considerable predicted CAGR of 2.6% for plastic paint cans in 2023. This is due to the growing awareness regarding the use of plastic products, given their adverse effects on the environment. Metal paint cans are mostly made of steel, which holds an expected CAGR of 5% by 2033.



PHOTO: 123RF

In the coming years, the implementation of stringent rules and regulations against the use of plastic is expected to cause stagnation in the plastic cans market. In addition, there are paint packaging solutions other than paint cans made out of plastic, such as bottles and pails, which are also available in the market.

FMI analysis indicates that despite the above factors, metal cans are likely to continue to be preferred for the next 10-12 years owing to their high recyclability and durability.

Plastic paint cans lack the rigid build of their metal counterparts. During our analysis, it was found that while plastic industrial pails and cans are widely used, they are not likely to exceed their metal counterparts in terms of performance. Metal paint cans, specifically the ones that are made of steel or tin-plated steel paint cans, are designed to be hard-wearing. Paint cans in the 1001 to 2000

ml segment are anticipated to increase in value of US\$1,191.57 million by 2033. The rising popularity of DIY projects, the expansion of the building sector, and the rising demand for eco-friendly paints all contribute to this increase.

By providing new designs and features that improve the usefulness and convenience of their products, manufacturers in this market are always innovating to satisfy the changing needs of their customers.

The intensity of competition is expected to be high in the market, during the forecast period. Currently, a very small number of manufacturers of plastic paint cans are present in the market, and there is a very less likelihood of any new entrant in the plastic segment, barring the Tier 3 players. There have been several attempts by top players to work on the design of metal paint cans, as they are not known to be very consumer convenient and are relatively heavier.

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# CUMI sets up center of excellence for wonder material graphene

Carborundum Universal Ltd. (CUMI), a global leader in high-performance, advanced materials, has taken a significant leap in the field of new materials by exploring the immense potential of graphene. Towards this end, CUMI has signed a memorandum of understanding (MoU) with the Digital University of Kerala to set up a Centre of Excellence, where further research and development on the wonder material will be taken up.

Despite the promising and myriad applications of this new material, large-scale commercialization of graphene needs investment in research to overcome the challenges of cost, identifying the right type of graphene for each application along with consistent availability, and the expertise needed to process it.

CUMI is committed to realizing the potential of this game-changing nanomaterial by developing application knowledge, ensuring consistent availability, and identifying the right type of graphene for the right application, notes a press communique from the company.

Dr A. P. James, Professor-in-charge, Maker Village, Professor, AI-Chip Design Center, Digital University Kerala, said, "We believe that the possibilities for graphene are endless and that it can have a huge impact on every industry. Graphene is ultra-light, super strong, flexible, transparent, and impermeable. It is also a superconductor, allowing electricity to flow without any energy loss. All these properties will allow new and exciting innovations to emerge. We are happy to join hands with CUMI to set up a

Centre of Excellence where further research on this new-age material can be taken up."

Mr M. V. Sivakumaran, Senior Vice President and Business Head, Electro Minerals Division, Carborundum Universal Limited said, "Graphene has the potential to revolutionize multiple industries, from electronics and energy storage to medicine and transportation, due to its exceptional strength, conductivity, and flexibility. As a pioneer in the field of materials science research and applications, CUMI is investing to develop the potential of this wonder material. The Centre of Excellence at the Digital University of Kerala will help us to advance our research and development efforts in graphene, perfect specific solutions for various applications and industries, and create new products."

CUMI is a pioneer in the manufacture of graphene. A special facility was commissioned in 2020 to manufacture various grades of graphene and allied products suitable for applications in composites, coating and energy areas. The 12,000 sqft facility can process 6 lakh litres/year of varying grades of graphene powders, besides producing master batches in different kinds of elastomers, thermosetting and thermo-plastic polymers.

The facility also offers proprietary formulations of graphene additives useful for applications in concrete, anti-corrosion, and anti-microbial applications. The facility has a state-of-the-art application lab well equipped with various types of particle characteriza-



*The possibilities for graphene are endless and can have a huge impact on every industry.*



*The CUMI facility also offers proprietary formulations of graphene additives useful for applications in concrete, anti-corrosion, and anti-microbial applications.*

PHOTOS: CARBORUNDUM UNIVERSAL LTD.

tion equipment like laser particle size analyzers, Coulter Multisizer and BET surface area analyzers. The lab also has an FTIR spectrometer, SEM and various electro-mechanical characterization equipment.

