In this issue:

Focus On Coating Applicators – Pages 11-15
Technical Topics – Page 7
Company News – Page 14
The Company
Cathodic Protection Co Limited is a leading provider of cathodic protection solutions to the oil, gas, water and construction industries. Established in 1950, the company has experienced significant growth in recent years through an effective market development programme and the introduction of innovative new products. The company enjoys an enviable reputation for quality and service and operates on a global basis serving major international clients.

The Role
Reporting to the Managing Director you will be responsible for developing the sales and marketing strategy in order to maintain growth in sales and margins in line with company objectives. You will provide direction to an experienced sales team and play a key role in managing major accounts for the business. You will be based at our Grantham facility and the role will involve significant overseas travel.

The Person
Ideally qualified to degree level, you will be an experienced Sales Manager/Director with a successful track record of delivering profitable sales growth in an engineering or construction environment. Preference will be given to candidates with experience of selling bespoke engineered products to the oil and gas sector. You will have a hands on approach and be comfortable preparing and negotiating high value tenders. The successful candidate can expect to progress quickly to Board level and will take an active part in shaping the future strategy of the business.

Salary
Commensurate with experience plus bonus and company car.

How to apply
If you feel that you have the skills to take on this important role please apply in writing or by e-mail, explaining why you are suitable and including details of your career and achievements to date. Applications should be sent to:

Rob Holden
Cathodic Protection Co Limited
Venture Way, Gratham NG31 7XS
e-mail: jobs@cathodic.co.uk
Closing date: End of February 2014
## CONTENTS

### Institute News

<table>
<thead>
<tr>
<th>Topic</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>The President Writes</td>
<td>4</td>
</tr>
<tr>
<td>New Members Attaining Professional Status</td>
<td>4</td>
</tr>
<tr>
<td>London Branch News</td>
<td>5</td>
</tr>
<tr>
<td>BSRIA</td>
<td>5</td>
</tr>
<tr>
<td>Midlands Branch Meeting</td>
<td>6</td>
</tr>
<tr>
<td>Technical Topic No.44</td>
<td>7</td>
</tr>
<tr>
<td>Midland Branch Meeting</td>
<td>8</td>
</tr>
<tr>
<td>Aberdeen Branch Meeting</td>
<td>9-10</td>
</tr>
<tr>
<td>Focus On Coating Applicators</td>
<td>11-14</td>
</tr>
<tr>
<td>European Federation of Corrosion</td>
<td>15</td>
</tr>
</tbody>
</table>

### Technical Article

**Company News**

<table>
<thead>
<tr>
<th>Topic</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corrosion and Elastic Behaviour of Cryogenically Treated En 19 Steel</td>
<td>16-21</td>
</tr>
</tbody>
</table>

### Company News

<table>
<thead>
<tr>
<th>Topic</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Winn &amp; Coales (Denso) Ltd</td>
<td>22</td>
</tr>
<tr>
<td>DNV-GL</td>
<td>23</td>
</tr>
<tr>
<td>Metallisation</td>
<td>24</td>
</tr>
</tbody>
</table>

### Sustaining Members                                      | 25-32|

### ICATS Registered Companies                              | 33-35|

### Diary and Branch Contacts                               | 36   |
Christmas 2013 showed me, and many others I am sure, how unpredictable life is - electrical power went off for us the day before Christmas Eve and came on again late on Boxing Day, nothing to do with the country’s infrastructure problems, simply the weather, pouring rain and high winds. The weather may possibly be attributable to global warming, however the official version has blamed the jet stream created by warm southern air meeting cold northern air streams, whatever the reason all affected due to flooding and power problems have my sympathy and I hope everything has returned to normal, or as near as is possible to normal.

Christmas 2013 showed me, and many others I am sure, how unpredictable life is - electrical power went off for us the day before Christmas Eve and came on again late on Boxing Day, nothing to do with the country’s infrastructure problems, simply the weather, pouring rain and high winds. The weather may possibly be attributable to global warming, however the official version has blamed the jet stream created by warm southern air meeting cold northern air streams, whatever the reason all affected due to flooding and power problems have my sympathy and I hope everything has returned to normal, or as near as is possible to normal.

This unpredictability seems to pervade all things in life, following the bad weather the day before Christmas Eve and the resulting flooding, our local filling station suffered ingress of water into the diesel storage tanks, 32,000 litres of diesel were contaminated, and guess who filled up with it? Yes me on Christmas Eve around 16:30, not much chance of a fix given the date and time, which proved to be the case and so two weeks later the car has been returned in running order. My concerns as you may imagine were the impact of water on the internal surfaces of the fuel tank, fuel lines, fuel pump, injectors and the engine, I have been assured by the main dealer there is nothing to worry about and corrosion will not occur, I have to accept what they say but it still concerns me knowing the subject and seeing day to day the impact of corrosion and the results, I refrained from asking if the dealer retained a corrosion consultant to hand down opinion in these cases but I think the answer would have been “no”. This of course is a small inconvenience and the problem was fixed at no cost to me, it does however bring home to the individual what the weather can do and how it impacts us all in one way or another, similar to corrosion which I am sure has been impacted and quite possibly accelerated by the poor weather conditions which have prevailed so far this winter.

This all leads me back to my last President writes in which I spoke of keeping the lights on, nothing to do with the weather at that time, so to this end ICorr have agreed to join with NACE and put on a conference entitled “Energy security – Corrosion matters” this will take place in June this year at The Royal Overseas League in St. James London, many of you will know this venue from the London Branch Christmas luncheons and other events. The organisation of this conference is well underway and a number of meetings have been held, a joint committee has been formed and a steering group put in place; over two days the conference will address energy in general including oil and gas, fracking, renewables and energy security, this we intend to be a high profile event with prominent speakers and will follow the joint themes of energy production and corrosion control in this process. I look forward to seeing you at this event and the many others ICorr have planned in 2014.

Trevor Osborne,
President of the Institute of Corrosion

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**WELCOME...**

210 new members and 10 new Sustaining members. The members who have attained Professional Status in 2013.

**Technician**
- Craig Stokes
- Thomas Whittleton
- Purushothaman Duraisamy
- Loganathan
- Andrew R Higson
- Gordon C Blair
- Edward Hall

**Professional**
- Muhammad Faisal
- Rajesh Kumar Durairaj
- Jason Ross
- Abdulrahman Alshahri
- Jonathan D Madden
- Mohammad Abbas
- Stephen E Jones
- Jack P Gummerson
- Mark A Smith
- Aneel Mumtaz
- David B Mobbs
- Ramachandran Venkatesan
- Vibhas Kumar
- William Whittaker
- Antonio C Caraballo Ortiz
- Yunnan Gao
- Arni M Gopinathan
- Suraj Tinani
- David M Jappy
- Narayana S Nallamothu
- Rajasekharan Pillai
- Steven Waldron
- Agresh Sharma
- Javid I Waheed
- Joseph R Morris
- Eric Catis

**Fellow**
- Shibu Abraham
- James Preston
- Christopher P Atkins
- James H McLaurin
- George Sergi
- Kevin J Quinn
- Xinming Hu
- Paul E Doherty
- Bob P de Boer
- Ian G Winning
- John R Scully
- Dilip Sankar

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ICorr President, Trevor Osborne.
London Branch began the New Year with a presentation on ‘Education and Training in Industry and Corrosion Control’ at The Naval Club, Mayfair on 9th January 2014. Under the Chairmanship of John O’Shea the presentation was given by Stephen Wisniewski, Courses and Examination Manager at Argyll-Ruane Ltd. Stephen first explained that Argyll-Ruane had recently become a wholly owned subsidiary of The Institute of Mechanical Engineers, the fastest growing professional institution in the UK. Stephen Wisniewski went on to describe ‘Life at the front end’ as being able to provide training and certification which would give assurance of the competence of personnel for positions in industry. The Institute of Corrosion has been for some time an important client of Argyll-Ruane and Stephen confirmed that ‘ICorr’ courses were continuing to become more popular and had achieved a good reputation from feedback on their content and presentation.

Particular details were given from an Argyll-Ruane course for the measurement of sectional loss under insulation (CUI) using both profile and tangential radiography. This was described as a particularly popular course for this ever increasing problem. Both techniques could be undertaken without disruption of the insulation and both were illustrated with typical radiographs detailing the accurate measurement of corrosion loss on the insulated pipelines.

Details of Institute of Corrosion courses in painting, coatings, cathodic protection, insulation, hot dip galvanising and fire proofing can be found at www.icorr.org or www.imeche.org.

On behalf of the 27+ attendees, which included past, future and current Presidents of the Institute, a vote of thanks to Stephen was given by Branch committee member Jim Glynn; after which, all enjoyed the traditional hospitality of the London Branch.

The next Branch technical meeting will be on 13th February 2014 and held at The Naval Club, 38 Hill Street W1J 5NS, at 17.30 for an 18.15 start.

BSRIA PUBLISHEDS NEW WATER TREATMENT FOR CLOSED HEATING AND COOLING SYSTEMS GUIDE (BG 50/2013)

This guide replaces (AG 2/93) Water Treatment for Building Services Systems with respect to closed heating and cooling systems.

The treatment of water in heating and cooling systems is essential for the avoidance of microbiological fouling (biofouling), corrosion and scale. These problems can result in energy wastage, poor system performance and the need for early replacement of plant and components. Many facilities managers have minimal understanding of how water treatment works and what it is intended to achieve but the consequences of ineffective water treatment can sometimes be disastrous.

This guide is intended for use by design engineers, installing contractors and the maintenance staff responsible for looking after the completed systems. In particular it will help facilities managers and others discuss the most appropriate water treatment programme with water treatment specialists.

The objectives of a water treatment programme are to maintain the system efficiency and cleanliness and prolong system life. The guide explains how to achieve this through:

- system design
- installation, testing and pre-commission cleaning
- application of a correct and appropriate water treatment programme
- effective management of the programme

The technical content of the publication has been compiled by a steering group comprising of BSRIA, the British Association for Chemical Specialities, the Institute of Corrosion, the Water Management Society, the Commissioning Specialists Association and the United Kingdom Water Treatment Association.


As part of the authoring arrangements, each of the participating bodies have been given thirty copies for selling on at half-price to their members. ICorr members may purchase a copy from Head Office for £30 plus postage and packing.
The Midlands Branch half-day meeting on 26th September 2013 had a theme of “Cathodic Protection Power Supplies”.

