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The President Writes

We have made great strides in continuing the work started by the previous Presidents in focusing on delivering value for our members. The committee who worked on the support we are giving in the 'Route to Chartership' have delivered an excellent package, drawing on personal and wider industry knowledge. The Young ICORR group goes from strength to strength with Chris Bridge at the helm, and I see the network that exists within our current membership being extended through this group.

As ever, I am thankful to our volunteers who give so much of their time to keep us functioning and relevant to our members.

Good news is that ICorr have now been approved by the Engineering Council’s Quality Assurance Committee as a Professional Affiliate for a further five years.

I have also represented the Institute at the Elcometer world conference, celebrating 70 years’ service to the corrosion industry.

The AGM was held at the end of November and this also marked the half way point in my Presidency, and on reflection a lot has been achieved, but there is certainly more still to be done!

I would finally like to wish all members a Merry Christmas.

Sarah Vasey, ICorr President

From the Editor

Another year is nearly over, and one in which we have seen challenges for some sectors, some areas where the industry is improving, and further consolidation in the market. I have tried to cover these developments in the magazine, and will continue to bring you topical news in future issues.

This issue features three technical articles which I hope you will find interesting. There are two covering high performance corrosion protection coatings. Experts from Sherwin Williams highlight advances in glass flake epoxies for the protection of hot substrates, and an overview of thermal spraying from Stuart Milton of Metallisation. The third article is a guide to the different ways coating specifications can be written, a timely reminder now that we are in the planning stages for next year’s projects.

The ICorr website has been re-launched and in addition to the current copy of the magazine being available under the ‘membership services’ tab, more detailed versions of technical articles published can be found there, including this months’ glass flake epoxy article.

Finally I would like to wish all readers the compliments of the season.

Brian Goldie, Consulting Editor

Young ICorr

On November 8th, Young ICorr hosted a joint young engineering networking event in collaboration with The Welding Institute and the London Materials Society, at the TimberYard in Soho, London. The evening brought together fifty young engineers, professionals and students who are interested in corrosion, materials, metallurgy and welding, and it was a great opportunity to meet like-minded peers from other industries and to allow an opportunity to network.

The evening's guest speaker, Dr. Adam Baker, gave a thrilling talk about the Materials challenges of rocket engineering and spaceflight. Since studying Materials Science and Metallurgy at The University of Oxford, Dr. Baker has spent his career working in the space industry and currently both teaches part-time at Kingston University and consults widely on space technology. Dr. Baker's enthusiasm for the UK space industry was palpable as he explained why rockets are needed, the different propulsion technologies and the materials and corrosion engineering challenges associated with the extreme environments they experience.

Sponsorship was kindly provided by the Institute of Corrosion and The Welding Institute. To stay informed about future Young ICorr events please join the LinkedIn group by searching for 'Young ICorr' or alternatively email chris.bridge@uk.bp.com

Visit the ICATS website www.icats-training.org
YOUNG ENGINEER PROGRAMME (YEP)

Following on from the successes of the previous YEPs, the next Young Engineer Programme will start in January 2018.

Lectures will cover basic corrosion, welding, materials, coatings, painting, fire protection and linings, cathodic protection, chemical treatments, and will include presentation skills. We are currently carrying out pre-enrolment for this programme, and are seeking engineers in the early stages of their career in the corrosion industry, and who are looking for extra experience to set them up for their future.

If you are interested in this event please fill in the application form which can be obtained from Institute of Corrosion, Barratt House, Kingsthorpe Road, Northampton, NN2 6EZ, or email, admin@icorr.org. Deadline for receipt of applications is mid December 2017.

Route to Chartership
(David Mobbs)

The Institute of Corrosion has developed a programme to assist Engineers and Technicians obtain their Chartered Status.

The Society of Environmental Engineers (SEE) in an agreement with the Institute of Corrosion, has been licensed by the Engineering Council to confer registration as a Chartered Engineer(CEng), Incorporated Engineer (IEng) or Engineering Technician (TechEng). The Engineering Council sets standards for competence and commitment to become registered as set out in the UK Standard for Professional Engineering Competence (UK-SPEC). The Institute of Corrosion has interpreted these standards and developed the professional competences required for registration. Chartered Engineer status demonstrates the achievement of a high-level education, the ability to practise the profession at a recognised level, and the maintenance and continued progression of engineering competencies.

The objectives of this programme are to support ICorr members to reach the required competency levels in the field of corrosion engineering to obtain Chartered Engineer status via a “Mentoring” approach to assess competency and advise development programmes to reach CEng. The benefits to Engineers and Technicians are, mentor guidance from an industry professional, competency assessment from a Chartered Engineer, a development programme via the competency matrix. Once a suitable mentor is appointed and the competency matrix completed a program is developed to assist the candidate towards the Chartered status goal. This could include suggested training, site visits, conference involvement or assistance in completion of the application and guidance for the PRI.

Who Should Apply? Engineers who have graduated and have completed 2 years in Industry, any member of ICorr who believes they are ready to progress to CEng, and mature engineers who have the experience but lower academic qualifications.

More information can be found on the Institute of Corrosion Website, or you can contact ICorr HQ, or the Chartered Status Team.
polina.zabelina@uk.bp.com
harropd7@gmail.com
david_mobbs@hotmail.com

Growing our Membership
(Gareth Hinds)

Like all professional societies, ICorr needs to take regular stock of how well it is serving the needs of its members. At the same time, the Institute has ambitious plans for future growth, with a target of achieving 2000 members by 2020. With this in mind, earlier this year the President Sarah Vasey asked me to chair a Membership Development committee, on which I have been joined by Young ICorr Chair Chris Bridge and ICorr Past Presidents John Fletcher and Bill Cox. Our remit was to review the perceived benefits of ICorr membership and to propose ways of enhancing what we can offer our members in order to sustain this growth.

Following much consultation and lively debate, we have put together a summary of the main benefits of ICorr membership, which will appear shortly on the website. We will be using this as the basis for a sustained marketing drive, both within the UK and overseas, with a particular focus on students and early career professionals. This demographic is clearly key to the future of the Institute but has suffered a slight decline in numbers in recent years, which needs to be addressed as an urgent priority.

One important initiative will be to strengthen our links with materials science and engineering students in UK universities by arranging automatic ICorr student membership registration for selected undergraduate courses. We will also be putting in place measures to retain these members once they have joined the workforce, for example by connecting them with successful initiatives such as the Young Engineer programme.

The central theme that has emerged quite strongly from our discussions is that you get out what you put in. The benefits of being an ICorr member increase dramatically the more you get involved, whether it be attending local branch meetings, joining a committee, attending a training course, carrying out professional assessment reviews or organising a conference. So I would encourage all members to consider how you could get more involved in the various activities of the Institute. Together we are greater than the sum of our parts!

Continuing Professional Development
(David Harvey)

Professional Development is a fundamental part of any career in engineering, either Initial Professional Development (IPD) for graduate engineers, or Continuing Professional Development (CPD) for established engineers, ensuring that you keep up to date by constantly learning, improving knowledge and developing skills to stay at the forefront of your industry. Not only will this aid your contribution to corrosion engineering, but it will also help you get the most out of your career. The Institute is committed to provide assistance and guidance in IPD and CPD by, the exchange of information and ideas at branch meetings, seminars and conferences, the provision of training courses in corrosion control activities to members and non-members, and the Institute Route is a Learned Professional Development Record Scheme and the provisions to become Chartered Engineers or Scientists.

Continues on page 6
What is Professional Development?

Professional development is the acquisition of knowledge and skills and the development of personal qualities. It plays a crucial part in achieving and maintaining your engineering competence. It generally takes place in a working environment and draws on knowledge and understanding, training and experience. However, it is not necessarily separate from education and the two processes may be integrated, for example in work-based training and external courses.

ICorr provides a series of training courses, usually presented by the Institution of Mechanical Engineers ETS in Sheffield. These courses provide theoretical and practical training and certification at various levels in Fundamentals of Corrosion, Protective Coatings Inspection and Cathodic Protection Certification in various application sectors in accordance with BS EN 15257. Further details can be found on our website, https://www.icorr.org/training-qualifications-2 and at http://trainingsolutions.imeche.org/training

What counts as CPD?

It takes effort to carry all this out, so, when planning and recording your CPD, remember the acronym SWEAT! (Self-study, Work experience, Events and seminar, Academic study, Training courses). Information on any of these activities can be recorded in mycareerpath® including subject, type of work, duration and learning outcomes. Using mycareerpath® puts your complete records in one place so that they can be simply and easily sent to your institution as part of your professional review, or to update them on your CPD record if you're already registered. You could even send your complete records to your employer as part of your appraisal. This database is available to all ICorr members to use via the Members Area of the website.

For graduate engineers or experienced engineers wishing to obtain CEng, ICorr has developed a mentoring scheme to help you ensure that you have the necessary education and experience to meet the competences required for this, and provide guidance with competency assessment in the field of corrosion engineering; completion of the application forms, and professional review interview. This scheme is being launched in Q1 2018 (see previous page). The Institute needs Mentors and Professional Review Interviewers to help candidates, so if any of our chartered members would like to become one or both, please let the ICorr office know and we will contact you.

2018 Paul McIntyre Award

We look forward to receiving nominations for the 2018 Paul McIntyre award, which is presented to a senior corrosion engineer, who, as well as being a leading practitioner in his field, has advanced European collaboration and international standards development. Please send any nominations for the Paul McIntyre award to the chair of the Corrosion Engineering Division, Nick Smart (nick.smart@woodplc.com), by 31 January 2018. The criteria for the recipient of this award are that, they have established an international reputation in the field of corrosion engineering, they have demonstrably advanced European collaboration and international standards development in the field of corrosion engineering, they must be living and working in the European corrosion community, and a member of a corrosion-related body in the European area (e.g. NACE UK, the Institute of Materials, the Institute of Corrosion, or another European corrosion society). They must not be a current member of the Council of the Institute of Corrosion, and be aged over 30.