Graphene is slated to be the game-changing nanomaterial of the 21<sup>st</sup> century due to its exceptional electrical, thermal, optical, and mechanical properties which can enhance the performance of various materials while reducing the carbon footprint. An extraordinarily light material, a single sheet of graphene large enough to cover a whole football field can weigh under one gram. It is 10,000 times thinner than a human hair and can take a billion stress cycles before it breaks, making it one of the most fatigue-resistant materials. Recent research has shown that graphene-based materials can profoundly impact composites, specialty coatings, electronic and optoelectronic devices, chemical sensors, nanocomposites, and energy storage.

CUMI's scientists and experts are exploring the application of graphene in many areas including energy storage,

renewable energy, automotive, manufacturing, construction, as well as defence and aerospace. With its light-weight, high strength, flexibility, and high thermal/electrical conductivity, graphene has emerged as the most ideal material for various applications in these industries.

For the aerospace and defence industry, CUMI is working on developing graphene-based composites which can be used to create lighter and stronger aerostructures and body armor products. CUMI's research team has filed a patent for the preparation of highly conductive grades of nitrogen-doped graphene through instantaneous thermal processing. This grade of graphene finds applications in super-capacitors, batteries, and fuel cells.

With extensive R&D backing it, CUMI has emerged as a pioneer in the field of graphene research and applications, and the company is confident that graphene will revolutionize the materials industry in the years to come, the press communique concludes.



## Er. Samir Surlaker conferred CIDC Vishwakarma Industry Doyen award

The 14th CIDC (Construction Industry Development Council) Vishwakarma Awards were presented during the India Construction Meet in New Delhi on April 12, 2023, at a glittering function attended by over 500 professionals. During this event, Er. Samir Surlaker, was conferred the prestigious CIDC Vishwakarma Award in the Category of Industry Doyen, as recognition of his 45 years of service in Construction Chemicals (CC) Industry.

The award was presented by Dr P. S. Rana, Chairman, CIDC and Dr B. D. Mundhra, Chairman Emeritus Simplex Infra. Er. Surlaker's son, Er. Sunny Surlaker, accepted the Award on his behalf.

Er. Surlaker said: "I thank the CIDC for conferring on me the prestigious CIDC Vishwakarma Award in the category of Industry Doyen. I am

grateful and humbled and I commit to continue to work in interest of CC Industry and contribute to technical upliftment of our construction chemicals and waterproofing / repair industry."

The Award function was part of a CIDC's mega event titled India Construction Meet 2023 (ICM 2023) April 10 – 12, 2023. The ICM 2023 was a series of technical sessions and exhibition along with the famed and coveted CIDC Vishwakarma Awards. Encouraged by Dr P. R. Swarup, (DG, CIDC) the Construction Chemical industry was one of the key stakeholders in this event.

The highlights of the event were release of the Codes of Practice in Waterproofing, an interactive Technical Session on Construction Chemicals besides honoring the industry during the CIDC Vishwakarma Awards.

Drafting codes of practice in waterproofing was the brainchild of Dr P. R. Swarup, Director General, CIDC and the committees are headed by Dr Niranjana Swarup, Director General, Indian Society for Trenchless Technology. The codes are an effort to formalize material specifications and application methods related to waterproofing. These codes, drafted by industry experts and users, are planned as a supplement to the existing Codes on Waterproofing, many of which are based on older technology, said Er. Surlaker. "Work on 3 to 4 codes has been completed and the committee is working on drafts for around 20 topics with more to be added soon in a phased manner."

Er. Samir Surlaker reiterated



Er. Sunny Surlaker (left) and Er. Samir Surlaker (right) with the CIDC Vishwakarma Award in the Category of Industry Doyen, in recognition of his 45 years of service in Construction Chemicals (CC) Industry.

his focus on writing codes and performance-based specifications as well as working towards the development of a skilled workforce under the guidance of CIDC.