A good-turn out of over 40 ICorr members and guests attended the late afternoon and evening meeting. The meeting was hosted at the Coalbrookdale Site in Ironbridge. The site is known as the ‘Birthplace of Industry’ and before the meeting members had chance to pay a complimentary visit to the Enginuity Centre, the Museum of Iron and the old blast furnace on the site dating from 1658.

Three experts in the field representing specifiers, users and manufacturers each passed on their experience in very informative presentations.

Jason Peters of BAC Corrosion Control Ltd gave a most educational talk on the different types of power supplies used for cathodic protection. These included thyristor controlled, switch mode and other types and looked at the basis of the electronic arrangements within each type. Jason explained the pros and cons of each type, and how the cost effectiveness of different types of power supply varied dependent on the nature of the CP system.

Jim Preston of Corrosion Prevention Ltd then moved proceedings on to the use and performance of remote monitoring and control systems for cathodic protection. Jim looked at the requirements for monitoring cathodic protection systems as defined in various cathodic protection standards and how this monitoring is done without remote monitoring. Jim went on to explain not only the many benefits with remote monitoring, but also some of the drawbacks that have become apparent over the past 20-years. A particular bugbear was items of kit that stop the CP system working altogether when the monitoring computer fails. Ways in which such equipment could be specified were suggested and it was considered what the realistic service life of such monitoring equipment may be.

The final presentation of the evening was by Dr Chris Atkins of Mott MacDonald. Chris gave a most entertaining presentation on his experience in the use of cathodic protection power supplies and associated remote monitoring systems. Chris drew upon his experience of monitoring the various cathodic protection systems that have been installed on the Runcorn – Widnes Bridge in Cheshire.

Chris reported that over a 20-year period a number of different contractors have installed cathodic protection systems on different elements of the structures. Each of these was state of the art when supplied, but as Chris showed with his selection of historic laptop computers technology rapidly moves on and equipment supplied needs to consider this.

In the following forum the reliability and life of different types of power supplies and monitoring systems were discussed before the Chairman thanked the meeting sponsors BAC Corrosion Control Limited and the speakers for their time in preparing the excellent presentations and papers.
I will start with a couple of plugs for upcoming meetings. On 8th May the Corrosion Engineering Division will have its annual Working Day. This will take place at the Royal Armouries in Leeds and apart from the usual work group meetings (there are seven: coatings, monitoring, concrete, nuclear, water treatment, oil field chemicals and cathodic protection), there will a symposium on “Coatings for the corrosion protection of ancient and modern structures”. A leaflet / registration form should be contained within this issue of CM.

Before that on March 26th there is a Contractors Forum on Paint Inspection being organised by David Horrocks (who incidentally will speak at the CED day). This will take place at BCC Council Chambers and take the form of a panel discussion. A number of experts in the field will be on the panel as well as Paint Inspection Ltd, Network Rail etc. Contractors and paint manufacturers are welcome but please contact David to check on availability of places.

Now to the main theme. I have touched on car corrosion before in my TTs. But it has come to my attention again recently in a technical enquiry that I received about a car made by Triumph. I cannot say more because of a sub-judice (I am NOT acting!). But it does raise questions about what realistic guarantees can be given against car corrosion.

There is no doubt at all that things have mightily improved in terms of protection from the days when I bought my first vehicle, a green Triumph Herald 1360 in 1974 for £315 (SJB 991G). I was, I suppose, lucky that the engine and the body both gave out at about the same time (circa 1981 - these days it would have failed its MOT because of rusting several years earlier!) Is this improvement because of a change in the general environment? Probably not. Main aggressive agent is salt. Still very commonly used on the roads in winter and airborne salt (more apparent close to the sea) is also ever present (as an aside, although no doubt somewhat less salt has been put down this winter, the factor making this winter much less aggressive is the huge amount of rain which has fallen which effectively cleans all the salt off!) So we must look elsewhere for the explanation.

No question paint systems are better with they used to be. The biggest advance has been the use of cathodic electrocoat (I have tested this in the lab and its resistance properties are EXCELLENT). Increasing use is also made of zinc as a coating applied before the paint (ie duplex system). But problems still arise as evidenced by my Megane MOT failure due to corroding brake pipes (covered in the last TT) and the enquiry I alluded to at the start. I teach a course on car corrosion at the University. Two aspects I stress is the way cars are moving towards aluminium body shells (still need a good paint system though - maybe one less coat) And also how better ways for testing the coating are needed.

Techniques such as Electrochemical Noise Measurement and Electrochemical Impedance Spectroscopy could be used for quality control ie to check the system has been properly protected in the first place. Then these methods can be used for regular checks thereafter (in the course I discuss the application of these techniques not just to motor cars but to other organically coated structures). Apart from the body shell (and brake pipes-see previous TT) there are other parts of a car that might give trouble. The exhaust is an obvious example although from my own personal experience (I reckon I have driven about 800,000 miles in my lifetime), I would say that the need to replace this (every couple of years in the bad old days) is much less frequent now . I would think design changes (less condensation of aggressive acids) and material improvements (better protection systems on the steel) are the main reasons.

Corrosion of steel wires in lorry tyres causing blowouts used to be quite common. But the increasing tendency to use nitrogen to fill the tyre (rather than air) lowers considerably the availability of oxygen, lengthening the lifetime of the wires (this is an example of local environmental control). The problems of corrosion in the mixed metal radiator circuit also now seem to be well under control with non-toxic (hopefully) and effective inhibitors incorporated in the anti-freeze. Perhaps the biggest threat is the attack on the electronic components that are such an integral part of the modern motor car. This can be tackled by spraying all the circuit boards with an inert polymer like Paralyne. This is routinely done for critical electronic items used in defence and medical applications. But maybe not so far applied to the typical production motor car.

What about smart coatings which will repair small defects that arise? My view is that this technology is still very much at an early stage. That small bump that locally destroys the coating is not going to instantly repair itself for a while yet!

As usual any comments on this month’s TT please e-mail me at Douglas@harrbridge.freeserve.co.uk
ICORR MIDLANDS BRANCH MEETING
½ DAY MEETING, BIRMINGHAM COUNCIL CHAMBERS; NOVEMBER 2013

The Midlands Branch held a half-day meeting in November 2013 at the Council Chamber of Birmingham Council House. A good-turn out of 45 ICorr members and guests attended the afternoon meeting that was held ahead of the Institute AGM.

The meeting got off to a lively start with a welcome to the Council Chambers by Councillor Dr Barry Henley. Councillor Henley is a chemical engineer and entertained the audience with some tales of his hands-on experiences. ICorr president Trevor Osborne presented Councillor Henley with an Institute tie by way of thanks. During his welcome speech Councillor Henley referred to the Midlands Links Motorways as one of the two of the great corrosion experiments in the region. This led us on to our first paper of the day.

Ali Sharifi, vice chairman of the Midlands Branch kicked things off with a paper entitled 'Cathodic Protection on the UK Midland Links Motorway Viaducts'. Ali explained a little of the history of the motorway network and the causes of corrosion of the reinforcement within the concrete beams and columns. This was due to the detailing and methods of construction at the time, the available materials and the subsequent application of de-icing salts.

Ali then went on to present how repair techniques have been developed, starting with the initial interventions in the early 1980s, the first full scale cathodic protection trials on structures later in that decade and the subsequent adoption of the technique which is still being applied and used. Developments in anode types, control and monitoring equipment and operation were all discussed.

Our second presentation of the day was ‘Confessions of a Corrosion Controller’ by Brian Wyatt. Brian’s presentation was partly a light-hearted review of a 40-year career in the corrosion control industry and partly a more serious consideration of how we should be developing a pathway into the industry for young entrants.

Brian explained how his career had started in Spencer & Partners in the early 1970s and World-wide travel soon followed. Brian’s career has subsequently led him to work in developing designs for cathodic protection systems for major North Sea assets, pipelines and reinforced concrete structures. Brian’s presentation was followed by a discussion with various audience members on how to get more young people interested in a career in our industry.

Peter Davys of Orrest Limited then gave an introduction to the Surfex 2014 exhibition to be held at the NEC in Birmingham. The exhibition is run by the Oil & Colour Chemists’ Association (OCCA) and ICorr have an association with the event. This year’s event will include a technical symposium in addition to the exhibition.

The Chairman thanked the meeting sponsors Freyssinet / CCSL for their hospitality and the speakers for their time in preparing and delivering the first-rate presentations.
Andrew Menmuir of Britannia Operator Limited was the guest speaker at the October meeting. He outlined the agenda, which covered a description of the Non-Intrusive Inspection (NII) philosophy and a case study of how the principle was successfully applied with lessons learnt.

Andrew started his presentation by introducing the content of the NII guidance document DNV-RP-G103 developed by HOIS. He noted that the document provided instructions on how to apply NII with guidance on when to use NII instead of Internal Visual Inspection (IVI) for vessel examination. He explained the NII philosophy noting that it could be used as part of a Risk Based Inspection (RBI) and risk optimisation process. He observed that the use of NII instead of IVI could potentially reduce risk of personnel injury due to opening vessels, avoid damage to vessel during intervention, reduce downtime, ensure optimal inspection of high-risk areas and in some cases may reduce overall cost of inspection.

The case study presented covered an assessment performed on slug catchers due for inspection as part of a Written Schemes of Examination (WSE) under the Pressure Systems Safety Regulations (PSSR) 2000. To optimise inspection of the vessels, NII versus IVI applicability assessments were performed in accordance with the HOIS guidance document. This assessment included a review design and operating data, corrosion assessments and inspection history/capability assessments.

Andrew noted that assessment findings recommended targeted external Close Visual Inspection (CVI) and various Non Destructive Testing (NDT) techniques such as Ultrasonic Testing (UT), Radiography, Time of Flight Diffraction (TOFD) etc. as part of a NII programme. Andrew went on to present the findings from the process noting that a deferment of the slug catcher IVI was recommended after extreme value analyses of the vessel shell UT checks risk assessed as part of Safety Critical Element (SCE) Deferment Risk Assessment process.

Andrew observed that results from IVI performed a year later matched the NII results with minor differences, some of which he explained were due to limitations of the NDT technologies and application. He concluded that there were positive findings when NII was applied as part of a RBI process and recommended that NII should be used alternately with IVI for optimal results. Limitations of inspection techniques and discrepancies in NII and IVI findings formed the basis of discussion during the Q&A session that followed.