The award consists of an engraved trophy, which will be presented at the annual CED working day meeting. The recipient will be requested to present a brief overview of their activities and encouraged to prepare an article for publication in Corrosion Management.

Corrosion Engineering Division

(Nick Smart)

2018 Working day

Following on from the successful Division working day on the topic of ‘Corrosion Engineering and Concrete’, the 2018 meeting will be held at the Birchwood Park Conference Centre, Warrington, on Tuesday 24 April 2018 on the subject of ‘Atmospheric Corrosion in Industrial Applications’. Most of the presentations from the previous CED meetings, and documents produced by the working groups, are available to members through the members’ area of the Institute’s website.

Coatings guidance documents

The Coatings Working group, under David Horrocks’ chairmanship, has prepared a series of guidance documents on the following topics:

- Inspection and testing of coatings
- Organic coating application methods
- Surface Preparation methods for coating application
- Paint: a definition and generic organic coating types
- Thermal metal spray coatings
- Corrosion protection coatings for steel structures

These documents are nearing completion and will be made available free of charge through the members area of the Institute’s website over the next few months.

Continued from page 5
2017 has been another eventful year for ICATS with the launch of the new Supervisor Course, the update of the Req Doc and the introduction of the CSCS Partner Scheme Card. 2018 promises to be another busy year with several new innovations planned.

Company Trainer Course
The next Company Trainer Course will be held on 16th and 17th January 2018 in Northampton. Please call the Correx office on 01604 438222 to book places.

Supervisor Course
We have held four Supervisor Courses during 2017 and the date for the first in 2018 will be announced soon. The application form can be downloaded from our website www.icats-training.org under the Supervisors Module tab, or places can be booked by calling the Correx office. The eligibility for the course is as follows:

1. Any applicator who has two years’ experience following successfully completing the mandatory Industrial Coating Applicator (ICA) ICATS module.

2. Supervisors and Technical Managers who have more than two years’ experience in the industrial coating field with supporting evidence from their employer, even if they have not completed the ICA course.

3. Other candidates (from non ICATS registered companies) with at least five years’ verifiable experience in the coating industry will also be eligible.

Eligibility for Applicator Training
Except at approved ICATS Registered Training Providers, all Applicators being registered for ICATS training must be a genuine employee of the company that registers them. We will be auditing all companies certifying Applicators and if this process reveals personnel have been certified and are not employed by the company that provided the ICATS training, the registration will be cancelled.

Approved ICATS Registered Training Providers are listed on our website.

Trainee Cards/Mentoring
In the latest version of the Req Doc (the Institute of Corrosion document which defines the requirements for the operation of the ICATS scheme) there were various changes of which a major one was clarification on Trainee cards and mentoring.

Candidates undergoing training for certification as Industrial Coating Applicator are not required to have any previous experience of industrial coatings application but if they have less three years' experience, they will be required to be mentored by a qualified ICATS operative in the workplace for a period of one year after successful completion ICATS ICA training. During the year of mentoring they will carry a Coating Applicator Trainee wallet card which is valid for one year to signify their status as under mentoring. A log of weekly activity must be kept and signed by the applicator and mentor during this period. A qualified ICATS operative may mentor a maximum of five Trainees at one time. On successful completion of the year as a Trainee, the candidate will be issued with an ICATS applicator card valid for a further two years at no cost.

Keep up to date with ICATS via the website www.icats-training.org

Aquatec Group offer a full range of cathodic protection and monitoring services, including consultancy, cathodic protection systems and insight into system performance. They have developed and supplied instrumentation systems for cathodic protection and monitoring for installation on oil platforms, pipelines, jetties, and FPSOs, from the UK North Sea to locations throughout the world, since 1993. Their portfolio ranges from the provision of cathodic protection design services, predictive modelling and inspection; the supply of ICCP and sacrificial systems and monitoring, with commissioning and support, to data gathering, interpretation and analysis services. The personnel have extensive experience protecting offshore assets.

The company was founded in January 2007 as specialist hydraulic commissioning and water treatment advisors to the building services sector. With many years’ service in both hydraulic commissioning and closed systems pre-commission cleaning, their role naturally evolved into assisting construction teams to evaluate technical and scientific information issued through commissioning and water treatment specialists and laboratories, to determine the most pragmatic course of action to ensure the handover of projects on time and in line with industry guidelines, not only to prevent corrosion in closed heating and cooling systems but also prove the hydraulic integrity of the systems in operation.

Over the years the company has been directly involved through the offices of the Water Management Society and the Institute of Corrosion in assisting BSRIA produce the current industry guidelines for closed systems pre-commission cleaning (BG29-2012) and Water Treatment for Closed Heating and Cooling systems (BG50-2013). They will also advise on any requirements for corrosion monitoring and investigations to assess the risk and or damage associated with poorly maintained or at risk closed heating and cooling systems and to maintain the efficacy of any water treatment programmes.
The CEOCOR 2018 CONGRESS is being organised by the Institute of Corrosion, which is the British representative to CEOCOR, from May 15th until May 18th 2018, at Stratford on Avon.

This is a great opportunity to present your most recent research and experiences on corrosion and protection of pipes and pipeline systems in the field of drinking water, waste water, gas and oil. Titles and abstracts (approx. 10 lines in WORD format) should be submitted to the Presidents of Commission 1 and Commission 2, with a copy to the Secretariat of CEOCOR, before January 15, 2018 at the latest.

Commission 1: tom.levy@syneauxsud.lu

Commission 2: markus.buechler@sgk.ch

Any questions should be addressed to the Presidents of Commissions or to the Secretariat.

Authors will receive notification of abstract acceptance before January 22, 2018, and full texts of the presentations must be sent to the Presidents of Commission 1 and Commission 2, again copied to the Secretariat of CEOCOR before April 1, 2018 at the latest. Author guidelines can be found on the CEOCOR 2018 website, www.ceocor2018.com

It should be noted that CEOCOR, and not the Institute of Corrosion, has control of the Technical Programme. The Institute of Corrosion is responsible for all other activities at the Congress at the Crowne Plaza, Stratford on Avon.

Registrations are now being taken by ICorr for attendance at CEOCOR 2018 and discounted rooms are available for booking at the Crowne Plaza. Details can be found on the CEOCOR website.

This topic will be subject of a more detailed technical paper in Corrosion Management in January/February 2018. This upcoming paper will aim to respond in more detail to the many questions raised by attendees, who clearly enjoyed the evening, including, the definitive evidence as to whether pipe lay procedures adequately did, in this instance, address the potential risk of wrinkling and whether (10 years on) more modern methods of fitting CRA Liners are any more resistant to this CRA wrinkling phenomenon; the evidence as to whether applying internal pressure can eliminate the wrinkling risk and as to whether cleaning tools irreparably damage the CRA Liner, or whether perhaps increased Anti-Scale Cl and Reduced Cleaning Frequency is a safer approach? The article will also consider the ability of the Intelligent Pigging (IP) Tool to detect thinning changes in a 3mm thick CRA Liner and / or small perforations or tears of this liner, and whether there is a likelihood of ongoing corrosion in the CRA/Carrier annulus in cases where CRA disbondment has occurred.

The October special event focussed on offshore external corrosion and repair solutions, which most importantly brought together specialists from two (normally competing) companies. Consultants, Ian Taylor and Nabeel Khan of IMG Composites Ltd., and Gareth Urakalo, Senior Technical Engineer of ICR Integrity Ltd, worked together to provide an objective insight into the development and application of two key standards, ISO24817: 2015, and the increasingly used ASME PCC-2 Code. The two presentations were entitled “Established Composite Engineering in 2017” and “Composite Repairs – A long Life-time Repair Solution”. Composite repair has been extensively used in the last 10 years to extend the operating lives of process systems, particularly but not exclusively, for piping systems, which would otherwise have required costly interventions and loss of production and outages that may ultimately have caused the facilities to cease production altogether!

The talks considered some key questions that once again generated much interest from the gathered audience. What came across was the increasing industry confidence that these composite repairs can provide fully engineered long-term repair solutions, providing additional structural strength (subject to necessary quality controls, such as a high standard of surface preparation), to provide to Energy operators a guaranteed service life.

The ‘new world’ of composites was wonderfully illustrated with many practical day-to-day examples such as the new A380 Airliner and the “New Bus for London”, that contain a very high percentage of composites. For example, the four key structural composite parts which make up the rear end of the new bus support the weight of the engine, the passengers on the platform, the staircase and the upper deck. Using these composite materials has resulted in the saving of several hundred kilograms from the structural weight of the bus compared to traditional materials, and of course very significant fuel savings.

Information about all forthcoming Aberdeen branch activities can be found on the diary page of the magazine and on the Institute website, alternatively a calendar of local events of interest to corrosion professionals in the Aberdeen area, and the opportunity to sign up to the Branch mailing list is available at https://sites.google.com/site/icorrabz/home. Aberdeen Branch have also established their new Media Centre on LinkedIn, which can be found at https://www.linkedin.com/in/abdeen-icorr/recent-activity/
London Branch

The Branch had a good start to the 2017-18 season, and whilst there were only had 40 people at the October meeting, the guests were from the major offshore operators, and about 30% were below the age of 40, which was the audience targeted.

Simon Bowcock of BP discussed the corrosion challenges and the considerations to be taken into account in the design and installation of 316 stainless steel clad subsea flowlines.

Material selection decisions are typically based on a compromise between cost, schedule, and meeting the specified engineering requirements. However, these decisions can often have wider, yet significant, impact on different stages of a project. Simon's presentation looked to identify and explore some of these wider considerations in more detail, specifically with respect to the use of 316 stainless steel clad subsea flowlines in the oil and gas industry. He also did a fantastic job with a very interesting topic and went to the bother of explaining in detail the complexity of the installation of a clad subsea pipeline.

Simon was presented with his iCorr pen and a vote of thanks from Ben Moorhouse.