The Surlaker family has dedicated this award to the memory their beloved Mr Sujay Surlaker.

## BASF's Coatings division appoints heads for global business units

Effective August 1, 2023, the Coatings division of BASF will implement global units for its Automotive OEM Coatings Solutions and Automotive Refinish Coatings Solutions businesses. With the new organizational setup, BASF better serves its global

customers who increasingly ask for global support and services.

Patrick Zheng Yu Zhao will take charge of the new Global Automotive OEM Coatings Solutions business unit, based in Hong Kong. Prior to this role, he was Senior Vice

President at Coatings Solutions Asia Pacific. Zhao started his career at BASF in 1999 within the Polyurethane business and held various positions across different divisions.

Chris Titmarsh will assume responsibility for the new Global Automotive Refinish Coatings Solutions business unit, located in Münster, Germany. Most recently, he was Senior Vice President Automotive Refinish Coatings Solutions EMEA, based in Germany. In 2006, he started his career at BASF as a

polymer research chemist. He held various positions in marketing and business management before moving to the Asia Pacific Automotive business located in Hong Kong in 2015.

Frank Naber will assume responsibility for the Global Surface Treatment business unit, which operates under the Chemetall brand, in Frankfurt, Germany. Prior to this role, Naber was Senior Vice President at Automotive OEM Coatings Solutions EMEA.



Patrick Zheng Yu Zhao, head of the new Global Automotive OEM Coatings Solutions business unit.



Chris Titmarsh, head of the new Global Automotive Refinish Coatings Solutions business unit.



Frank Naber, head of the Global Surface Treatment business unit, which operates under the Chemetall brand.

## LIBERTY Galati invests in coated tubular product line

LIBERTY Galati, the largest steel producer in Romania, has extended its high value-added product portfolio into coated tubular products, following the installation of a new state-of-the-art pipe coating line at its specialized unit LIBERTY Tubular Products Galati. The new line will allow LIBERTY Galati to become the only regional provider of 100% in-house coated pipes from its own plates and highlights its commitment to provide end-to-end solution for its customers across Romania, Central and Eastern Europe, the Middle East and the Americas, notes a press communique from the company.

Following an investment of more than RON 40 million, the new and highly automated pipe coating line is now fully installed and is currently in its completion and production testing phase. It will be operated by a team of 25 specialists. This will give LIBERTY Galati access to a global market worth more than \$8 billion, with the market in Europe worth around \$1.6 billion and estimated to grow at around 3.5% annually up to 2031.

Prasanta Mishra, Executive Director of LIBERTY Galati, said: "In March we restarted our blast furnace following a three month care and maintenance program, during which time we fully paid all our employees and maintained all jobs without seeking any external support. The implementation of the new automated pipe coating line is another important step



PHOTO: LIBERTY GALATI

*The implementation of the new automated pipe coating line is another important step forward for LIBERTY Galati, as we look to expand our high value-added product portfolio and increase profitability.*

forward for LIBERTY Galati, as we look to expand our high value-added product portfolio and increase profitability. By implementing these investments, we will be able to coat the pipes using the steel plates produced here at Galati and be able to finish them into premium products for customers in Romania and Europe. This means we will have additional products in our portfolio of high quality, value-added integrated products that will satisfy the market demand. In the meantime, we continue to invest in operational flexibility as well as in the implementation of our GREENSTEEL transformation plans."

With a capacity of 100,000 tons per year, the line provides washing, drying,


blasting, inspection, and coating of successive layers of epoxy, adhesive, polyethylene/polypropylene as well as – on request – polypropylene foam. In addition to these coatings on external surface of the pipe, the pipe coating line can also perform coating on the internal surface pipes using epoxy resin. Treated this way, the pipes can be used in transmission lines for oil, natural gas, water or other fluids: they are accredited to ISO 3183 fourth edition 2019-10 and API 5L standards.