The branch Chair thanked the speaker and delegates for attending the meeting. Corrosion Management magazines and continuous professional development certificates were distributed to members immediately after the meeting. For information about the Aberdeen branch activities please contact our branch Secretary, Frances Chalmers, ICorrABZ@gmail.com. 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.
Trevor Osbourne, the National President of ICorr and John Thirkettle of Thor Corrosion were the guest speakers at the November meeting. After the safety brief by the branch Chair, Trevor started by explaining the various ICorr membership categories and how members could continue to develop professionally with assistance from the Institute. He explained how members could attain chartership status through the ICorr and reminded members to visit the ICorr website regularly for latest updates and news.

John Thirkettle delivered the presentation for the night. He started by describing the framework, key statement and gave a brief history of the development of the BS EN 15257:2006 standard. He noted that standard covered three recognised sectors, which were underground or immersed, marine and reinforced concrete with each sector having three levels of competence. John went through how competence could be achieved by gaining the appropriate levels of training and experience in a specific sector stating that competence was measured by professional knowledge, skill, experience and training.

In addition to providing an outline of the requirements for the three levels of certification, John also summarised the meaning of these certification levels. He explained that level 1 meant “the candidate certified to demonstrate outline knowledge and competence in defined tasks”, level 2 meant “the candidate certified to demonstrate competence in the area and a significant increase in level 1 competency” and level 3 meant “the candidate certified to the highest level in at least one sector”. He covered areas such as certification eligibility, training, experience and competence assessment process with exemptions. He also provided information on how members could obtain the required training and experience for certification.

He updated the audience on the status of the standard development with the committee plans going forward. He concluded by encouraging members interested in Cathodic Protection as an area of expertise to get certified and also advised operators to only request personnel who were competent (by training/education and experience). Questions on various aspects of the presentation and continuous professional development via the ICorr followed immediately after the presentation.

Eugene Ogosi, the branch Chair, thanked the speaker for his presentation and members for attending. Corrosion Management magazines and continuous professional development certificates were distributed to members immediately after the meeting. For information about the Aberdeen branch activities please contact our branch secretary, Frances Chalmers, ICorrABZ@gmail.com. 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.
Whether anaerobic digestion, renewable energy, or other sustainable developments, it’s certainly true that environmental and eco-friendly projects are growing in volume, scale, and vision, and many are turning to a proven formula for protection from corrosion as Wedge Group Galvanizing’s Sales Director Trevor Beech explains.

"Over the last few years there has been a rapid increase in the volume of these types of projects and it seems somehow apt that such cutting-edge and innovative companies should turn to the trusted and proven process of hot dip galvanizing to protect their equipment from the elements and other corrosive factors."

Hot dip galvanizing sees clean steel coated with a layer of molten zinc, and a metallurgical reaction between the iron in the steel at the interface and the zinc forms very tough alloy layers. This makes it more robust than other coatings which only bond chemically or mechanically, and it has the added advantage of fully coating the steel, inside and out.

The process has not only proved popular because of its ease of application, cost effectiveness and long-term durability, but also because of its own inherent sustainable qualities.

It lengthens the lifespan of steel, for example, with a single treatment providing a finish which can protect steel for up to 60 years, or even more in the right conditions. Treated steel also needs no maintenance which means that the whole life costs of products protected by hot-dip galvanizing can be further reduced because there is no need for the expense, down-time, and sheer inconvenience of repeated visits.

Galvanizing is also energy-efficient throughout its production and whole lifecycle, with the galvanizing process using resources considerately to ensure a relatively low environmental burden. In addition, galvanized steel can easily be recycled with steel scrap, or it can be re-galvanized or removed and reused elsewhere, further extending its use. Waste zinc is also sold on for use in the cosmetics and health and beauty industry, and natural assets like water are saved through our investment in rainwater harvesting systems where water which falls on the roofs of our 14 sites UK-wide is incorporated into the galvanizing process to counter evaporative losses. These qualities alone make it an appealing choice for an industry that is based upon sustainable technologies and environmental efficiencies.

The Government committed to a target of producing 15% of the UK’s energy from renewable sources by 2020, and this has seen an even more rapid increase in investment in biomass plants. As an organisation, Wedge Group Galvanizing has seen demand for our specialist services increase accordingly in this area, and we recently galvanized more than 1,200 tonnes of steel on behalf of Total Steelwork & Fabrications Ltd as part of a new multi-million pound biomass storage and transfer facility situated at the Liverpool Docks. Its proximity to the River Mersey meant the process of rust and corrosion is faster than in a normal environment, so galvanizing was chosen to extend the longevity of the steel.

We have also been involved in a project which saw us galvanize 120 tonnes of steel for an anaerobic digestion unit in Kent. The AD plant was commissioned to convert maize, grass, and damaged potatoes into electricity which is stored in sealed tanks without any oxygen, an environment where naturally-occurring organisms digest it and release methane-rich biogas. Here hot dip galvanizing was chosen to remove the need for maintenance.

And we’ve galvanized parts for all types of renewable energy equipment too, from bolts for wind turbines, right through to platforms and access ladders. Indeed, more and more sectors are recognising the long-term benefits of hot dip galvanizing, not only to provide protection against rust and corrosion but to ensure long, hassle-free life. And with efforts being made across industry as a whole to ensure practices and procedures are as environmentally-friendly as possible, it seems that hot dip galvanizing is a process set to long remain a leader in the sustainability stakes.
REPAIR PROTECTION & MAINTENANCE (RPM) LTD
THE RIGHT COATING CAN MAKE IT BETTER THAN NEW

By Dan Macdonald, Managing Director, Repair Protection & Maintenance

It is often said that we live in a throw-away age, where it is easier to buy a replacement than try to fix something. This may be alright for things like mobile phones and iPods, but it is another matter when you consider large pieces of capital equipment worth thousands, or even tens or hundreds of thousands of pounds.

This is where industrial coatings come in. They can prevent equipment failing due to corrosion and erosion in the first place, or make it as good as, or even better than, new if a problem does occur.

The cost of corrosion in the UK is around 4% of GDP per annum, but these are costs that can be cut when it is realised that not everything that is corroded necessarily needs replacing.

It is no-longer the case that a corroded tank, pipe, pump or other vessel needs to be replaced; even ones with numerous holes. One way of achieving this is rebuilding corroded or damaged areas with appropriate material and lining the vessel to protect and extend its life.

Anyone who has ever repaired a boat or a canoe will be familiar with the basic principle. You use some suitable material and GRP to repair the hole and then use further GRP layers and other coatings, until the boat is not only water tight but also looks as good as new. While slightly different materials are used, and in industrial strengths, the principle is the same.

These lining methods are a very effective alternative solution to replacement in terms of costs, time and environmental impact. For example, there is no necessity to dispose of contaminated equipment, to dig anything up or knock anything down to deal with the problem.

The same methodology can also be employed to extend the life of new plant and equipment and older equipment can be updated to comply with new legislation.

The effective use of coatings can be employed when a change of service conditions would be advantageous. For example, redundant diesel tanks can, through the use of coatings, be changed to water storage tanks. This effectively recycles the tank, reduces the carbon footprint and saves the costs of a new tank and removal of the old tank.

Large fuel storage tanks can also have their life extended in a similar way. The bottom of the tank and walls, up to around 300mm above the floor, suffer from various forms of corrosion, mainly due to the water content in the fuel; the environmental fall-out along with the subsequent associated costs should a leak occur are immense. A cost effective and environmentally friendly solution is to line these areas with a suitable coating and if required this could be reinforced with a laminate system to strengthen the floor.

It is a wise precaution to implement a regular programme of inspections to monitor the condition of plant, tanks, pipework and equipment, so that damage and wear and tear can be identified early and rectified before it causes a major problem, costly down time and either replacement or expensive repairs.

An additional bonus is the fact that a longer warranty period can often be obtained for something that has been repaired and lined than the manufacturer will offer on brand new equipment. A typical manufacturer’s warranty will be two to three years at most, where coatings companies usually offer up to 10 years, depending on the environment and proposed use.

For further information contact:
Repair Protection and Maintenance Limited, Roall Lane, Kellington, North Yorkshire
DN14 0Ny Tel: 01977 663 111
www.rpm ltd.co.uk

visit the new ICorr website
www.icorr.org
REPAIR PROTECTION & MAINTENANCE (RPM) LTD
RPM HELPS KEEP LEAVES OFF THE LINE

Repair Protection & Maintenance (RPM) assisted Network Rail keep leaves off the line by relining all 125 water bowser tanks in the organisation's Autumn Seasonal Fleet.

Between two and eight of the 17,000ltr tanks are used on each special train in the fleet, to provide water for a jet washing system. Because the fleet needs to operate at speeds of up to 60mph to avoid other traffic on the network, the system operates at 1,500 Bar to ensure removal of railhead contamination. Some of the units also spray the rail head with adhesion modifiers to increase grip. With this kind of pressure, any blockage can seriously damage the jet washing system, so the purity of the water is an important factor, to the point where only potable water can be used.

Network Rail were encountering problems with blockages to the jet wash system which were adversely affecting the cleaning schedules and performance of the units. The cause of the blockages was identified as flakes of paint from the tank lining.

To resolve this, Network Rail called in RPM, which has a long track record of lining tanks of all shapes and sizes. Detailed inspection of a number of tanks revealed the root cause of the problem was the patch repairs previously carried out by another contractor. It was apparent that whilst the localised areas of through film corrosion had been prepared to the right standard, the patch applied had extended well beyond the prepared substrate resulting in poor adhesion and flaking paint.

Due to the number of patches and the large number of tanks affected RPM were asked to provide a repair specification for all the tanks to give a long term solution to the problem. The specification entailed RPM grit blasting the sides of the tanks to remove any poorly adhered paint, localised corrosion deposits and key the surface prior to coating the tanks with Chemco International RA564, a glass flake filled epoxy coating. Any exposed metal would be cleaned back to Swedish Standard SA 2.5 and spot primed with Chemco RSS00P.

Chemco RA564 was selected to provide a tough, near impermeable barrier with extremely good abrasion and chemical resistance. Being low odour and solvent free it was also entirely suitable for application in Network Rail’s Holgate Depot in York, the workshop where the tanks were located.

To minimise the potential dust problem RPM selected chilled iron as the abrasive media and a filtered dust extraction unit and vacuum recovery unit was taken to site to enable the recycling of the grit.

To ensure the project went smoothly RPM set up a production line at the depot, moving the tanks along from stage to stage, working on six tanks at a time.