The Branch also held a joint meeting with SCI (Society of Chemical Industry) at their premises on Belgrave Square, on 19th October. The evening was chaired by Dr Nicholas Bourne of SCI who introduced the two evening presentations. Coincidentally, the SCI was the home for the Institute of Corrosion from 1965 to 1980, when it moved to the IMF in Birmingham.

The first presentation was by Dr Fred Parrett, who has over 50 years' experience in business, industry and academia. Fred's presentation was a comprehensive look at the life and works of businessman, scientist, inventor and politician, Benjamin Franklin. Fred developed a timeline to show the developments in the study of electricity that were sweeping Benjamin Franklin. Fred developed a timeline to show the developments in the study of electricity that were sweeping Europe in 1740's. Franklin wanted to find answers to a number of fundamental questions, what is electricity, how is it distributed in nature, are there two kinds of electricity, and why are materials conductors or non-conductors?

In 1751, he published his book 'Experiments and Observations on Electricity'. The famous 'Kite Experiment' where Franklin showed that lightning did produce electricity, followed in 1752. In 1756 he was nominated for Fellow of The Royal Society of London, being described as 'a gentleman, who has very eminently distinguished himself in various discoveries in natural philosophy and who first suggested the experiments to prove the analogy between lightening and electricity'. Following this award, Franklin moved to London as a diplomat and politician for Pennsylvania and became involved with the move to make America independent, predicting this would happen long before the war began. Eventually, around 1772 he returned to the colonies to help draft the Declaration of Independence and become one of the Founding Fathers of the United States.

The second presentation was by Dr David Eyre, an independent consultant, specialising in corrosion management and the integrity of buried pipelines, with over 35 years' experience on UK and overseas projects.

David continued the theme of electricity but moved away from DC and introduced the problems created by modern high voltage AC transmission systems on oil and gas pipelines. David described the policy of routing AC transmission systems in the same corridor as pipelines. The magnetic field created around each AC phase wire running from tower to tower can induce AC voltages and currents in the wall of the buried steel pipelines, under both normal load and fault conditions on the transmission system. These effects can, on the one hand, create unsafe conditions for personnel working on the pipeline and secondly can induce significant AC currents which can cause corrosion on the external surface of the pipeline leading to full wall penetration in extreme conditions.

David indicated that the magnitude of the induced effects depended on many factors, including the transmission system voltage and current loading, the length of parallelism and separation distance of the pipeline from the transmission system, the pipeline characteristics and resistivity of the soil in which the pipeline is buried.

It is now generally recognised that pipelines can suffer AC corrosion despite satisfying the conventional cathodic protection (CP) criteria based on pipe to soil potentials. New CP criteria have been developed based on measured AC current density values, which can be used to minimise the risk, and these details are contained in the latest standard, BS ISO 18086 (see standards section below). It was emphasised that monitoring and data logging was essential to assess the 'persistency' of the problem and that the longer this monitoring is conducted the better the assessment of risk. Mitigation methods were described and David admitted that the mechanisms of AC corrosion on pipelines are still to be fully understood.

The Vote of Thanks was given by John O'Shea, a past President of iCorr. He ended by thanking Dr Parrett, Chairman of the SCI London Group for initially floating the idea of the Joint Meeting and for all his support in organising this successful event. John also gave a brief eulogy for the late David Deacon, who had done so much for the Institute, worked at this Belgravia address and whose birthday was on the following Tuesday.
The November meeting was held at the Rosen Facility in Gosforth, and Barry Turner gave a presentation entitled, “A review of ISO 21800-3 standard for field joint coating”. Barry has over 30 years’ experience in industrial coatings and plastics for the oil and gas and water industry. He has a strong technical background with experience in sales, marketing development and technical service positions, and is an active participant in ISO standardisation development for pipeline coatings as UK nominated expert.

ISO 21800-3 is becoming the recognised standard for the qualification and testing of field joint coatings on steel pipelines in the Oil and Gas sector. Barry presented his personal review of the 2016 revision of the standard and tried to put some light on the standard development process and explain the different material classes and associated issues and concerns. The presentation started with a historical look at the qualification of field joint coatings (FJC), viz: DIN 30672-1 (2000) - Joint DIN/DVGW developed standard for tapes and shrinkable materials, with no cathodic protection, and max. temperature 50°C.

EN 12068 (1999) - developed under CEN leadership for tapes and shrinkable materials, with cathodic protection, material defined maximum temperature, and offshore and “special situations” are excluded.

NF A49-716 (1998) - replaced by EN 10329 in 2006. Covers 8 different coating types, as very diverse materials unable to standardise requirements. End user to chose coating type. (EN 10329 based on similar philosophy to 49-716).

The presentation then moved on to the dominant standard in North America, CSA Z245.30 (2014) developed by Canadian Standards, and which is a mandatory requirement in Canada for FJC, but also for field applied coatings in general, covers 7 material classes. It also defines responsibilities of each party involved in a coating job and the qualification of materials, application procedures and individuals as applicators. ISO 21809-11 is new and currently being drafted and will similarly be for field applied coatings but looking more toward external coating’s rehabilitation in the field. The bulk of the discussion held was on the ISO 21809 standard and especially the different coating types, as very diverse materials unable to be covered in situ” are excluded.

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The Branch in association with Loughborough Surface Analysis Ltd (LSA) and Midlands Surface Analysis Ltd (MSA), is holding a one-day workshop on surface analysis and depth profiling techniques, and how they can be used to help with a variety of challenges relating to corrosion. The workshop will draw upon a wealth of real-world experience in using these techniques, and will be held on 24 January 2018, at Aston University, Birmingham. It will consist of a series of seminars given by experts in the field on the individual techniques (including case studies), together with an optional practical demonstrations on some of the techniques in the laboratories of MSA Ltd. Opportunities will also be provided to discuss participants’ specific cases either in an open forum or in private with the analysts present.

The agenda for the day and further details can be found on the Institute website.

Obituary: Mike Pursell, FICorr

Mike Pursell, who was prominent in the Aberdeen offshore industry, died in September this year. He had been a Fellow of the Institute since 1993.

Mike graduated in Chemical Engineering from Manchester University in 1966. He then continued to study and completed his MSc in Corrosion Science in 1967. He started his career at BP the same year as a trainee engineer, and within one year was promoted to a corrosion engineer at the Grangemouth Refinery. Mike continued to build his experience in corrosion, working at various BP locations including London and overseas in Abu Dhabi. He was promoted to management in 1982 and at that time changed his career focus to quality management.

However, by 1990 Mike had returned to his corrosion career and left BP to join Quest Consultancy based in Aberdeen. He stayed with this company as the principal corrosion engineer until 1999, when he joined MB Inspection as their technical manager, where he stayed until 2005, after which he continued to work as an independent consultant.

Throughout Mike’s career his focus on quality and training of less experienced engineers was exemplary. Mike accepted the role of mentor very seriously and showed a high level of enthusiasm for developing young engineers. It is safe to say that Mike helped to mould many of the competent engineers that work in the industry today and was actively involved in the work of ICorr, MCF and EI, contributing to their many events and publications. Mike was a highly respected and valued contributor to Energy Institute activities in the area of corrosion management. In particular, he was the consulting author for the influential “Guidance for Corrosion Management in Oil and Gas Production and Processing” document, published May 2008 and used worldwide.

He was well respected as a professional engineer, and will be missed by many.

Outside of work Mike was a very keen golfer and was a founder member of his local golf club. Mike is survived by his wife Stella, children, Andrew and Mark and grandchildren, Anna, Rachel and Fergus.
EUROCORR 2017: Corrosion Control for Safer Living

(Reported by Douglas Mills)

This major conference, which this year was combined with the 20th International Corrosion Congress and the Process Safety Congress, was held from 3rd – 7th September 2017 in Prague, Czech Republic. It attracted 1200 participants from 62 countries, with the largest number coming from France, second was China, third was Germany, fourth United Kingdom and fifth the Czech Republic. There was a large exhibition, featuring a total of 49 exhibitors and this was opened on the Monday evening with a reception. In accordance with the traditional format, the conference was divided into parallel sessions, 43 in total, running concurrently. These included sessions organised by the various EFC working parties (details of these are available at http://efcweb.org/wp.html), various Joint Sessions, Technical Forums and Workshops, and six Process Safety sessions. The conference was opened by Tomáš Prošek (Czech Association of Corrosion Engineers and chief organiser) and Damien Féron (President of the European Federation of Corrosion). The European Corrosion Medal was then awarded to Mário G. S. Ferreira (University of Aveiro, Portugal) who gave a talk on ‘Immobilisation of active molecules in nano-structured materials for multifunctional coatings’ in which he argued that although additives can confer important functionalities (corrosion inhibition, anti-fouling, sensing, adhesion), the direct mixing of additives into coating formulations can have serious drawbacks.

The Marcel Pourbaix Award was presented to Christofer Leygraf (KTH Royal Institute of Technology, Sweden), who delivered a plenary talk on ‘Atmospheric corrosion: current challenges in an evolving research field’. The development of simplified but practically relevant model systems, along with international exposure tests and laboratory experiments aided by analytical and technical advancements has greatly increased our understanding of atmospheric corrosion. The speaker sought to highlight present and future challenges.

On the Wednesday morning the EUROCORR Young Scientist Grant award, which provides financial support to young corrosion practitioners to visit and interact with groups working in other countries, was presented to Hongchang Qian, who will work with Dr Yaiza Gonzalez-Garcia (Delft University of Technology, Netherlands); Anissa Célina Bouali, who will work with Dr Alexander Lutz (Vrije Universiteit Brussel, Belgium); and Bork Ozdirik, who will work with Dr Patrik Schmutz (EMP A, Switzerland). Details of this award can be found at http://efcweb.org/EUROCORR+Young+Scientist+Grant.html.