LIBERTY Galati already produces a wide range of quality flat products (plates, coils, galvanized sheets & coils, and organic coated products) as well as welded tubular products and supplies steel to customers across Romania and in approxi-

mately 30 countries worldwide. The steel products made in Galati are used in shipbuilding, construction, pressure vessels, automotive, transportation, as well as other sectors. LIBERTY Galati products have been used in many of Romania's major infrastructure projects, including: the new bridge over the Danube in Braila, which will be the third largest in Europe; the railway bridge connecting the "Henri Coanda" International Airport terminal with the National Road 1; and the bridges over the Mures River which are part of the A10 Sebes – Turda motorway. Its steel has also been used on Turkey's "Osman Gazi" bridge over the Gulf of Izmit and the pedestrian walkway at Koge Nord railway station in Denmark.

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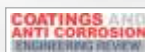
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# Positive signs and an excellent response for PaintExpo 2024

Registrations for the world's leading trade fair for industrial coating technology are already at an excellent level one year before the next edition of the event opens its doors. From April 9 to 12 2024, PaintExpo ([paintexpo.de/en/](http://paintexpo.de/en/)) will once again be providing a global showcase for the latest trends in industrial coating. The who's who of the coating technology industry exhibits at PaintExpo 2024 in Karlsruhe, Germany.

With around 430 exhibitors from 27 countries and more than 9,000 trade visitors from 57 countries, PaintExpo was successfully restarted in 2022 following the pandemic break. More than one in three exhibitors travelled from abroad. Visitors included a large number of key decision-makers, specialists and managers, with around 90 percent of visitors to the previous PaintExpo able to influence investment decisions in their companies.

Preparations for PaintExpo 2024 are in full swing. With one year still to go before the trade fair opens its doors,

around 250 companies have registered and more than 70 percent of the exhibition space of the previous event is already sold. "The response from the industry has been great. This clearly confirms that PaintExpo is a well-positioned, must-attend event for everyone in the industry. In April of next year, PaintExpo will once again serve as a worldwide showcase for innovations and future technologies as well as providing a platform for practical solutions in industrial coating technology," says Markus Geisenberger, Chief Executive Officer of Leipziger Messe. Registration information is available on the PaintExpo website.

## Key industry players, interesting new exhibitors, high international participation

Global market and technology leaders will join innovative medium-sized companies in three exhibition halls at this world's leading trade fair to present their latest products and applications in industrial coating technology. Exhibitors will include important industry



PHOTOS: PAINTEXPO

players from Germany and abroad such as Axalta, DeFelsko, Dürr, Eisenmann, FreiLacke, Gema Switzerland, J. Wagner, Krautzberger, Louis Schierholz, Nordson, PPG and Venjakob. In addition,



interesting new exhibitors were also convinced by the trade fair concept: Among those in Karlsruhe presenting their range of products and services for the first time at PaintExpo will be Mitsuda, a Turkish supplier of cleaning and pretreatment technology and Neybo, a specialist in heating up industrial containers.

The coming edition of PaintExpo also has a lot to offer internationally: Most exhibitors will be from Western European countries. Alongside Germany, they will be primarily from Italy, Switzerland, Austria, the Netherlands and Spain. However, companies from countries such as Turkey and

Greece have also already booked their stands. The proportion of international exhibitors is – as of today – around 40 percent.

## Full spectrum of industrial coating

The products and services on display at PaintExpo cover the full spectrum of industrial coating. Next year, the range of exhibits will again include surface treatment solutions, quality assurance, paints and paint finishing lines as well as powders and powder coating systems. The industry platform offers a comprehensive package of coating solutions for all industries, applications and materials, from wet coating and powder coating to coil coating.





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# International Antifouling Conference to return in 2023

The 2<sup>nd</sup> International Antifouling Conference will bring the best minds in the antifouling coatings industry, ship operators and academia together in Gothenburg, Sweden to explore collaborative pathways and novel approaches at a time when biofouling risk is intensifying on a global scale.

I-Tech AB, the developers of the antifouling biotechnology for marine coatings, Selektope® and RISE (Research Institutes of Sweden) will host the International Antifouling Conference in Gothenburg for a second year following demands for its return as one of the key platforms for antifouling coating experts, academia, and end users to discuss challenges, solutions, and approaches towards marine biofouling prevention.