Says a seasonal and incident fleets spokesperson: “We have been using this system to keep the rails free of contamination for the past eight years, treating most lines twice during the season. It works pretty well and has undoubtedly cut down delays.

Obviously keeping the equipment in tip-top condition is essential to the task, so we selected RPM because we believed it was the best quality company to carry out the work and the price was competitive; we made the right decision.”

For further information contact: Repair Protection and Maintenance Limited, Roall Lane, Kellington, North Yorkshire DN14 0NY Tel: 01977 663 111 www.rpm ltd.co.uk

CORROCOAT LIMITED
CORROCOAT PROTECTING ASSETS ACROSS THE WORLD

In 2013 Corrocoat carried out a large project that involved many different companies around the world.

After discussions it was decided that Polyglass VEF a glass flake filled vinyl ester coating and biofoul which is an anti fouling system, were the system of choice to protect a large seawater caisson in 5 sections. The caisson was fabricated in Scotland, then sent down to Corrocoat's Leeds workshop. The 30” diameter 97.5 metre long Caisson in 5 sections was blasted internally and externally with new abrasive to S.A 2½. Polyglass VEF was the applied internally using Corrocoat’s own unique internal pipe spraying equipment to a dft of 750 microns. Externally the system was applied using airless spray units to a dft of 750 Microns. Polyglass VEF is a proven system in aggressive environments and will give excellent corrosion protection in excess of 25 years.

The client also requested an anti-foul system. Biofoul was specified and applied over the Polyglass VEF at a dft of 400 microns. Biofoul is a three pack cold cured system containing copper flakes. The product is non-toxic and has excellent anti fouling properties. Biofoul will withstand flow velocities in excess of 25M/S.

The caissons were then wrapped and protected for shipping to South Africa. Corrocoat SA then coated the field joints internally and externally after welding, on-site.

The project was a major success and demonstrates Corrocoat’s capability at carrying out complex projects that meet the deadlines set by the various multi national companies involved.

Corrocoat have a proven track record of providing long term corrosion protection, to a wide range of capital equipment operating in aggressive environments.

For further information contact: Corrocoat Limited, Forster Street, Leeds, West Yorkshire, LS10 1PW United Kingdom Tel: 44 (0)113 276 0760 Fax: 44 (0)113 276 0700 www.corrocoat.com
The London Tube network fights a never-ending battle with corrosion, as environmental conditions and heavy wear combine with age. As 2013 saw the 150th anniversary of the Metropolitan Railway - the world’s first underground railway – one Underground renovation project has won awards for exemplifying the theme of “heritage with strength”.

London-based infrastructure specialists Rhinoceros took on the works to strengthen underpinning and replace decorative fittings and all of the faience tiling throughout the complex structure, which includes 5 separate entrances at different levels and passes beneath one of London’s busiest road intersections.

Main girders spanning station platforms were suffering from extensive corrosion, in part due to their concrete cover being less than 50mm in places. One street entrance to the subway network had also received a direct hit from a double-decker London bus, requiring extensive rebuilding, and tiles throughout the structure were badly cracked and stained.

Demolition and removal of the old tiles was followed by concrete repairs and installation of stainless steel mesh (EML) to reinforce new rendering of all walls, in preparation for re-tiling. Eml mesh was secured using 9000 Reiner Fixings, while corroded areas of steel were cleaned back to clean steel and primed with Fosroc zinc rich primer followed by concrete repairs with Fosroc Renders A finish coat of Renderoc GP approx 22mm was then applied through the Eml to provide a true base for the faience tiles. These were fixed using Ardex X77 adhesive.

The original faience tiles, in stone oatmeal colour and contrasting detail stripes, were originally made in 1935. Replacements were sourced from the original manufacturers (Shaws of Darwen, still in business). Expert work was required since long horizontal stretches had to be matched with the complex underground topography.

**PARAPETS AND PLINTHS**

Rhinoceros craftsmen concurrently cleaned, repaired and re-polished granite plinths dating from 1935 at the entrances to the pedestrian subways. These had suffered considerable deterioration and damage, not least from a number of vehicles including two London buses. Also, during WW11, a bomb had been dropped on the road above the subways causing considerable damage.

Using traditional stone mason skills and natural materials, crushed granite and marble, Rhinoceros craftsmen restored the original beauty and lustre of these stones. The new finish is a terrazzo type granolithic material, a close match to the original. A new spheroidal steel parapet was manufactured, replicating the original bronze parapet installed in 1935.

New brass handrails were installed where the originals were beyond repair, and other signage was repaired. Lighting was replaced in modern but sympathetic style, along with electrical wiring. The project was topped off with new London Underground signs following the original 1930’s design.

As usual in London, all work had to be completed while maintaining passenger access through the subways.

Monument tube station was originally opened in 1884, then linked to Bank station in 1933. Its pedestrian subways carry both passengers and an additional high volume of foot traffic under the busy road junction of King William Street, Gracechurch and Cannon Streets with Eastcheap.

The work by Rhinoceros was recognized with a winning award for Craft Skills at the National Railway Heritage Awards 2013. The award, for ‘craftsmanship skills in the use of materials and/or modern technology in the repair or conservation of an historic railway or tramway building or structure in any ownership’ is sponsored by First Rail.

(Materials used include a range of concrete repair materials and high strength renders from Fosroc. Fixings by Reiner, Tile adhesive and grouts from Ardex, Lighting by Holophane, Stainless Steel conduit from Lasnek, cables from Anixer. Tiles from Shaws of Darwen. Specialist sub-contractors Cast Iron Welding Services for parapets, F W Hall Ltd for handrails and Rupert Harris Ltd for restoration of bronze signage. B & T Asphalt for gullies and drainage channels.)

For further information contact:  
RHINOCEROS, Tel: 020 8444 6165  
Email: contracts@rhino247.co.uk  
www.rhino247.co.uk
The European Federation of Corrosion is the largest corrosion organisation in Europe and in the world, dedicated to advancing the science and engineering of corrosion and the protection of materials. It represents over 30 national societies and affiliate members from 25 European countries with an increasing number of international members from outside of Europe. Its three secretariats are located in London, Paris and Frankfurt and its activities are carried out through its 20 working parties of corrosion specialty areas.

EUROCORR is the EFC’s annual flagship event and has become one of the biggest corrosion congresses in the world.

EFC WORKING PARTY 15: CORROSION IN THE REFINERY INDUSTRY
Chairman: Francois Ropital, IFP Energies nouvelles, BP3, 69360 solaize France
Email: francois.ropital@ifpen.fr
Vice Chairman: Hennie De Bruyn, Saudi Aramco
Email: hendrik.debruyn@aramco.com

ACTIVITIES:
Information Exchange
- Sharing of refinery materials /corrosion/ inspection experiences by operating company representatives.

Forum for Technology
- Sharing materials/ corrosion/ protection/ monitoring information by providers, users, R&D.

Scientific exchange
- Sharing materials/ corrosion/ protection scientific works.

Development of documents, guidelines, publications related to corrosion in the refinery industry.

STRATEGY:
Survey of corrosion problems in refinery industry.
The group will collect information first on hydrotreating and hydrotreating units, then processes as FCC, Catalytic reforming, Distillation, Sulfur plant, Alkylation, Sour water stripper will be considered, Stress relaxation cracking, Guideline and publication will be issued.

Corrosion under insulation (new EFC Guideline n°55).
Failure cases presentations and discussions.

Corrosion resistant materials
Presentation and discussion on new CRA materials for refinery application.

Corrosion by sour waters (SSC, SOHIC)

INHIBITORS

Monitoring of corrosion

PUBLICATIONS
- EFC Book 40 “Requirements for cooling water systems”
- EFC Book 42 “Collection of Selected Papers”
- EFC Book 46 “Amine Unit Corrosion Survey”
- EFC Book 55 “Corrosion under insulation

NEXT PLANNED PUBLICATION:
A revision of the current guidelines is deemed as being timely and useful, particularly for old equipment that will not be covered by future ISO standards.

The revision is in progress and proposals of modifications have been received for the different chapters. Stefan Winnik will prepare a draft of the complete revised document for its examination during the April 2014 WP15 Spring meeting.

DATE AND PLACE OF NEXT MEETING:
Spring meeting: April 8th 2014 Mechelen (Brussels) – Belgium Annual meeting during EUROCORR 2014 Congress in Pisa (Italy) 8-12 September 2014.

Excerpts from this past September 5th meeting minutes at EUROCORR 2013 in Estoril can be found on the EFC website. (file “Minutes of the 12 September 2012 meeting” enclosed).

For further details and minutes of Working Party activities on Corrosion in the Refinery Industry please refer to the WP 15 webpages on the EFC website: www.efcorg.com

EUROCORR 2014  September 8-12 Pisa, Italy
The Call is Now Open!
Abstract submission instructions and the submission tool can be found online at www.eurocorr2014.org

For membership inquiries contact: Juliet Ippolito, juliet@unina.it
ABSTRACT
This paper deals with the effect of shallow (-80° C for 5 h) cryogenic treatment (SCT) and deep (-196° C for 24 h) cryogenic treatment (DCT) on the corrosion performance and the elastic behaviour of En 19 steel. Potentiodynamic polarization tests and the impulse excitation tests were performed to evaluate the corrosion and elastic behaviour of the cryogenically treated samples. The results showed that the cryogenic treatments do not have a major influence on the corrosion rate of En 19 steel when compared to conventionally heat treated (CHT) samples. However, in the case of alkali conditions the DCT seemed to offer higher corrosion resistance than the other samples. Impulse excitation technique also revealed that DCT reduces linear expansion of En 19 steel samples when compared to CHT.

Keywords: Corrosion, Elastic properties, Linear Expansion, steel, cryogenic treatment.

1.0 Introduction
Many critical or highly stressed steel components are subjected to conventional heat treatment to achieve a combination of high strength and toughness as pointed out by Ferguson et al. [1]. For the past two decades, research efforts have been made with an aim to reduce the wear of crankshafts, axle shafts, steering joints and many other automotive components and also mineral processing equipment namely cyclones, pumps, and heavy medium vessels [2]. En 19 steel is widely used for these applications, yet, wear and corrosion present application challenges for the use of such steel components, hence the interest by the researchers in enhancing the lifetime under wear/corrosion conditions [3].