Prizes for the best posters were also presented, with first prize going to Alexander Lutz (Vrije Universiteit Brussel, Belgium) for ‘Local electrochemical study of ternary Zn–Fe–Mo alloy coatings on carbon steel’. The second prize going to Beatriz Mingo (The University of Manchester, U.K.) for ‘Active Functionalisation of ceramic coatings: incorporation of loaded nanotubes’. The plenary lecture on the Wednesday was ‘Continuum and atomic scale simulation of stress corrosion cracking and causality’ by Tetsuo Shoji (Tohoku University, Japan). The speaker described the application of stress and strain analysis by theoretical elastic-plastic stress field analysis and FEM, quasi-continuum (FEM and molecular dynamics) and Quantum Chemical Molecular Dynamics to examine the role of stress and strain in SCC in relation to the chemical and physical properties of materials.

The conference Gala Dinner took place on the Wednesday evening at the riverside Zofin Palace, with an extensive buffet of Czech specialties and drinks, presented in the numerous rooms of this impressive building including an upstairs and gallery. The multiple levels made it possible for a choice of two parallel entertainments, the spacious upstairs ballroom being entertained by the Havelka Sisters and their Orchestra with traditional light jazz and swing music, while the downstairs dance room was rocked by the Beatles Revival (Brouci Band) with their repertoire of Beatles hits.

On Thursday, the plenary lecture was given by John R. Scully (University of Virginia, USA) on ‘Needs, gaps and opportunities for better design of corrosion resistant materials’. The speaker cited a recent National Academy study suggesting that an ideal corrosion-resistant alloy might well be formulated in the future using integrated computational materials design. This presents the challenge of connecting the attribute-defined features of an alloy, with the subsequent properties, by applying relevant scientific principles. Significant scientific needs, gaps and opportunities must be met in order to improve this theory-based design approach.

Next year the EUROCORR congress will be held from 9th to 13th September at the ICE Kraków congress centre, Poland.

The above is an edited version of a longer report that will appear in the first issue of 2018 of the journal Corrosion Engineering Science and Technology. Thanks are due to Ruth Bingham for supplying the two photographs.
New Book on Coating Failure Analysis

A new book by Jon Cavallo, "CorrCompilations, Coating Failure Analysis" discusses a wide array of coatings failures — from abrasion and adhesion failure to peeling. This is the latest book in a compendium of technical information to be used as a guidance for coatings inspectors in a number of industries. With clear language and timely guidance, the book offers a comprehensive approach to failure analysis that can be applied in many technical categories.

The book covers the causes of coating failures and how to properly analyse them by learning, how not to perform a failure analysis, how to determine the root cause of a coating failure, and whether it’s a mechanical flaw or human fault. The book looks in depth at common pipeline coating challenges that range from handling external polymeric coatings to dealing with trenchless pipeline coatings, analyses the failures of prior tank lining coating systems in order to avoid the loss of product, process downtime and repair costs, reviews case studies of coating failures within offshore and marine environments, and gives an understanding of laboratory analysis tools for coating evaluations and failure prediction.

Jon Cavallo has worked in the military and private sectors and has made his mark as a writer, speaker and authority in the field of protective coatings, with particular expertise in nuclear coatings, for more than 40 years.   He is an ASTM fellow and a NACE CIP instructor. "CorrCompilations, Coating Failure Analysis" is available in paperback or as an e-book in the NACE Store.

Inspection Instruments for the Pipeline Coating Industry, Volume 2: Verifying the Quality of Coating Application

The second of three volumes in the Inspection Instruments for the Pipeline Coatings Industry E-Book Series, "Verifying the Quality of Coating Application" is written by KTA COO, William D. Corbett. It provides information on the proper use of test instruments for verifying the quality of the application of protective coatings. It is applicable to new pipe in the shop, field splices (girth weld areas), existing pipe in the field, and painted steel in general.

Some topics include, use of digital psychrometers and calibration, measuring coating temperature, measuring and calculating wet film thickness, frequency of measurement according to SSPC PA-2, and Type 1 & 2 Gauges. You can download “Verifying the Quality of Coating Application” from https:ktauniversity.com.

Verifying the quality of coating application post-application is the subject of Volume 3.

EUROCORR 2018, Krakow, Poland, 9-13 September 2018

The Polish Corrosion Society, together with the European Federation of Corrosion and DEHEMA, will be organising the 2018 Eurocorr congress. This year the theme is “Applied Science with Constant Awareness”. The scientific programme of EUROCORR gives delegates an opportunity to catch up with the most recent and reliable scientific results and the latest industrial achievements, and to take part in the development of new standards and regulations in the subject of corrosion control. As always during EUROCORR, each day 10 to 12 parallel sessions will run, some dealing with the most important general corrosion problems and some focusing on those specific to each branch of industry. For further information concerning EUROCORR 2018, see the congress website at: http://www.eurocorr.org

A call for papers has also been issued, and the deadline for abstract submission is 16 January 2018. Instructions for abstract submission and the online submission form are available on the congress website.

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Axalta buys Plascoat Systems

Axalta Coating Systems has acquired Plascoat Systems Ltd., a supplier of thermoplastic powder coatings, from its parent company, International Process Technologies (IPT) Ltd. Established in 1952, Plascoat pioneered some of the science behind the formulation, manufacturing, and application of thermoplastic polyolefin coatings. Plascoat’s product portfolio of highly durable powder coatings used for a variety of outdoor applications includes a product specifically developed for coating potable pipes, fittings and tanks. As part of the transaction, Axalta will acquire both Plascoat manufacturing facilities in Farnham, England and Zuidland, Netherlands.

WorleyParsons enters UK North Sea Market

WorleyParsons has announced the completion of its acquisition of Amec Foster Wheeler (AFW) Oil and Gas UK Limited, a leader in the Engineering & Construction, Operations and Maintenance and Hook-up services markets in the UK oil and gas market. AFW UK has 45+ years’ experience operating in the North Sea providing services across the full asset lifecycle, and has over 3,000 employees in seven offices in the UK and the Middle East.

STANDARDS UPDATE

ISO

- These documents are currently under consideration in the technical committees.
  - ISO/DTR 11303 Corrosion of metals and alloys — Guidelines for selection of protection methods against atmospheric corrosion
  - ISO/DTR 19735 Corrosion of metals and alloys — Corrosivity of atmospheres — Guidelines for mapping areas of increased risk of corrosion
- These documents have obtained substantial support within the appropriate ISO technical committee. They have been submitted to the ISO member bodies for voting.
  - ISO/DIS 14993 Corrosion of metals and alloys — Accelerated testing involving cyclic exposure to salt mist, dry and wet conditions (Revision of ISO 14993:2001)
  - ISO/DIS 16151 Corrosion of metals and alloys — Accelerated cyclic test with exposure to acidified salt spray, dry and wet
- These final draft International Standards have been submitted to the ISO member bodies for formal approval
- Standards issued during September include:
  - ISO 9717:2017 Metallic and other inorganic coatings — Phosphate conversion coating of metals

The standard specifies a process for the confirmation of requirements for phosphate coatings which are usually destined for application on ferrous materials, zinc, cadmium and their alloys. This third edition cancels and replaces the second edition which has been technically revised, including the requirements for the phosphate layer, shifting the statements on corrosion resistance to a new Annex A, Annex B on salt spray testing, and the properties of the phosphate layers in Annex C.

New global paint and coatings study launched

Kusumgar, Nerli & Growney has published its third global paint & coatings study. According to the firm, global consumption of coatings was 90.4 billion pounds valued at EUR103 billion in 2016, and an annual rate of growth of 4% is forecast through 2021.

The Asia-Pacific region was the leading coating consumer with 47% of the volume and 45% of the value in 2016 and overall growth there is 6% per year, due to the emerging economies of the region. China accounts for 59% of the volume, and India is now among the leaders in growth in the region at just over 10% per year.

The global coating industry continues towards water-based and other more environmentally friendly technologies, particularly in emerging economies. Many developed economies now employ a significant percentage of these technologies. Further information about the study “Global Paint & Coatings, 2016-2021” can be obtained at www.kusumgar-nerli-growney.com.

Continues on page 14
Following is a list of standards relative to our industry published by CEN (including joint ISO standards), in the last two months.

EN 12438:2017 Magnesium and magnesium alloys - Magnesium alloys for cast anodes.

This standard specifies the grades and the corresponding requirements for magnesium alloys for cast anodes. It specifies 2 groups of cast magnesium alloy grades by a damage pattern as in outdoor weathering, but rather to give the first group deals with magnesium alloy ingots for anodes and the second group deals with magnesium alloy anode castings. The standard specifies chemical composition, designation, testing, and inspection documentation.

EN 1504-10:2017 Products and systems for the protection and repair of concrete structures - Definitions, requirements, quality control and evaluation of conformity - Part 10: Site application of products and systems and quality control of the works.

This part of EN 1504 gives requirements for, substrate condition before and during application of systems and products, storage of systems and products, structural stability during preparation, protection and repair, methods of protection and repair, quality control for execution of work and maintenance of the structure.

EN ISO 11997-1:2017 Paints and varnishes - Determination of resistance to cyclic corrosion conditions - Part 1: Wet (salt fog)/dry/humid conditions using specified solutions.

The standard specifies a method for the determination of the resistance of coatings to one of four defined cycles of wet (salt fog)/dry/humid conditions using specified solutions.

EN ISO 15110:2017 Paints and varnishes - Artificial weathering including acidic deposition

This specifies a so-called acid dew and fog test (ADF test) as an accelerated laboratory test method for simulating, by the use of artificial acidic precipitation, the damaging effects of acidic atmospheric precipitation in association with UV radiation, neutral condensed precipitation, and changing temperature and humidity. This test method is intended to be used in evaluating, on the basis of relative performance rankings, the suitability of painted materials for use in outdoor environments with acidic precipitation. It is not intended to generate the same extent of damage or the same damage pattern as in outdoor weathering, but rather to give a ranking which is similar to that which would be obtained in outdoor weathering. The method produces damage which is more homogeneous, allows fewer specimens to be exposed (and hence more rapid testing) and enables evaluation of the exposed specimens to be carried out using methods which are more objective than visual assessment.