As the maritime industry takes steps towards significantly decarbonizing, the risk of marine biofouling accumulation on underwater surfaces is posing an increasing threat to the reduction of gaseous exhaust emissions from vessels. Marine biofouling can be extremely detrimental to ship performance since it increases hydrodynamic drag when a vessel sails through water, resulting in vessels burning more fuel to maintain a set speed or suffering speed losses if operating on fixed shaft power.

Unfortunately, rising oceanic and coastal water temperatures are providing a more



favorable environment for biofouling species to flourish. As such, the risk faced by vessels from the negative effects of biofouling will only intensify in coming years. While antifouling coatings provide the best line of defense against biofouling, the technology must continue to evolve to meet the changing needs of vessels now, and in the future.

Participants of the inaugural International Antifouling Conference in 2022 held the unanimous belief that collaboration between technology providers and their suppliers, in addition to the expansion of the antifouling toolbox to include emerging novel solutions, are key to ensuring that antifouling coating solutions offer the best protection in intensifying biofouling conditions.

Dr Markus Hoffmann, Technical Director at I-Tech comments: "This conference provides a much-needed

platform for the R&D community from the marine coatings sector to meet, with the bonus that academia and end users participate and provide their vital insights. Having a platform to discuss and gain inspiration from learning about novel solutions to ensure coatings are reliable and as high performance as possible is particularly important at this moment in time."

The International Antifouling Conference 2023 will be held on September 12 - 13 in the iconic Eriksberg shipyard area in Gothenburg, Sweden. The conference is sponsored

by Stena Teknik and Lanxess. Keynote addresses will be delivered by representatives from Jotun, Stolt Tankers, Hapag Lloyd, Arxada, and the Florida Institute of Technology.

In addition to the full two-day conference program, delegates of the International Antifouling Conference 2023 will also enjoy an optional visit to the research facilities of RISE which is included in the conference ticket.

For more information about the International Antifouling Conference 2023, visit: <https://antifouling-conference-2023.confetti.events/>

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# SSPC India to host international conference cum expo along with 20<sup>th</sup> anniversary celebrations

The Society for Surface Protective Coatings, India (SSPC India) will be celebrating their 20th anniversary along with the 15th International Conference on Surface Protective Coating & Paint Coatings, cum Expo, September 15 – 16, 2023 at The Lalit Mumbai, next to the Chhatrapati Shivaji Maharaj International Airport, Sahar, Andheri (East).

"This conference is being held after a gap of four years and we have planned it with a difference," said Prof A. S. Khanna, SSPC India. "This time we want to focus on some of the important burning issues within our industry not just by having author presentations as is the norm in many forums, but by discussing these topics with a panel of experts who will answer relevant questions on the topic. The response can be extempore, or with a presentation of the information."

The presentations planned include:

- New age coatings on highways and roads with a special focus on traffic and road marking coatings; critical review on single coat system versus multiple coat systems; nano technology material science and its use to build multi-functional properties in paints and coatings;
- Water borne coatings – present status and future prospects and whether waterborne coatings technology has come to the age of metal substrates;
- Marine coatings – ships, jetties, naval structures, offshore platforms, offshore windmills;
- Highly corrosion resistant coatings – battery pits in ships and submarines, acid storage tanks, sewage water treatment plants, pickling plants, etc.,
- Eco-friendly, green and energy saving coatings – solar heat reflective coatings, insulation coatings; new developments in pipeline coatings, oil and gas, water pipelines, potable water coatings, external coatings, etc.

Speakers at the conference will include prominent personalities from across various industries, paint manufacturers, pigment manufacturers, and additive manufacturers. "At this event, we hope to share details about the new developments within the industry, share knowledge, network, update oneself about the preparedness of the Indian paint industry to meet the challenges of structural failure due to corrosion, weakness of existing technologies, and learn more about the new developments such as waterborne coatings and grapheme based coatings," said Prof Khanna. "There will be keynote talks, four on each day and two poster sessions from R & D and paint organizations on the latest work on the paint coatings. We are looking for panel members with expertise on each panel topic, experts who can deliver keynote talks on the important topics and



PHOTO: SSPC INDIA

'poster paper titles' at the earliest."