Cryogenic treatment is nowadays a wide spread technology used for improving the tribological behaviour of steels [4]. Two kinds of cryogenic treatment namely shallow (SCT, -80°C for five hours) and deep cryogenic treatment (DCT, -196°C, 24 hours) may be carried out between quenching and tempering in conventional heat treatment (CHT) process [5-6]. To improve the wear resistance of existing metals in a relatively economic manner, several treatments, aimed at increasing the volume fraction of the martensite phase, are being considered [7]. Amongst these treatments, shallow and deep cryogenic treatments seem very promising and not too expensive routes, although little research has been yet reported to date. What literature is available appears to be mainly focused on medium carbon steel [8]. The cryogenic treatment can convert the retained austenite to martensite along with carbide precipitation, thus improving the tribological properties, hardness and compressive residual stress of steels [4-7].

The purpose of the current work is thus to investigate the effect of the SCT and DCT on the elastic behaviour and general corrosion performance of En19 steel in different environments (acidic medium (H₂SO₄), alkali medium (Na₂CO₃) and neutral medium (NaCl).

2.0 MATERIAL
The composition of the En 19 steel (in weight percent) is given as: C - 0.45, Si-0.35, Mn-0.75, P-0.017, Si-0.019, Cr-1.19, Mo-0.21.
diameter and 15 mm long. Potentiodynamic polarization technique was used to investigate the corrosion performance of the steel having different treatments, namely CHT, SCT and DCT. Tests were conducted in a 500ml Pyrex cell using the samples as the working electrode, saturated Ag/AgCl as reference electrode and platinum mesh as counter electrode. The samples were soldered to a copper wire and then mounted in epoxy resin allowing a fixed working electrode surface area of 0.785cm². Potentiodynamic polarization tests were carried out in three solutions (3.5 wt% NaCl, 2M H₂SO₄, and 1M Na₂CO₃) at room temperature using a voltage range between -1 and 0.2V with a potential sweep rate of 10 mV s⁻¹.

Prior to immersion, the samples were polished using a series of grinding papers at 120, 180, 240, 360, 400, 600, 800, 1000, 1200, 2500, and 4000. The samples were immersed in the test solutions during 25 minutes before polarization to allow Open Circuit Potential (OCP) stabilization. Fresh samples (metal and electrolyte) were used for each measurement. All measurements were carried out using Autolab® PGSTAT302N equipped with NOVA software for data acquisition and analyses.

2.3 Impulse Excitation Test

An impulse excitation technique was carried out by softly tapping a sample with a small hammer and recording/analyzing the induced sound vibration. This technique was used to determine the Young’s modulus, resonant frequency, and internal friction at room temperature. The ASTM E1876 standard [11] was adopted for the test. Firstly, the impulse tests were carried out for the CHT, SCT and DCT treated samples of size 30mm length and 10 mm diameter. Then the samples were machined into 7 mm diameter, retaining the original 30 mm length, and then Young’s modulus, resonant frequency, and internal friction were determined in order to find out the influence of machining on cryogenic treatment. Thirdly, linear expansions of machined CHT and DCT samples were also measured continuously from 50ºC to 500ºC. Microstructures of CHT, SCT and DCT were also reported in this study.

3.0 RESULTS AND DISCUSSION

Cryogenic treatment leads to greater benefits including wear resistance, hardness and compressive residual stress due to a reduction in the amount of retained austenite in the microstructure. Our previous x-ray diffraction studies on En 19 steels revealed that the deep cryogenic treatment sample consists of 2.7% retained austenite, shallow cryogenic treatment consists of 5.1% retained austenite, conventional heat treatment consists of 6.5% retained austenite.

3.1 Corrosion Test

3.1.1 Corrosion performance of En 19 steel in NaCl solution

The potentiodynamic polarization curves for the bulk metal of the cryogenically treated (SCT and DCT) and conventionally heat treated samples (CHT) in 3.5 Wt% NaCl solution at room temperature are shown in Figure 2.

As can be seen from Figure 2 and Table 1, the three treatments lead to similar corrosion behaviour in an acidic environment, although with some small differences depending on the cryogenic treatment with respect to the general corrosion and the breakdown potential. While the SCT has no clear effect on the uniform corrosion rate of conventional En 19 steel (CHT), the DCT tends to slightly increase the corrosion rate in salt solution, which could be due to a higher amount of martensite phase as found for other type of steels in previous reports [12] [13]. The DCT samples lead to a decrease of corrosion potential (Ecorr) when compared to CHT and SCT samples. The decrease of Ecorr is higher for
the DCT sample due to the higher amount of martensite which shifts the $E_{\text{corr}}$ of the steel towards more anodic potentials. This trend also coincides with results found in Sarkar et al. [12].

As can be seen from Figure 2, the behaviour of the anodic current of the CHT and DCT samples is similar to materials subjected to surface passivation, thus reaching a “nobler” state. This was also evident in the case of chromium, nickel and nitrided steel, as reported by Chyou et al. [14] and Isaacs [15]. The results indicate that the initial surface passivation response of the CHT is lost when compared to SCT (i.e. after five hours of cryogenic treatment). However, after DCT, the passivation capability of the sample is restored or not lost, suggesting that the reason of passivation and corrosion resistance is not the same for CHT and DCT. Because, both SCT and DCT are fundamentally two different cooling treatments.

Although the main target of the cryogenic treatment is to complete the transformation of austenite to martensite in the bulk of the sample, the conditions applied during the cryogenic treatments could also cause some surface modification, especially in the case of DCT. To clarify the possible effect of the cryogenic treatment on the surface corrosion performance, the surfaces of the samples were subjected to a potentiodynamic polarization test. In the case of CHT, the surface is less susceptible to passivation than the bulk (Figure 3). The formation of a protective passive film inhibits corrosion damage. The corrosion rate of the bulk is greater than the corrosion rate of the surface, as can be seen in Table 1. This difference can be attributed to the protective layer on the surface of the sample during the conventional treatment, which produces surface hardening.

In the case of the DCT sample, clear differences can be seen from the point of view of the general corrosion rate, indicating that the bulk and the surface are not similar (Figure 4 and Table 1). Nonetheless, the surface material is clearly more cathodic and susceptible to active corrosion (i.e., not forming a passive layer), indicating a higher sensibility to localized corrosion. One possible explanation to the surface being more corrosion susceptible than the bulk could be due to the state of residual stresses depends on the time shift of the martensitic transformation in the surface and in the core of the samples during the cooling process at -196°C. Apart from oxidation, a possible reason for the different corrosion resistance of the core and the surface could be the state of the residual stresses at the surface (i.e. compressive stresses after DCT, tensile stresses after SCT and after CHT [5]). However, in the bulk, the residual stresses

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Figure 3: Polarization curve recorded in 3.5 wt % NaCl at a scan rate of 10 mv/s for bulk and surface of CHT sample.

Figure 4: Polarization curve recorded in 3.5 wt % NaCl at a scan rate of 10 mv/s for bulk and surface DCT sample.
The susceptibility to localized corrosion is, generally, higher on the surface than on the bulk of the samples and strongly related to the formation of a passive layer. In the bulk of the CHT and DCT samples, where the formation of the passive layer is more clear to take place during the polarization test, the current increased rapidly after the breakdown potential (around -0.41 V for both samples). In the case of the SCT sample, the increase in current is more gradual after not-so-clear passivation. The results suggest that the surface of the DCT is different to that one of the CHT and SCT.

3.1.2 Corrosion performance of En 19 steel in Na$_2$CO$_3$ solution

Figure 6 shows the potentiodynamic polarization curves for the bulk of the CHT, SCT and DCT samples in 1M Na$_2$CO$_3$ solution. It can be seen that the $I_{corr}$ values for SCT and DCT are almost same, with the $I_{corr}$ value for the CHT sample being slightly higher. At the same time, the three samples show very clear, and similar, passivation behaviour after the corrosion peak. Upon increasing the anodic scan limit to 2V (versus Ag/AgCl reference), passive film breakdown potentials were observed at almost the same potential (about 0.75V) for the three samples before they show another passive state. In the case of the CHT and DCT, the passivation layer seems to offer more protection and to form at lower potentials than in the case of the SCT as observed with the lower corrosion currents. The results show that the corrosion resistance of the DCT steel in alkali media, based upon passive film currents measured in the different media, is higher than that of CHT and SCT.

3.1.3 Corrosion performance of En 19 steel in H$_2$SO$_4$ solution

Due to the diverse type of environments in which En 19 is normally used, the samples were also immersed in an acidic media and their corrosion behaviour tested. Figure 7 shows the potentiodynamic polarization curves for the bulk of the CHT, SCT and DCT samples in 2M H$_2$SO$_4$ solution. Noticeably, the three samples show the same behaviour indicating that in acidic media the cryogenic treatments do not harm nor benefit the corrosion performance of the En 19. It should be noted that the corrosion currents in acidic media are about two orders of magnitude higher than in alkaline solutions due to the high rate of the cathodic hydrogen ion reduction reaction.
3.2. Elastic behaviour

The test results of the elastic properties for CHT, SCT and DCT conditions are presented in Table 2. The Young’s Modulus values of CHT, SCT and DCT samples have approximately the same values for both before and after machining conditions. Note: the steel samples are subjected to machining process reducing the 10mm cross-section to 7 mm. Before machining, the internal friction of DCT sample is lower when compared to CHT and SCT, because of a greater number of interstitial carbon atoms separated to the nearby dislocations during the process of DCT.

The DCT increases its lattice distortion and thermodynamic instability; the large internal stresses result in the segregation of carbon atoms to nearby defects forming clusters [16-17].

The internal friction of DCT samples is marginally increased when compared to CHT samples. Heating of samples during machining process may be responsible for the residual stress relaxation thereby increasing the internal friction of DCT when compared to CHT.

It is observed that the linear expansion (change in length as a function of original length - \( \Delta L/L \)) for the DCT sample is reduced when compared to the CHT sample as shown in Figure 8. Our previous studies report on retained austenite present in the samples of En 19 steel when subjected to CHT, SCT and DCT using X-ray diffraction techniques. After conventional heat treatment of steel samples (i.e. CHT), it was reported that there is 6.5% retained austenite. The sample after SCT results in the reduction of retained austenite from 6.5% to 5.1%. The sample after DCT results in a further reduction of retained austenite from 6.5% (CHT) to 2.7%[7]. The reduction of retained austenite content in the SCT and DCT samples shows that cryogenic treatment promotes the transformation of retained austenite into martensite. This causes a reduction in linear expansion of En 19 steels. The microstructural studies of the treated samples were also carried out to see if any significant changes occurred. Fig.9. a, b, c shows the SEM micrographs of CHT, SCT and DCT samples at a magnification of 20000X. The martensitic structure is observed in CHT, SCT and DCT samples. There are no micro-structural changes observed between CHT, SCT and DCT samples. Therefore no appreciable differences could be detected by Scanning Electron Microscopy, due to the Wanted...
small amounts (less than 10%) of retained austenite. However, Senthilkumar et al. and Arockia Jaswin et al. [18]-[19] reported that the reduction in linear expansion is due to the transformation of retained austenite along with the carbide precipitation and grain coarsening effect, which was promoted by cryogenic treatment.