EN ISO 15589-1:2017 Petroleum, petrochemical and natural gas industries - External corrosion protection of risers by coatings and linings - Part 1: Elastomeric coating systems - polychloroprene or EPDM

The standard specifies the minimum requirements for materials selection, surface preparation, application, inspection, testing, qualification criteria and documentation for onshore coated steel risers pipes used in the splash zone, their field joints and clamps/guides, using an elastomeric protective coating based on polychloroprene, EPDM or equivalent. This is applicable for new construction and repair of applied pipes before installation. It also specifies the requirements for transportation, handling and storage of riser pipes before and after surface preparation and coating application. Maintenance requirements and field repairs are covered in ISO 18797-2.

EN ISO 2063-1:2017 Thermal spraying - Zinc, aluminium and their alloys - Part 1: Design considerations and quality requirements for corrosion protection systems

The standard specifies requirements for the protection of iron and steel surfaces against corrosion by applying thermal-sprayed metallic coatings of zinc, aluminium or their alloys. It covers the requirements for the planning of the corrosion protection system and for the constructive design of the coating component to be protected. Characteristics of the coatings, including their chemical composition, are specified. The characteristics that are introduced for thermal spraying are intended to be the process for the deposition of the metallic corrosion protection. Some field-related basic terms are defined and instructions for corrosion behaviour of the zinc and aluminium materials under different environmental conditions are provided. Characteristic properties of the coating, e.g. coating thickness, minimum adhesive strength and surface appearance, are specified and test procedures for thermal-sprayed corrosion protection coatings of zinc, aluminium or their alloys are determined. The standard is valid for applying thermal-sprayed zinc and aluminium protection coatings against corrosion in the temperature range up to +200°C, taking into consideration the service conditions of any sealants used.


This part specifies requirements for the coating of steel structures, components or parts, which are coated by thermal spraying of zinc, aluminium or their alloys. It specifies requirements for coating manufacturers of surface preparation, thermal spraying, testing and post treatments, e.g. sealing of the coating. The standard applies to metallic corrosion protection coatings in the case of new fabrication in the workshop, as well as on-site and for repair on-site after assembly. Requirements for coating thickness, minimum adhesive strength and surface conditions, specified in a coating specification, are given. Recommendations are given for suitable process steps and quality assurance measures for new production and maintenance and for supervising of corrosion protection works. It covers the application of thermal-
sprayed zinc, aluminium and their alloys for protection against corrosion, and specifies requirements for the equipment, the working place and the qualification of the spray and testing personnel. The standard is addressed to the designer and to the planning engineer of corrosion protection system.


The standard specifies a method for non-destructive measurements of the thickness of non-conductive coatings on non-magnetic electrically conductive base metals, using amplitude-sensitive eddy-current instruments. In the standard, the term “coating” is used for materials such as, for example, paints and varnishes, electroplated coatings, enamel coatings, plastic coatings, claddings and powder coatings. This method is particularly applicable to measurements of the thickness of most oxide coatings produced by anodizing, but is not applicable to all conversion coatings, some of which are too thin to be measured by this method. This method can also be used to measure non-magnetic metallic coatings on non-conductive base materials.
Glass Flake Epoxy (GFE) technology has been a mainstay of the Oil & Gas (O&G) offshore market for many years, particularly for highly aggressive splash zone areas, despite other technologies for similar end uses having been investigated. This, consequently, resulted in the opportunity of assessing the performance of these materials in real life conditions and enabled coating suppliers to optimize their GFE formulations for wider end uses and longer service life times.

The versatility of glass flake epoxy technology allows it to be used not only for O&G offshore applications but for buried steel in O&G downstream applications, subsea pipelines and equipment, and even for bridges & highways where local authorities—such as Network Rail and Highways Agency in the UK—dictate the use of such a technology due to its superior anti-corrosion properties and longer service life times.

Use of glass flakes in combination with other functional pigments (for example, aluminium) or more advanced epoxy polymers (such as surface tolerant epoxies, epoxy novolacs, amine cured epoxy linings...etc) delivers effective long term protection of water, fuel, and chemical tanks, vessels and pipelines, as well as maintenance and repair of such steelwork whether it's immersed or atmospheric.

Traditionally, glassflake coatings were based on relatively large particle size glass flake pigments (nominal width 0.4mm). These coatings typically required approx. 500µm to achieve a full film and an overall specification could be in excess of 1mm dry film thickness. However extensive research and development using significantly smaller glass flakes has enabled the production of formulations which could deliver equivalent performance at much lower film thickness, and with a vastly superior aesthetic appearance.
In this respect various tests have been conducted to understand the effect of glass flake pigmentation on the overall performance of epoxy coating systems. It is commonly accepted in the coatings industry that glass flake pigmentation increases barrier properties of the dry film and enhances mechanical properties, making it an ideal choice for immersed and buried steel. Table 1 clearly displays the benefit of using glass flake in a 500 microns thick dry epoxy film, which was loaded with 20% w/w glass flake at an average particle size of 0.4mm.

**Benefits of incorporating glass flake in modern coating specifications**

The current criteria for selection of coating specifications include reduced VOC and elimination of toxic components to comply with ever more stringent environmental legislation; fewer coats to reduce application costs; improved performance to give longer life to first maintenance compared to traditional multi-coat systems; and proven performance with external independent test evidence - NORSOK, Oil Company, Highway, Network Rail, specifications and ISO 12944.

Glass flake pigmentation is a primary weapon in the formulator’s armoury, which can be incorporated in a range of high performance binder systems to produce coatings with the following benefits:

- Very low VOC content.
- User friendly - easily applied over a wide range of specified film thickness.
- Superior resistance to water ingress.
- Good mechanical properties - adhesion, abrasion resistance, flexibility.
- Compatible with cathodically protected steel on immersed structures.
- Capable of withstanding a wide range of chemical resistance and high temperature conditions, depending on the binder system used.

**Glass flake**

Borosilicate glass (c - glass), with a thickness of 1 - 7 microns, and various nominal particle width grades, viz, 3.2mm - used for trowelling compounds

0.4mm - used in high build spray applied coating micronised - used in spray applied coatings - low and high (typical 45 micron) build.

**Binder types**

The main properties of a coating are dependent upon the resin system employed. These may be enhanced, or even detracted from, by the pigments and other ingredients included.

**Epoxy**

The properties of epoxy resins enable them to be formulated into coatings to provide protection over a wide range of specification requirements, including, excellent corrosion protection for subsea, splash zone and atmospheric environments, excellent resistance to cathodic disbondment, toughness and abrasion resistant. They have a long track record, and there are no catalyst storage problems. The disadvantages however are, maximum immersion temperature typically 60C, maximum dry heat resistance typically 120C, chalking/colour retention problems on atmospheric exposure, and generally poor acid resistance.

**Polyester**

These consist of isophthalic or bisphenyl polyester resins, cured with organic peroxide catalysts. They offer improvement in performance over epoxy in terms of mechanical properties and temperature resistance, with maximum immersion temperature typically 80C and maximum dry heat resistance typically 140C. The isophthalic polyesters are more resistant to chalking and offer superior colour retention on atmospheric exposure compared against epoxy. Polyesters can also offer faster curing rates than high solids epoxies, although applicators need to be sufficiently aware of the relatively short pot life, and safety aspects of the catalyst. In order to minimise potential problems with the relatively short pot life of these products, twin component application equipment is used.

**Vinyl Esters**

These have the ultimate performance in terms of chemical and temperature resistance, with maximum immersion resistance typically 120C and maximum dry heat resistance typically 250C. In sea water immersed structures, the cooling effect of the water allows application onto substrates operating at much higher temperature, e.g. pipelines with an internal temperature of 180C.

**Specification philosophy - film thickness**

Traditionally glass flake coatings have needed to be specified at dry film thicknesses in the order of 500 - 1000 microns, due to constraints caused by their application characteristics. These thicknesses are required for performance under some, but not all, environments. For atmospheric anticorrosive protection of structural steel, for example, such thicknesses can be over-engineered, and uneconomic. A range of glass flake coatings which can be applied at different film thickness, ie to give the required protection without the need to apply more paint than is necessary is now available. Extensive laboratory testing, and track record in the field, have proved the validity of such specifications which can be devised in conjunction with the ISO 12944 standard, plus testing to NORSOK or oil company performance testing.

**Formulation Aspects**

Given the available raw materials, how can they be combined to achieve the required performance?

The theory of glass flake pigment particles aligning within an applied paint film to give an extended diffusion pathway through the film is well documented, as is the reinforcing nature of the lamellar pigment. There are, however possibilities where particles of glass can end up misaligned in the film and if these particles have a length greater than the film thickness, they can create a potential fault within the coating leading to accelerated permeation through the film. This effect can lead to the necessity of applying very thick films or multi coat application to compensate for these defects, and pass high voltage pinhole detection testing.

**Micronised glass “Controversy”**

The incorporation of micronised glass flake into high build epoxy coatings has been a cause for debate. It is accepted that the lower aspect ratio of the micronised flake does not give the potential for a potential diffusion pathway as the larger flake sizes, and indeed a straight A versus B comparison of 0.4 mm flake against micronised flake at constant loading in the same resin system will show that the micronised flake pigmented system has higher rates of water absorption and vapour permeability compared with the larger flake (tables 1 and 2).

Research has shown however that in epoxy systems, combination of the micronised flake with other lamellar fillers and zinc phosphate, gives a synergistic effect which offers similar permeability characteristics to large flake systems (tables 1 and 2), coupled with a closed, defect free film which offers, ease of application using smaller spray tips than standard glass flakes allow, film thickness variable from 200 microns to 1000 microns depending on end requirements, retention of mechanical properties, abrasion resistance, cathodic disbondment, coupled with outstanding corrosion resistance (tables 3 - 5).