In addition, there will be an expo area with about 35 stalls with various paint and corrosion related activities like recent developments in paint testing and characterization, new or modified equipment for mechanical testing of paints and corrosion measurements besides new technologies like cool roof coatings, grapheme manufacturing and much more, said Prof Khanna.

The special feature of this Conference would be 20th anniversary celebrations with a grand 'cultural night.' There will be special appreciation awards to all those who have contributed to SSPC in the last twenty years. In addition there will be seven awards from the ASK Endowment Fund, created by Prof. Khanna in 2018. Also there are Kansai Nerolac Awards, Berger Awards and first time an award by Voxco Pigments.

SSPC India - was founded in July 2004, as a non-profit

professional society concerned with the use of coatings to protect industrial steel structures. SSPC India serves its members and advances the Industry through standards, regulatory advocacy, education and information exchange. It has the large membership of companies such as facility owners, paint manufacturers, painting contractors, architectural, engineering and construction firms, educators. "We have conducted over 250 training programs and several focused technical lectures on various topics of interest to the industry like courses on pipeline integrity, pipeline corrosion, nano technology and grapheme-based coatings," said Prof Khanna. "Ours is an association of professionals engaged in educational institutes, industrial houses and any other bodies interested in the area of protective coatings, corrosion science, etc."

Participants are requested to register at the earliest.





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- Highly Corrosion Resistant Coatings
- Role of Nano Pigments/additives to enhance paint properties

**SSPC India Awards -2023**



- ASK Endowment Awards -7
- 20<sup>th</sup> Anniversary SSPC India Awards 15
- Kansai Nerolac Awards -2
- Berger Award -1
- Voxco Pigment Award-1
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For Award Registration : <https://askhanna.in/askendowmentfund/award.php>

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Date	Event	Venue	Organizer	Contact Details
JUN 29 – JUL 01, 2003	CII SURFACE & COATING EXPO 2023	Chennai Trade Centre Chennai, India	Confederation of Indian Industries	T: (044) 42444555 E: surface.coating@cii.in W: ciisce.in
JUL 13 – 15, 2023	EXPO PAINT AND COATINGS 2023	Pragati Maidan New Delhi, India	Toredo Fairs India Pvt Ltd	T: (080) 43023891 E: info@expopaintcoating.in W: expopaintcoating.in
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AUG 27 – 31, 2023	EUROCORR 2023	Square – Business Meeting Centre, Brussels, Belgium	DECHEMA	E: eurocorr@dechema.de W: eurocorr.org
SEP 06 – 08, 2023	ASIA-PACIFIC COATINGS SHOW	BITEC Bangkok, Thailand	DMG Events	W: asiapacificcoatingsshow.com
SEP 12 – 13, 2023	INTERNATIONAL ANTIFOULING CONFERENCE	Eriksberg Shipyard Area Gothenburg, Sweden	RISE/I-Tech	W: antifouling-conference-2023.confetti.events
SEP 15 – 16, 2023	15th INT CONF ON SURFACE PROTECTIVE COATINGS AND PAINT COATINGS	Hotel Lalit Mumbai, India	SSPC India	T: (91-22) 35113458 E: sspcindia1@gmail.com W: sspcindia.org
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MAR 03 – 07, 2024	AMPP ANNUAL CONFERENCE + EXPO	New Orleans Louisiana, USA	AMPP	W: ace.amp.org
APR 09 – 12, 2024	PAINTEXPO 2024	Karlsruhe, Germany	FairFair GmbH	T: +49(0)70226025150 E: info@leipzig-messe.de W: http://www.leipzig-messe.de
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- Multisensory feedback via LED, sound and vibration
- Ergonomic design
- LI-Batteries with up to 24 h runtime
- USB-C and Bluetooth
- New, innovative software
- Easy data transfer, evaluation and export
- Easy creation of reports and protocols
- Extensive range of accessories
- Professional Service
- 24 months warranty as standard

Contact us for more details on DMP Series -  
Email : [sales@fischerindia.com](mailto:sales@fischerindia.com) | Tel : +91 20 67909500

More about the new DMP series, all applications  
and the launch video can be found here:  
[www.helmut-fischer.com/dmp](http://www.helmut-fischer.com/dmp)