4.0 CONCLUSION

The corrosion behaviour of the cryogenically treated (SCT and DCT) and the conventionally heat treated (CHT) samples has been studied in neutral, acidic and alkali environments. The results obtained showed that the cryogenic treatment did not dramatically increase nor decrease the corrosion rate of En 19 in any of the studied conditions, although in the case of alkali conditions the DCT seemed to offer higher corrosion resistance than the other samples due to the formation of a passive film at low oxidation potentials.

It has been found that the cryogenic treatment did not alter Young’s Modulus of En 19 steel. It has also been found that the internal friction of SCT and DCT conditions is lower than that of CHT sample. The linear expansion of the DCT samples is lower than that of CHT.

ACKNOWLEDGMENTS

The authors wish to thank Dr. S.J. Garcia and Dr. A.M. Abdelkader, Professors of Novel Aerospace Materials, Faculty of Aerospace Engineering, Delft University of Technology, Kluyverveeg 1, 2629 HS Delft, The Netherlands, for having extended their corrosion testing facilities for the successful completion of work.

References


Table 2. Impulse Excitation Test Results

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<th>Prior Machining Average Residual Frequency</th>
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<th>After Machining Average E-modulus</th>
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Table 2. Impulse Excitation Test Results
SOUTH STAFFS WATER CHOOSE DENSO STEELCOAT PROTECTION

Winn & Coales Denso Steelcoat 100/400/700 system was recently chosen by South Staffs Water to give long-term protection to a pipebridge over the river Stour near Stourbridge, West Midlands.

The specialist contractors for the project were Deborah Services Ltd, Industrial Services Division, head office in Wakefield. Following hand preparation to ST2 standard using scrapers, wire brushes and emery cloth of the 30 metre pipebridge to remove the residue of previous paint coatings, the water pipe was then protected with Denso Steelcoat 100 and 400 Tape Wrap systems. The Denso Steelcoat 400 consisted of: Hi-Tack Primer, Denso Profiling Mastic, Hi-Tack Tape, Ultraseal Tape, followed by a final two coats of acrylic topcoat.

The steelwork on the main structure of the water bridge was protected using Denso Steelcoat 700 system. This consists of Denso ST Epoxy followed by a top coat of Denso Weathershield.

For further information contact: Winn & Coales (Denso) ltd., Chapel Road, London SE27 0TR
Tel: 020 8670 7511  Fax: 020 8761 2456  e-mail: mail@denso.net  website: www.denso.net

DENSO PROTAL AGAIN CHOSEN FOR BRINE FIELDS WELD JOINTS

Having used Winn & Coales Denso Protal, with its corrosion resistant properties, to coat steel welded joints and fittings on the 900mm Stublach Minimum Offtake contract for National Grid, J Murphy and Sons Limited have again chosen Denso Protal 7000 brush grade to protect additional welded joints and fittings. These are on the 750mm bi-directional pipeline tie-in to the Minimum Offtake to connect the underground Gas Storage Infrastructure being developed by Storengy UK Ltd, a subsidiary of Gaz de France.

Following shotblasting to the Swedish St 2 standard, Murphy applied the Denso Protal 7000 which enabled them to obtain a required coating thickness of 1000 microns in two applications.

Winn & Coales Denso Protal coatings give effective anti-corrosion properties by forming a firmly bound corrosion inhibiting film on the metal surface. The result is a thick, effective physical barrier against air and moisture which remains permanently flexible. The brush grade can be applied by plural Hydrocat spray.

For further information contact: Winn & Coales (Denso) ltd., Chapel Road, London SE27 0TR
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18-20 June 2014 in Aberdeen, Scotland
1,855 GBP per person

This 3-day introductory course will teach participants the qualitative and quantitative Risk Based Inspection (RBI) methodology within DNV-RP-G101 and API 580 for oil and gas production. The course covers practical exercises including:

- Damage mechanism assignment
- Probability of failure
- Consequence of failure and risk calculations
- Interpretation of assessment results
- Formulation of inspections plans

This DNV-RP-G101 course will help corrosion engineers apply RBI technology to upstream, offshore pressure systems where escalating failure consequence is an important safety consideration.

Discounts are available for early bookings and for group bookings. To make a booking or for additional course information please send an email to:

 julian.speck@dnvgl.com

DNV GL, Palace House, 3 Cathedral Street, London SE1 9DE, UK.
Telephone: +44 (0)20 7357 6080.

ONSHORE RISK BASED INSPECTION (RBI) USING API 581 AND API 580

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This 3-day introductory course will teach participants the qualitative and quantitative RBI methodology within API 580 and API 581 for the downstream and midstream refining, petrochemical, and gas processing industries. The course covers practical exercises including:

- Damage mechanism assignment
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This API 581 course will help corrosion engineers apply RBI technology to downstream, onshore pressure systems with a complexity of damage mechanisms and materials of construction.

Discounts are available for early bookings and for group bookings. To make a booking or for additional course information please send an email to:

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Metallisation flamespray equipment has been used to protect a BP Clair Ridge offshore oil platform from corrosion. The 168 metre high platform will be installed in the North Sea west of the Shetland Isles.

Clair Ridge jackets have seven storage tanks, two drill water tanks and a base oil tank, in the Drilling Production (DP) jacket, and four diesel tanks in the Quarter Utility (QU) jacket. The project specified the jackets to be metal sprayed, to protect from corrosion, using arcspray equipment. The system for the internal storage tanks was to be sprayed with 200 – 300 microns Thermal Sprayed Aluminium (TSA), the drill water tanks were to be sealed with aluminium silicone and the base oil and four diesel tanks were to be left unsealed.

Due to the complexity and dimension of some of the jacket components, it was impossible to coat all of them using arcspray equipment. Piping nozzles in diaphragms, pipe supports and difficult to access areas were coated using the Metallisation MK73 flamespray equipment and the deflected flamespray extension, which was designed specifically for difficult to access areas. The major advantage of the MK73 system is the extra long supplies package that accompanies the equipment, which in this instance made an extremely difficult spraying project much easier and safer.

To metal spray the internal surfaces of the pipes, the operators had to crawl within the pipes and, with a dimension of just three and a half metres or less, it was no mean feat. The 80 metre long supplies package allowed the operators to leave the control panel and gas bottles outside, enabling them to reach the difficult to access areas safely and effectively.

The Metallisation deflected flamespray extension is ideal for onsite use. It comes in three lengths, 150mm, 300mm and 450mm and can be used with either 3.17mm or 4.76mm wires. The unit can spray directly forward or at a deflected angle, which can range from 00 to 900 by varying the deflector air pressure. The deflection nozzle can also be rotated through 1800 to allow spraying in a 3600 arc around the pistol.

Metallisation attended site for several days to train, support and customise the system to meet with the requirements of this demanding application. It was important for Metallisation to get good, first hand insight into the job, which enabled the team to fully understand the issues facing the customer. Safety is obviously critical in these confined spaces and keeping the gas supply and control panel outside of the confined space greatly assisted in safe completion of the job. Inside the jacket access to some of the spray areas was very tight. The general flexibility of the MK73 flamespray system, combined with the deflected extension, made the job quicker and easier to complete.

In the Metallisation wire flamespray process, the raw material in the form of a single wire or cord, is fed by a driven roller system into the centre of an oxygen-gas flame, where it is melted. An annular air nozzle then applies a jet of high-pressure air, which atomises and projects the molten material towards the work piece. The molten spray solidifies instantly on the component surface to form a dense, strongly adherent coating that has no drying or curing time. The driving of the wire is typically via an air motor and gearbox that forms part of the pistol. The gas fuel used varies, depending on the wire to be sprayed and, in some cases, the application. The two most common gas fuels used are Propane and Acetylene.

David Stowers, Lead Coating Inspector on the project, says: “I am very pleased with the performance of the MK73 system. It proved to be a really useful tool in helping us to reach a successful conclusion on the TSA scope of this project. The angled deflector extension arm was perfect to reach the most difficult surfaces. I wouldn’t hesitate to recommend the Metallisation team and its equipment.”

For further information contact: Stuart Milton, Sales Director, +44 (0) 1384 252 464 or visit www.metallisation.com
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Donyal Engineering Ltd
Holborn Industrial Estate, Burnopfield, Newcastle Upon Tyne NE16 1EA
T: 01207 270909

Drys & Butler Ltd (Rail)
Mead House, Station Road, Nunsling, Southampton,
SO16 OAH, UK
T: 02380 667549

ENC (Yorkshire) Ltd
Unit 3B Rotherham Road, Dinnington
Sheffield, S25 3RF
T: 01909 567860

E P Painting Ltd
Rossfield Road, Rossfield Trading Estate
Ellesmere Port, Cheshire CH65 3AW
T: 0151 355 8141

Excel Contractors Ltd
11a West End Road, Bitterne, Southampton
SO18 6TE
T: 02380 444420

F A Clover & Son
Bardolph Road, Richmond
Surrey, TW9 2LH
T: 0208 948 6321

Forth Estuary Transport Authority
Forth Road Bridge, Administration Office
South Queensferry, EH30 9SF
T: 0131 319 1699

Gabre (UK) Ltd
9 Holme Road, Drromore, Omagh
Co Tyrone, BT78 3BX
T: 02892 897950

H&H Painting Contractors Ltd
Unit 3 Bell Park, Bell Close, Newnham Ind Est
Plymouth PL7 4TA
T: 07837 382619

Harsco Infrastructure UK Ltd
Unit 3 Manby Road, South Killingholme, Immingham,
North Lincolnshire, DN40 3DX

Harrisons Engineering Lancashire Ltd
Judge Wilmye MILL Longworth Road
Billington, Clitheroe, Lancashire, BB7 9TP
T: 01254 823993