**Glass flake levels**

There are no official standards governing glass flake levels compared with the criteria laid down for zinc phosphate for example in BS 5493. The factors to be considered include:

1. Steric effects of glass flake - overloading will cause physical interference between flakes which may in turn give rise to film defects.
2. Viscosity increase - Higher levels of glass flake cause increased viscosity which will eventually affect application characteristics.

and that actual test data shows that more is not necessarily better. In short, there is no such thing as a universal optimum for glass flake loading. This is a case of “horses for courses” with the type of glass flake and its level of incorporation having to be thoroughly researched with the particular end use in mind.

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mind. An epoxy based formulation intended for anticorrosive protection of structural or immersed steelwork will be quite different in terms of glass type and content to a vinyl ester for chemical resistant vessel linings.

**Primer requirements**

In the case of glassflake epoxy materials formulated on a blend of glassflake and zinc phosphate, a separate primer coat is not necessary from the viewpoint of anticorrosive performance, although in practice they are often used in conjunction with a proprietary epoxy blast primer or epoxy zinc phosphate primer.

In the case of polyester or vinyl ester specifications, a vinyl ester based holding primer is available to maintain the integrity of grit blasted substrates prior to application of the glassflake coating. For non-immersed systems it is permissible to apply specially formulated glassflake polyester over epoxy primer. Work is ongoing to confirm whether epoxy primers may be used under immersed polyester/vinyl ester systems. However until results are confirmed, the vinyl ester primer should be used under any immersion system.

There is a synergistic effect of incorporation of zinc phosphate with micronised glass flake with gives similar results to larger flakes.

Increasing glass flake size reduces permeability of vinyl ester systems. In this case, zinc phosphate cannot be incorporated due to its effects on the curing mechanism of the resin system. Abrasion resistance is improved with increasing 0.4 mm glass content up to 20%, however further increases actually cause an increase in loss of coating.

### Table 1 - Water Absorption/Permeability Glass Flake Epoxy

<table>
<thead>
<tr>
<th>Coating Applied at 500 microns dft</th>
<th>Water Vapour Permeability g/m²/day ASTM E96</th>
<th>Water Absorption % to Equilibrium ASTM 570-81</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control. No Glassflake or Zinc Phosphate</td>
<td>5.9</td>
<td>6.54</td>
</tr>
<tr>
<td>Epoxy, 0.4 m Glassflake</td>
<td>1.05</td>
<td>1.18</td>
</tr>
<tr>
<td>Epoxy, Micronised Glassflake. No Zinc Phosphate</td>
<td>3.5</td>
<td>2.8</td>
</tr>
<tr>
<td>Epoxy Micronised Glassflake &amp; Zinc Phosphate</td>
<td>1.26</td>
<td>1.21</td>
</tr>
</tbody>
</table>

### Table 2 - Water Absorption/Permeability Vinyl Ester

<table>
<thead>
<tr>
<th>Coating Applied at 500 microns dft</th>
<th>Water Vapour Permeability g/m²/day ASTM E96</th>
<th>Water Absorption % to Equilibrium ASTM 570-81</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control. Unpigmented Vinyl Ester</td>
<td>8.24</td>
<td>7.3</td>
</tr>
<tr>
<td>Vinyl Ester Micronised Glass</td>
<td>2.24</td>
<td>3.56</td>
</tr>
<tr>
<td>Vinyl Ester 0.4 mm Glass</td>
<td>1.04</td>
<td>0.25</td>
</tr>
<tr>
<td>Vinyl Ester 3.2 mm Glass</td>
<td>0.59</td>
<td>0.15</td>
</tr>
</tbody>
</table>

### Table 3 - Abrasion Resistance Comparison - Taber Abrador Weight Loss Per 1000 Revolutions, 1000 gm Load H22 Wheel

<table>
<thead>
<tr>
<th>Resin Type</th>
<th>Glass Type</th>
<th>Glass Loading</th>
<th>Wt Loss</th>
</tr>
</thead>
<tbody>
<tr>
<td>Epoxy at 500 microns dft</td>
<td>0%</td>
<td>0.703g</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.4 mm</td>
<td>5%</td>
<td>0.692g</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10%</td>
<td>0.499g</td>
</tr>
<tr>
<td></td>
<td></td>
<td>15%</td>
<td>0.463g</td>
</tr>
<tr>
<td></td>
<td></td>
<td>20%</td>
<td>0.120g</td>
</tr>
<tr>
<td></td>
<td></td>
<td>25%</td>
<td>0.806g</td>
</tr>
<tr>
<td>Epoxy at 500 microns dft</td>
<td>Micronised &amp; Zn Phos</td>
<td>10%</td>
<td>0.403g</td>
</tr>
<tr>
<td></td>
<td></td>
<td>25%</td>
<td>0.392g</td>
</tr>
<tr>
<td>Vinyl Ester at 500 microns dft</td>
<td>0%</td>
<td>0.725 g</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.4 mm</td>
<td>5%</td>
<td>0.621g</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10%</td>
<td>0.306 g</td>
</tr>
<tr>
<td></td>
<td></td>
<td>20%</td>
<td>0.300g</td>
</tr>
<tr>
<td></td>
<td></td>
<td>25%</td>
<td>0.378g</td>
</tr>
</tbody>
</table>

Increasing glass flake levels improve cathodic disbondment performance (CD). However zinc phosphate content would appear to be a major contributory factor in CD of epoxy glass flakes.

Micronised glass flake does not perform well in polyester (or vinyl ester) resin systems on CD testing, and a glass flake loading of approx 20% of 0.4 mm flake is necessary for acceptable performance. Df is also a crucial factor in the performance of these systems.

Accelerated laboratory tests further confirm the superior performance of micronized glass flake epoxies (MGFE) over non-glass flake or ceramic filled epoxies. Figure 1 highlights this superior performance by carrying out salt spray (ISO 9227) tests for up to 6,000 hours, which is well over typical test durations in O&G, Power, Mining and Minerals and other industrial end uses.

**Figure 1** Micronised glass flake epoxy versus ceramic filled epoxy.
The micronized glass flake epoxy technology has delivered excellent performance over a 25 year track record. Relying on experiences gained from this success, the technology has been extended for end uses where properties such as surface tolerance, high film build in one layer by brush application, ability to go over damp surfaces, suitability to be applied over hot substrates are amongst the key requirements sought by asset owners, engineering contractors and paint applicators. This makes the micronized GFE technology, which is capable of building up to 400µm in a single brush coat and able to go over hot substrates up to 120°C, ideal for challenging maintenance and repair scenarios typically observed in O&G offshore and other similar heavy industries. It allows for maintenance painting on hot process steel (up to 120°C) without the need to take the asset or process unit out of service, saving time and cost for the asset operator.

A proprietary product, which was formulated on the basis of micronised glass flake epoxy technology, has been evaluated to determine the effect of prolonged high temperatures on it after being applied to Sa2.5 blasted, and St2 and St3 hand prepared steel, at high temperatures (110°C and 120°C) and then stored at 150°C, in comparison to when applied and kept at ambient temperature. In summary, the testing on heat aged samples showed that there was very little change on cross cut adhesion (ASTM D3359) over 1 - 6 months; no cracking or other deterioration of the film was observed after 6 months heat ageing, and Thermogravimetric Analysis (TGA) showed no weight loss in the samples test up to 6 months in test area i.e. 150°C.

These results show that the formula is thermally stable at 150°C and has good adhesion to a range of substrates with good film integrity. Detailed results can be found on the extended version of this article on the Institute website, www.icorr.org/publications.

Conclusions
Coatings specifications based on micronised glass flake epoxy technology have been developed which will allow paint application onto hand prepared steel at elevated substrate temperatures up to 120°C, and with a maximum operating temperature of 150°C, without the necessity of shutting down high temperature industrial processes. Such coatings will allow straightforward maintenance solutions under challenging conditions, typically found in O&G offshore and other Energy operations, where extensive surface preparation is not possible. Other differentiated value propositions of the technology deliver time and cost savings through up to 400µm dry film thickness build in a single brush coat, suitability for application with airless spray as well as brush and roller and aesthetically pleasing appearance in comparison to conventional epoxy glass flake epoxies. All of these operational and application benefits are complemented with an outstanding long term anti-corrosion performance through micronised glass flake epoxy technology.

Table 4 - Cathodic Disbondment Testing - Epoxy Formulations
28 Days at -1.50 Volts wrt Silver/Silver Chloride Electrode

<table>
<thead>
<tr>
<th>Resin Type</th>
<th>Glass Type</th>
<th>Glass Loading % Wt on Pigments</th>
<th>Temp °C</th>
<th>mm Disbondment</th>
</tr>
</thead>
<tbody>
<tr>
<td>500 µm Epoxy</td>
<td>0.4 mm</td>
<td>0</td>
<td>23°C</td>
<td>28mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5</td>
<td></td>
<td>25mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10</td>
<td></td>
<td>16mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>15</td>
<td></td>
<td>17mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>20</td>
<td></td>
<td>13mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>25</td>
<td></td>
<td>7mm</td>
</tr>
<tr>
<td>1000 µm Epoxy</td>
<td>0</td>
<td></td>
<td></td>
<td>14mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5</td>
<td></td>
<td>10mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>15</td>
<td></td>
<td>5mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>20</td>
<td></td>
<td>4mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>25</td>
<td></td>
<td>5mm</td>
</tr>
<tr>
<td>400 µm Epoxy</td>
<td>Micronised &amp; Zn Phos</td>
<td>0</td>
<td></td>
<td>10mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10</td>
<td></td>
<td>7mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>25</td>
<td></td>
<td>6mm</td>
</tr>
<tr>
<td>800 µm Epoxy</td>
<td></td>
<td>0</td>
<td></td>
<td>4mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10</td>
<td></td>
<td>1-2mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>25</td>
<td></td>
<td>1mm</td>
</tr>
</tbody>
</table>

Table 5 - Cathodic Disbondment Testing - Vinyl Ester/Polyester
28 Days at -1.50 Volts wrt Silver/Silver Chloride Electrode

<table>
<thead>
<tr>
<th>Resin Type/ Glass Type</th>
<th>Glass Loading</th>
<th>Temp °C</th>
<th>mm Disbondment</th>
</tr>
</thead>
<tbody>
<tr>
<td>500 µm Micronised Polyester</td>
<td>25%</td>
<td>23°C</td>
<td>Film degraded at holiday Polyester</td>
</tr>
<tr>
<td>500 µm 0.4 m Polyester</td>
<td>10%</td>
<td>23°C</td>
<td>20 mm Some degradation</td>
</tr>
<tr>
<td>500 µm 0.4 m Polyester</td>
<td>20%</td>
<td>23°C</td>
<td>4-5 mm</td>
</tr>
<tr>
<td>1000 µm 0.4 m Polyester</td>
<td>20%</td>
<td>23°C</td>
<td>0 mm</td>
</tr>
<tr>
<td>500 µm 0.4 mm Vinyl Ester</td>
<td>20%</td>
<td>23°C</td>
<td>2 mm</td>
</tr>
<tr>
<td>1000 µm 0.4 mm Vinyl Ester</td>
<td>20%</td>
<td>23°C</td>
<td>0 mm</td>
</tr>
<tr>
<td>1000 µm 0.4 mm Vinyl Ester</td>
<td>20%</td>
<td>60°C</td>
<td>0.5 - 1.0 mm</td>
</tr>
</tbody>
</table>

Table 6 - Hot CD Testing - 28 Days at -1.50 Volts wrt Silver/Silver Chloride Electrode

<table>
<thead>
<tr>
<th>Internal Wall Temp</th>
<th>1mm dft</th>
<th>2mm dft</th>
<th>3mm dft</th>
</tr>
</thead>
<tbody>
<tr>
<td>100°C</td>
<td>4mm</td>
<td>9mm</td>
<td></td>
</tr>
<tr>
<td>120°C</td>
<td>5mm</td>
<td>5mm</td>
<td></td>
</tr>
<tr>
<td>140°C</td>
<td>5mm</td>
<td>4mm</td>
<td></td>
</tr>
<tr>
<td>160°C</td>
<td>5mm</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
An Introduction to Thermal Spraying
Thermal spraying, also commonly known as metal spraying, is a surface engineering/coating process whereby a wide variety of metals, ceramics and polymers can be sprayed onto the surface of another material. The range of materials that can be sprayed is almost limitless - if the material can be heated to its melting point without boiling away, then it can be thermally sprayed.

Thermal spraying is widely used to provide corrosion protection to ferrous metals or to change the surface properties of items, such as improving the wear resistance or thermal conductivity. The range of thermal spray applications is vast. All methods of thermal spraying involve the projection of small molten or softened particles onto a prepared surface where they adhere and form a continuous coating. As the heat energy in the molten particles is small relative to the mass of the workpiece, the process imparts very little heat to the substrate. As the temperature increase of the coated part is minimal, heat distortion is not normally experienced, which is a major advantage over hot-dipped galvanising or welding.

To create the molten particles, a heat source, a spray material and an atomisation/projection method are required. Upon contact with the target surface, the particles flatten, freeze and mechanically bond, firstly onto the roughened substrate, and then to each other, as the coating thickness is increased.

Thermal spraying is a technology which protects and greatly extends the life of a wide variety of structures, equipment, and vessels, in the most hostile environments and in situations where protective surface coatings are vital for longevity. The variety of metallised coatings is vast but can be broken down into two main categories, anti-corrosion coatings and engineering coatings. The largest volume business for metal spraying is for anti-corrosion purposes, but the range of engineering coating uses is also large where they are used to provide wear resistance, as thermal barriers, for electrical and thermal conductivity, chrome replacement, and insulation, across many industries.

The type of industries using the metal spraying process is endless and includes offshore, oil and gas, marine, tube and pipe and general fabrication, petrochemical, construction, water supply, sewage, ship building, aerospace and airside support. These industries use metal spraying for the protection of structures, vessels, pipelines, water / fuel / storage tanks, bridges and gantries, to name just a few. Both corrosion and wear are major problems for these industries.

This article will concentrate on the use of thermal spraying for corrosion control, and brief descriptions of the various systems will be given together with a case study of a typical use.

**Thermal spraying**

Thermal spraying can be carried out by four processes, Flame spray, Arc spray, Plasma, and High Velocity Oxy-Fuel (HVOF), and by manual or automated spraying systems, although normally only Flame spray and Arc spray are used for corrosion protection coatings. The exception to this can be the application of corrosion resistant alloys by HVOF in very harsh environments.

**Flame Spray process**

In this process, the heat source is commonly propane or acetylene fuel and oxygen gas. The material to be sprayed can be in the form of metallic wire or powder or ceramic rods, and the transfer medium is compressed air. In the process, the gas fuel and oxygen are mixed and ignited to produce a flame. The material, either a wire, powder or rod, is fed into the flame. In the case of water / fuel / storage tanks, bridges and gantries, to name just a few. Both corrosion and wear are major problems for these industries.

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**Arc Spray process**

The heat source is electric and the material to be sprayed is in the form of wire and transfer is by compressed air. In the process two wires (hence a common term for the process is Twin Wire Arc Spray), are fed into the pistol and electrically...
charged, one positive and one negative. The wires are forced together and form an electric arc, melting the wire. Compressed air, passing through a nozzle, atomises the molten metal and sprays it onto the work piece. There are three methods of wire feeding, push, pull and push/pull. The higher the current rating of the system, e.g. 350A, 700A etc., the higher the spray rate.

**Plasma Spray process**

The heat source is a plasma arc and material to be sprayed is a powder (ceramic, metal or plastic) and transfer is via plasma jet. Plasma is the term used to describe gas which has been raised to such a high temperature that it ionises and becomes electrically conductive. In the case of Plasma spraying, the plasma is created by an electric arc burning within the nozzle of a plasma gun and the arc gas is formed into a plasma jet as it emerges from the nozzle. Powder particles are injected into this jet where they soften and then strike the surface at high velocity to produce a strongly adherent coating. The work piece remains cool because the plasma is localised at the gun.

**HVOF Spray process**

In this process, the heat source is liquid or gas fuel and oxygen flame, and the material to be sprayed is a metal powder which is transferred to the workpiece by the flame. The process fuel, commonly liquid kerosene, is mixed with oxygen and ignited. The combustion gases pass through a converging/diverging nozzle and accelerate to around 1,500m/sec. The powder is injected into the accelerated flame where it softens and gathers speed. The high impact speed of the particles produces a highly adherent, dense coating structure.

As noted above, flame spray or arc spray are the processes commonly used to apply corrosion protection coatings, but what are the differences between the two? As with many engineering situations, a clear and precise answer to this is not easy. In some cases, the coating properties achieved by one or the other process does provide a simple answer, for example, arc sprayed aluminium has a bond strength approximately 2.5 times higher than flame sprayed aluminium. Other factors include deposit efficiency, ease of operation, environment, set-up time, maintenance time and costs, coating cost, safety. Plasma and HVOF coatings are more commonly used to apply engineering coatings. In simple terms, the coatings produced by plasma and HVOF are of a higher quality, bond strength and density than flame or arc coatings but are costlier and slower to apply. Hence, the reason flame and arc spray coatings are more widely used for corrosion protection of larger structures. There are a number of applications, for example high temperature combined with high abrasion in boilers, where HVOF coatings are suitable and used.

**Corrosion protection**

As a protective system for structural steelwork, coatings of thermal sprayed zinc, aluminium and their alloys are unsurpassed. After accelerated testing but more importantly, long term real life tests and examples, several independent standards cite greater than 20 years’ service of the coating before first maintenance. This is in the harshest environments including coastal, industrial and seawater splash-zone for example.

Zinc, aluminium and zinc/aluminium alloys are commonly used for corrosion protection. The choice of material to be
used for a specific project depends on many factors such as environment (corrosive atmosphere, high temperature etc), local specifications, life expectancy, adhesion requirements, availability of material, and access. In general terms, zinc is used in relatively low corrosion applications, such as water tanks, some bridges and general steelwork. Aluminium is used in harsher corrosion applications, such as immersion, salt water contact, splash zones. In addition, aluminium is used in high temperature applications such as flare stacks. Zinc/aluminium alloy tends to be used in environments where corrosion resistance of zinc is borderline.

The most common system used in the petrochemical industry, is Thermal Sprayed Aluminium (TSA). In this industry, Corrosion Under Insulation (CUI) in pipeline and storage systems is an on-going problem and consumes a significant percentage of the maintenance budget. A large portion of this money is spent on expensive items such as external piping inspection, insulation removal and re-installation, painting and pipe replacements. The application of TSA has been shown to be a successful CUI prevention strategy allowing the industry to move towards inspection-free and maintenance-free piping systems and significant maintenance cost reductions.

**Case study**

A recent project saw the Metallisation Arcbeam spray concentrator used successfully at a Middle Eastern oil refinery by one of its customers. Anti Corrosion Protective Systems (APS), based in Dubai, have been using thermal spraying for over twenty years across a variety of projects. This latest project is significant in that APS has successfully used the Arcbeam spray concentrator where High Velocity Arc Spray (HVAS) has been previously specified. The Arcbeam produces very dense coatings with low levels of porosity, and was an ideal solution for the oil refinery project. Typical porosity levels lower than 2% are achievable with the unit, which is key to enhancing the performance of the applied coating in these harsh refinery applications.

The internal shells of two absorber columns, which were 5.2 metres in diameter, and two cooling columns, 5.4 metres in diameter, were treated on the inner shell and at the bubble cap and support ring areas. The surfaces were prepared by grinding to remove sharp edges and smooth out any heavily pitted areas. The coating areas were blasted to SA 3 cleanliness, with a minimum of 90µm profile, with garnet then followed by a final sweep blast with aluminium oxide.