Herrington Industrial Services Ltd
Crown Works, Crown Road, Low Southwick, Sunderland
SR5 2BS
T: 0191 5160634

Hi-Tech Surface Treatment Ltd
Unit B, Deacon Trading Estate, Chickenhall Lane,
Eastleigh, Hants SO50 6RP
T: 023 80611789

Hyspec Services Ltd
Unit 3 Meadowfield Industrial Estate,
Cowdenbeath Road, Burntisland,
Fife, KY3 0LH
T: 01592 874661

Industrial Coating Services
A1 House, Rolling Mill Street, Norton Canes, Cannock
WS11 9UH
T: 0845 474 0007
<table>
<thead>
<tr>
<th>Company Name</th>
<th>Address</th>
<th>Phone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industrial Painting</td>
<td>48-49 RCM Business Centres, Sandbeds Trading Estate, Dewsbury Road, Ossett, WFS 9ND</td>
<td>T: 01924 272606</td>
</tr>
<tr>
<td>International Energy Services Ltd</td>
<td>94 AwoLOWO, IyOy, Lagos State, Nigeria</td>
<td>T: 0146156366</td>
</tr>
<tr>
<td>Interserve Industrial</td>
<td>Unit 2, Olympic Park, Poole Hall Road Ellesmere Port, Cheshire, CH66 1ST</td>
<td>T: 0151 3737660</td>
</tr>
<tr>
<td>J Murphy &amp; Sons Ltd</td>
<td>Hiview House, Highgate Road, London NW5 1TN</td>
<td>T: 020 7267 4366</td>
</tr>
<tr>
<td>Jack Tighe Coatings</td>
<td>Sandall Lane, Kirk Sandall, Doncaster, DN3 1QR</td>
<td>T: 01302 880360</td>
</tr>
<tr>
<td>Jack Tighe Ltd</td>
<td>Redbourne Mere, Kirton Lindsey, Gainsborough, Lincs, DN21 4NW, UK</td>
<td>T: 01652 640003</td>
</tr>
<tr>
<td>JPV (Painters) Ltd</td>
<td>Unit 8 Prospect Way, Hutton Industrial Estate, Brentwood, Essex, CM13 1XA, UK</td>
<td>T: 01277 201515</td>
</tr>
<tr>
<td>KAEFER Opus Ltd</td>
<td>Ethan House, Royce Avenue,Cowpen Industrial, Estate, Billingham, TS23 4BX, UK</td>
<td>T: 01642 371850</td>
</tr>
<tr>
<td>Keep Protective Coatings Ltd</td>
<td>Unit 4, James Park, Mahon Road, Portadown, County Armagh BT62 3EH</td>
<td>T: 02838 338151</td>
</tr>
<tr>
<td>Lanarkshire Welding Co.</td>
<td>82 John Street, Wishaw, Lanarkshire, ML2 7TQ</td>
<td>T: 01698 264271</td>
</tr>
<tr>
<td>Mabey Bridge Ltd</td>
<td>Station Road, Chepstow, Monmouthshire NP16 5YJ</td>
<td>T: 01291 623501</td>
</tr>
<tr>
<td>Maclean &amp; Speirs Blasting Ltd</td>
<td>Unit D, East Fulton Farm, Darlutch Road, Linwood, Paisley PA3 3TP</td>
<td>T: 01505 324777</td>
</tr>
<tr>
<td>M&amp;B Decorators Ltd</td>
<td>26 Jail Lane, Biggin Hill, Westerham Kent TN16 3SA</td>
<td>T: 0770 2051729</td>
</tr>
<tr>
<td>MCL Coatings Ltd</td>
<td>Pickering Road, Halebank Industrial Estate, Widnes, Cheshire, WA8 8XW</td>
<td>T: 0151 423 6166</td>
</tr>
<tr>
<td>NSC UK Ltd</td>
<td>Fourth Avenue, Deeside Industrial Park, Deeside, Flintshire CH5 2NR</td>
<td>T: 01244 833138</td>
</tr>
<tr>
<td>N L Williams Group Ltd</td>
<td>Westside Industrial Estate, Jackson Street, St. Helens, Merseyside WA9 3AT</td>
<td>T: 01744 26526</td>
</tr>
<tr>
<td>Northern Protective</td>
<td>16 High Reach, Fairfield Industrial Estate, Bill Quay, Gateshead, Tyne &amp; Wear, NE10 0UR</td>
<td>T: 0191 438 5555</td>
</tr>
<tr>
<td>Nusteel Structures</td>
<td>Lyme Industrial Estate, Lyme, Hylte, Kent, CT2 1LR</td>
<td>T: 01303 268112</td>
</tr>
<tr>
<td>Offshore Marine Services Ltd</td>
<td>Brumby House, Jalan Bahasa, PO Box 80148, 87011 Lubuan F.T. Malaysia</td>
<td>T: +356214244410</td>
</tr>
<tr>
<td>Orrmac Coatings Ltd</td>
<td>Newton Chambers Road, Thomcliffe Park Estate, Chapeltown, Sheffield, S35 2PH</td>
<td>T: 0114 246 1237</td>
</tr>
<tr>
<td>Over Rail Services Ltd</td>
<td>Unit 10 Milhead Way, Purdys Industrial Estate, Rochford, Essex, SS4 1ND</td>
<td>T: 07976372866</td>
</tr>
<tr>
<td>Paintel Ltd</td>
<td>Trianon, Westover, Ivybridge, Devon, PL21 9JH</td>
<td>T: 01752 719 701</td>
</tr>
<tr>
<td>P&amp;H Shotblasting &amp; Spraying Services</td>
<td>43a Drumraine Road, Castledaculafield, Dungannon, Co Tyrone, BT87 3NY</td>
<td>T: 028 8776 7722</td>
</tr>
<tr>
<td>PCM Nigeria Plc</td>
<td>99 Rivoc Road Trans Amadi, Port Harcourt, Rivers State, Nigeria</td>
<td>T: +2348055237828</td>
</tr>
<tr>
<td>P H Shotblasting &amp; Spraying Services</td>
<td>43a Drumraine Road, Castledaculafield, Dungannon, Co Tyrone, BT87 3NY</td>
<td>T: 028 8776 7722</td>
</tr>
<tr>
<td>Pipeline Induction Heating</td>
<td>The Pipeline Centre, Farrington Road, Rosendale Rd Industrial Estate, Burnley BB11 5SW</td>
<td>T: 01282 415323</td>
</tr>
<tr>
<td>Port Painters Limited</td>
<td>Unit 3, Ringside Business, Hoei-Y-Rhosog Cardiff, CF3 2EWWx</td>
<td>T: 02920 777070</td>
</tr>
<tr>
<td>PPC Ltd</td>
<td>Unit 2, Oyster Industrial Estate Jackson Close, Drayton, Portsmouth PO6 1QN</td>
<td>T: 023 9221 5957</td>
</tr>
<tr>
<td>Pyeroy Limited</td>
<td>Kirkstone House, St Omeres Road, Western Riverside Route, Gateshead, Wear, NE11 9EZ</td>
<td>T: 0191 4932600</td>
</tr>
<tr>
<td>Roy Hankinson Limited</td>
<td>Alexander House, Monks Ferry, Birkenhead Wirral, CH41 5LH</td>
<td>T: 0870 7892020</td>
</tr>
<tr>
<td>Severn River Crossing Plc</td>
<td>Bridge Access Road, Aust, South Gloucestershire, BS35 4BD</td>
<td>T: 01454 633351</td>
</tr>
<tr>
<td>Shutdown Maintenance Services Ltd</td>
<td>Kingsnorth Industrial, Hoo, Rochester, Kent, ME3 9ND</td>
<td>T: 01634 256969</td>
</tr>
<tr>
<td>Solent Protective Coatings Ltd</td>
<td>Tredgar Wharf, Marine Parade Southampton, Hants, SO14 5JF</td>
<td>T: 02380 221480</td>
</tr>
<tr>
<td>South Staffs Protective Coatings Ltd</td>
<td>Bloomfield Road, Tipton, West Midlands, DY4 9EE</td>
<td>T: 0121 522 2373</td>
</tr>
<tr>
<td>SPG Ltd</td>
<td>8-10 High Street, Market Deeping, Peterborough PE6 8EB</td>
<td>T: 01778 343391</td>
</tr>
<tr>
<td>Standish Metal Treatment Ltd</td>
<td>Tarn Howe, Lakes Road, Derwent Howe Industrial Estate, Workington, Cumbria CA14 3YP</td>
<td>T: 01900 870780</td>
</tr>
<tr>
<td>Stobbarts Ltd</td>
<td>Tarn Howe, Lakes Road, Derwent Howe Industrial Estate, Workington, Cumbria CA14 3YP</td>
<td>T: 01900 870780</td>
</tr>
<tr>
<td>Teces Valley Coatings</td>
<td>Riverside Park Road, Middlesborough, Cleveland TS2 1Ut</td>
<td>T: 01642 228141</td>
</tr>
<tr>
<td>T I Protective Coatings</td>
<td>Unit 6, Lodge Bank, Crown Lane, Horwich, Bolton, Lancs, BL6 5HU</td>
<td>T: 01204 468080</td>
</tr>
<tr>
<td>TEMAX Engineering Ltd</td>
<td>5-6 Curran Road, Cardiff, CF10 5DF, UK</td>
<td>T: 020920 344556</td>
</tr>
<tr>
<td>Vale Protective Coatings Ltd</td>
<td>Building 152 – Langar North Industrial Estate, Harby Road, Langar, NG13 9HY</td>
<td>T: 01949 869784</td>
</tr>
<tr>
<td>Walker Construction (UK) Ltd</td>
<td>Park Farm Road, Folkestone, Kent, CT19 SDY</td>
<td>T: 01303 851111</td>
</tr>
<tr>
<td>Company Name</td>
<td>Address</td>
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<tr>
<td>Wardle Painters Ltd</td>
<td>Unit 5, Wimborne Building, Atlantic Way, Barry Docks, Glamorgan, CF63 3RA, UK</td>
<td>01446 748620</td>
</tr>
<tr>
<td>W G Beaumont &amp; Son</td>
<td>Beaumont House, 8 Bernard Road, Romford RM7 0HX</td>
<td>01708 749202</td>
</tr>
<tr>
<td>William Hare Ltd</td>
<td>Brandleholme House, Brandleholme Road, Burys, Llan, BL6 1J, UK</td>
<td>0161 609 0000</td>
</tr>
<tr>
<td>Xervon Palmers Ltd</td>
<td>331 Charles Street, Royston, Glasgow G21 2QA</td>
<td>0141 5534040</td>
</tr>
<tr>
<td>Abbey Gritblasting Services</td>
<td>Unit 13, Clopton Commercial Park, Clifton, Woodbridge, Suffolk, IP12 3TP</td>
<td>0191 262 0510</td>
</tr>
<tr>
<td>Advanced Construction and Eng Resources Ltd (ACER)</td>
<td>5th Floor, Horton House, Exchange Flags, Liverpool L2 3PF</td>
<td>0161 408 0155</td>
</tr>
<tr>
<td>A McKie Building &amp; Engineering Ltd</td>
<td>19 Kyle Road, Irvine, Ayrshire, KA12 8JX</td>
<td>01294 279586</td>
</tr>
<tr>
<td>BSM Consulting</td>
<td>11 Kingsmead, Nailsea BS48 2XH</td>
<td>01275 854708</td>
</tr>
<tr>
<td>BAM Nuttall Ltd</td>
<td>St James House, Knoll Road, Camberley GU15 3XW</td>
<td>0782 5798440</td>
</tr>
<tr>
<td>Celtic Specialist Treatments Ltd</td>
<td>Rosedale, Careclicke Lane, Langstone Newport, Gwent, NP18 2JZ</td>
<td>01633 400194</td>
</tr>
<tr>
<td>Centregreat Engineering Ltd</td>
<td>17/12 Wyndham Close, Brackla, Brackla Industrial Estate, Bridgend, CF31 2AD</td>
<td>01656 650481</td>
</tr>
<tr>
<td>Coastground Ltd</td>
<td>Morton Peto Road, Capton Hall Industrial , Great Yarmouth, Norfolk, NR31 0LT</td>
<td>01493 650455</td>
</tr>
<tr>
<td>Corroless Eastern Ltd</td>
<td>Greens Road, Greens Industrial Estate, Dereham, Norfolk NR20 3TG</td>
<td>01362 691484</td>
</tr>
<tr>
<td>Darcy Spillage Manufacture</td>
<td>Brook House, Larkfield Trading Estate, New Hythe Lane, Larkfield, Kent ME20 6CN</td>
<td>01622 715100</td>
</tr>
<tr>
<td>D F Coatings Ltd</td>
<td>Unit 17, Willaments Ind. Estate, Hazel Road, Woolston</td>
<td>T: 0238 044 5634</td>
</tr>
<tr>
<td>E G Lewis &amp; Company Ltd</td>
<td>Suite 5, 3 Shawcross Industrial Estate, Ackworth Road, Portsmouth PO3 3JP</td>
<td>T: 01792 323288</td>
</tr>
<tr>
<td>Farbuild Ltd</td>
<td>Trelawn Lodge, Vicarage Road, Wingfield, Diss, Norfolk IP21 5RB</td>
<td>T: 01379 640670</td>
</tr>
<tr>
<td>Forward Protective</td>
<td>Vernon Street, Shirebrook, Mansfield</td>
<td>T: 01623 748323</td>
</tr>
<tr>
<td>Gemini Coirorosion Services</td>
<td>Brent Avenue, Forties Road, Montrose, Angus, DD10 9PB</td>
<td>T: 01674 672678</td>
</tr>
<tr>
<td>Galladr Construction Ltd</td>
<td>Galladr House, Pavilion Business Centre, Kinetic Crescent, Innfeld BN3 7F</td>
<td>T: 01992 763000</td>
</tr>
<tr>
<td>GEJ Project Services Ltd</td>
<td>118 Molly Lane East, Banstead, Surrey SM7 2BE</td>
<td>T: 01737 202271</td>
</tr>
<tr>
<td>Hempel UK Ltd</td>
<td>Llantarnam Park, Cwmbran, Gwent, NP44 3XF</td>
<td>T: 01633 874024</td>
</tr>
<tr>
<td>JB Specialist Refurbishments Ltd</td>
<td>The Old Village Hall, Savtry, Huntingdon, Cambridgeshire PE28 5SZ</td>
<td>T: 01536 266607</td>
</tr>
<tr>
<td>Kaefer C&amp;D Ltd</td>
<td>Riverside House, Rolling Mill Road, Viking Industrial Estate, Jarrow, Tyne &amp; Wear NE32 3DP</td>
<td>T: 0191 428700</td>
</tr>
<tr>
<td>Livis Ltd</td>
<td>Livis House, 50 Victoria Park</td>
<td>T: 01322 220058</td>
</tr>
<tr>
<td>Malakoff Limited</td>
<td>North Ness, Lerwick, Shetland, ZE1 OQZ, UK</td>
<td>T: 01595 695544</td>
</tr>
<tr>
<td>Matthew James Services</td>
<td>Unit 4, Shibdon Business, Cowen Road Blaydon, Newcastle-Upon-Tyne, NE21 5TX</td>
<td>T: 0191 414 5700</td>
</tr>
<tr>
<td>Moore Steel Developments Ltd</td>
<td>Station Road, Thorney, Peterborough PE6 0QJ</td>
<td>T: 01733 270729</td>
</tr>
<tr>
<td>Paint Inspection Ltd</td>
<td>Milton House, 7 High Street, Fareham PO16 7AN</td>
<td>T: 0845 4638680</td>
</tr>
<tr>
<td>Parks Fabrication Ltd</td>
<td>Park Farm, Holme-upon-Spalding-Moor, York, YO43 4AG</td>
<td>T: 01430 861628</td>
</tr>
<tr>
<td>Possilpark Shotblasting Co Ltd</td>
<td>Dalmarnock Works, 73 Dunn Street, Glasgow, G40 3PE</td>
<td>T: 0141 556 6221</td>
</tr>
<tr>
<td>R.L.P. Painting</td>
<td>Heathfield House, Old Bawtry Road, Finningenly, Doncaster, DN9 3DD, UK</td>
<td>T: 01302 772222</td>
</tr>
<tr>
<td>SCA Group Ltd</td>
<td>Woolbridge Ind. Park, Three Legged Cross, Dorset, BH21 6FA</td>
<td>T: 01202 820820</td>
</tr>
<tr>
<td>Sherwin-Williams Protective &amp; Marine Coatings</td>
<td>Tower Works, Kestor Street, Bolton, lancs. BL2 2AL</td>
<td>T: +44 (0)1204 521771</td>
</tr>
<tr>
<td>Shirley Industrial Painters &amp; Decorators Ltd</td>
<td>Grand Union House, Bridge Walk, Accok’s Green, Birmingham, B27 6SN</td>
<td>T: 0121 706 4000</td>
</tr>
<tr>
<td>Specialist Blasting Services Ltd</td>
<td>Smiths Quay, Hazel Road, Woolston, SO19 7GB</td>
<td>T: 023 80438901</td>
</tr>
<tr>
<td>Stamford Construction Limited</td>
<td>Barham Court Business Centre, Teston, Maidstone, Kent MW18 5BZ</td>
<td>T: 07912037033</td>
</tr>
<tr>
<td>Story Contracting Ltd</td>
<td>Burgh Road Industrial Estate, Carlisle, Cumbria CA2 7NA</td>
<td>T: 07730 764414</td>
</tr>
<tr>
<td>Tinsley Special Products</td>
<td>Enterprise House, Durham Lane, Eaglescliffe, Stockton-on-Tees TS16 0PS</td>
<td>T: 01642 784279</td>
</tr>
<tr>
<td>Wescott Coatings &amp; Training Services Ltd</td>
<td>The Quadrus Centre, Woodstock Way, Boldon Business Park, Boldon NE35 9PF</td>
<td>T: 0191 5197380</td>
</tr>
</tbody>
</table>
DIARY DATES 2014