The internal shells of the absorber and cooling columns were coated with two layers of Hastelloy® 73E at 225-250µm per coat using the ARC140 system. The surface coating was finished with one coat of a single component, air curing, polymeric sealer (Sprayseal F), which applied by brush until full penetration was achieved. The area coated was approximately 80m² per column.

**Editor’s note:** This article is based on information supplied by Stuart Milton, Metallisation Ltd, Dudley, UK
Specifying Coatings

Bill Corbett, KTA-Tator Inc, Pittsburgh, USA

Independent of the type of coating project, a properly prepared specification is a key component to its success. A coating specification describes the project and the objective of the coating system. It also describes the surface preparation requirements, materials required to complete the work, the intended appearance of the completed work, and lists the inspection check points to help assure that the work is done according to the specification. The coating specification for a project should be read and understood by all parties involved in the project (before the project begins), including the facility owner’s representatives, the coating manufacturer, the inspector and the contractor personnel assigned to the project.

Some contracts may simply require that the work be performed in accordance with the coating manufacturer’s instructions. However, for most projects, the facility owner prepares a detailed project specification, or contracts an outside engineering firm to prepare one. The manufacturer(s) of the coatings that will be used on the project should be involved in the specification development process to ensure that the correct coatings are being specified and that the cleaning and painting requirements are suitable for their products.

A coating specification is a legally binding document. It is a contract between the owner and the contractor. When the project goes well, the detailed requirements of a coatings specification rarely come into play. However, in the event the project does not go well and legal actions are pursued, the specification becomes a critical document in the suit. It is important that the specification be written so that the project manager, foreman and workers can perform the work without confusion. The best written specifications are well-organized and use simple language that is easy to understand.

A coating specification should be practical, so that the owner can effectively communicate the desired outcome. The specification should not be unreasonably restrictive, but should anticipate problem areas that the contractor may encounter and must overcome to successfully complete the contract. A well-prepared coating specification benefits both the facility owner and the contractor’s crew, and should be written in a non-adversarial tone to foster teamwork between the owner, contractor and material supplier to achieve the end goal: long term corrosion protection.

Prescriptive verses performance-based specifications

Many coating specifications are prescriptive in that they provide the contractor with the means and methods to accomplish the work, rather than simply indicating the desired end-result. This can be a mistake, in that the contractor’s hands are tied regarding the use of innovative methods in which to accomplish the work. In a performance-based specification, while some directions are required (e.g., the contractor shall dry abrasive blast clean the steel using a recyclable abrasive to achieve Sa2 ½ and a 50 - 75 micron angular surface profile), the means and methods of achieving this level of surface preparation (abrasive size, nozzle size, air pressure, distance from nozzle...
to surface, blast nozzle angle, etc.) are left to the contractor. Another risk in developing a prescriptive specification is that if the prescribed means and methods do not achieve the end-result, claims against the owner and project cost overruns can occur.

It should be evident that the preparation of a well-written, thorough coating specification is not a simple task, and should be done with great care to avoid contract disputes and coating failure.

Specifying coating systems

There are several ways that coating systems can be specified for use on a project. Some specifications are written around specific product trade names, and some are written as “trade name or equal.” Others are based on a pre-established “Qualified Products Lists” (QPL), or are based on a set of performance standards. While infrequent, a coating system can also be specified based on a coating formulation or a set of formulations. The principle advantages and limitations of each are listed below.

Specifying coatings by “Trade Name”
The advantages of this method are that there is a high rate of success if use is based on past performance, and that the facility owner has full knowledge of the material based on past use. Also the manufacturer stands behind the product and provides advice/guidance to help ensure proper installation.

The limitations include, potentially high material costs (no competition), products can be changed even though the brand names remain the same, and the method can be problematic on projects involving public funding (government agencies), since sole sourcing is difficult.

Specifying coatings by “Trade Name or Equal”
The advantages are, if “or equal” product is truly equal in performance, competitive pricing can be established, however the limitations are that “or equal” needs to be defined. Determining “or equal” should be based on performance testing or historical use of the product/system in the same/similar service environment, and acquiring this data can be time consuming and evaluating “or equal” status can be subjective.

Specifying coatings by “Qualified Products Lists”
Here the advantages include, establishes “equivalent” performance based on successful field use and/or laboratory testing, competitive pricing established with little risk of acquiring sub-standard product, but the limitations are the time period required to establish a QPL, the cost of testing to attain QPL status may be passed on to facility owner by the coating manufacturer via higher material costs, and random tests of supplied batches may be required to confirm that the material being supplied is the same as the material that was originally qualified.

Specifying coatings by “Performance”
With this method, any coating that meets/exceeds performance requirements can be selected for use which avail the facility owner to potentially more options for corrosion prevention than the other methods. The specified performance standards are typically prepared by industry trade organizations as consensus standards (e.g., Norsok), indicating that they have been developed by a mix of owners, vendors, engineers, and contractors across many industries. The limitations however are that testing prescribed by the performance standard may be short term laboratory testing and may not mimic the prevailing service environment, and field exposure testing of candidate coating systems to assess performance can be costly and time consuming. Unless carefully written, the specification may open the project up to many different generic coating types, which may not be in the best long term interest of the owner.

Specifying coatings by “Formulation” (e.g., Network Rail)
Advantages include the fact that various coating manufacturers can supply formula-based products, since the formula is published, and many formulas have a history of successful use in various service environments. The limitations are that the coating manufacturer follows a formula and does not conduct performance evaluations to verify performance. Once the product passes to the facility owner, the manufacturer has no responsibility for performance provided it was formulated according to specification. The formulation may have been developed based on laboratory testing verses field performance. Formulations are antiquated and cannot keep up with new technology or improved formulations – they do not take advantage of the R&D money being spent by coating manufacturers to improve products, and raw materials used to formulate coatings may be inferior, but still conform to the minimum requirements of the specification.

Conclusions
No matter if it’s a new building project or planned (or unplanned) maintenance painting, a specification of the work to be carried out needs to be prepared in advance. The coating specification should not be ambiguous, and should clearly state the owner’s requirements so that they can be easily understood, and carried out by the contractor. There are several ways in which coatings can be specified, and to help engineers draw up these specifications a knowledge of the advantages and limitations of the different methods is necessary.

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New HT/HP subsea valve coating developed

An international collaboration between Hardide Coatings and Master Flo Valve Inc (MFV) has resulted in the development of a new solution to protect high temperature, high pressure (HT/HP) subsea choke valves. According to company, the Hardide-T coating can be applied to choke valve stems so they can withstand temperatures up to 205°C and pressures of 20,000 psi, and it has already been applied to MFV’s P4-15K choke valve, which is rated from -29°C to 205°C and 15,000 psi, and the P4-20K choke valve, which is rated to the same temperatures but a greater pressure of 20,000 psi. The coating also has the potential to expand into other subsea choke valve sizes and models with HT/HP requirements, stated the company.

Axalta Introduces Latest Addition to Internal Pipe Coatings Portfolio

Axalta Coating Systems has introduced the latest addition to the corrosion resistant internal pipe coatings line from the Nap-Gard® Functional Coatings collection. Nap-Gard 7-0015 Tan Internal FBE, is a thermosetting epoxy powder designed to pass the Saudi Aramco 09-SAMSS-091 (2011) specification. According to the company, the product is a flexible coating that provides corrosion protection in severe downhole environments up to 105°C, and which offers high adhesion properties to pipelines subject to H₂S, CO₂ and CH₄ exposure.

Hempel has launched a new versatile activated zinc primer, Hempadur Avantguard 860, which according to the company, combines best in class corrosion protection at the level of an inorganic zinc silicate, with the application benefits of an epoxy. The product is specifically designed to protect steel structures in moderate to severe corrosive environments, and is the first of its class specifically developed to overcome the problems experienced with zinc silicate primer application, without compromising corrosion protection, and increasing productivity.

The SSPC Level 1 compliant two-component activated zinc rich primer can provide improved barrier, inhibitor and galvanic protection in a single coating for all-round performance. It is certified to NORSOK M-501 Ed.6 System 1, ISO 12944-6 Part 5, and Level 1 type II in SSPC Paint 20 standards, and is based on Hempel’s advanced and proven Avantguard technology. The properties stated include; fast drying, at least 4 times faster than zinc silicates, a three coat system can be applied in a single shift; high mud cracking resistance, two times better than coatings with inorganic zinc silicates; and flexible application. It has a wide application temperature range, can be applied in temperatures down to -10°C with no need for a mist coat as required for inorganic zinc silicates.
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27th March 2018
Aberdeen Branch Industrial Visit
Element Materials Technology
Industrial Visit to Element’s New H2S/Sour Service Lab in Aberdeen Visit to start from 6.30pm
Venue: Hareness Circle, Hareness Circle, Altens Industrial Estate, Aberdeen, AB12 3LY United Kingdom

29th May 2018
Aberdeen Branch – Joint meeting with NACE;
Industrial Visit
Industrial Visit to Sonomatic. Presentations and Showcasing Kit and Facilities on Overcoming and Identifying Corrosion/Integrity Challenges. Visit to start from 6.30pm
Further details can be obtained from Aberdeen Branch.

ADDITIONAL DIARY DATES

5th/9th February 2018
The Fundamentals Corrosion Course for Engineers 2018
A new Fundamentals of Corrosion course is presented by the Institute of Corrosion. The course will be based on practical information and hands-on examples as well as relevant background theory. Attendees on the course will be given a wide ranging introduction to all the major aspects of corrosion engineering.
February 5, 2018 at 9:00 am
February 9, 2018 at 5:00 pm
Further information on the course, local hotels, etc., can be obtained from the Institute of Corrosion: admin@icorr.org

15th May 2018
CEOCOR 2018 International Congress and Technical Exhibition
ICorr will host the 2018 CEOCOR Congress in Stratford-upon-Avon. For further details see www.ceocor2018.com

Institute Events
DIARY DATES 2017

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