Tuesday 28th January 2014
Plant Integrity
Venue: Palm Court Hotel, 6pm for 6.30pm
Presenter: Steve Plant. Details can be obtained from ICorr Aberdeen Branch.
T: 01224 243360
E: ICorrABZ@gmail.com

Thursday 13th February 2014
London Branch Meeting
Speaker to be announced – please see website for details
Venue: Naval Club, 38 Hill Street, London 17.30 for 18.00 start.

Tuesday 25th February 2014
Development of a Corrosion Micelle Detection Method- A Review including Case Studies
Venue: Palm Court Hotel, 6pm for 6.30pm
Presenter: Emma Perfect. Details can be obtained from ICorr Aberdeen Branch.
T: 01224 243360
E: ICorrABZ@gmail.com

Tuesday 4th March 2014
Midlands Branch Meeting & Branch AGM
Venue: AMEY, International Design Hub, Colmore Plaza, 20 Colmore Circus, Queensway, Birmingham B4 6AT.

Thursday 13th March 2014
London Branch Meeting and AGM
Speaker: London Branch Chairman, John O’Shea on ’The past, with a viable future’. 
Venue: Naval Club, 38 Hill Street, London 17.30 for 18.00 start.

Tuesday 15th April 2014
Corrosion Related Failures for Downhole Chemical Injection Lines
Venue: Palm Court Hotel, 5.30pm for 6pm
Presenter: Dr. Eugenia Marinou. Details can be obtained from ICorr Aberdeen Branch.
T: 01224 243360
E: ICorrABZ@gmail.com

Tuesday 29th April 2014
Midlands Branch Meeting
Laboratory Tour & Presentation Visit to the Exova Corrosion Centre
Venue: Exova, Corrosion Centre, Dudley.

Thursday 8 May 2014
CED Working Day and Symposium on Coatings for the Corrosion Protection of Ancient and Modern Structures
Venue: Royal Armouries Conference Centre, Leeds Armouries Museum
The meeting will consist of a series of lectures on coatings for ancient and modern applications, a tour to the conservation laboratory at the museum and CED working group meetings.

18th-12th September 2014
19th International Corrosion Congress (19th ICC)
The Call is Now Open!
Deadline for submitting abstracts to the European Corrosion Congress, EUROCORR 2014 is January 13, 2014.
Abstract submission instructions and the submission tool can be found online at www.eurocorr2014.org

Sunday 2nd - Thursday 6th November 2014
19th International Corrosion Congress (19th ICC)
Venue: Jeju Island, Korea
Organized by The Corrosion Science Society of Korea (CSSK) and the International Corrosion Council (ICC)
Details can be obtained from: www.19thiccc.com

For all the latest news, events and debates join us on LinkedIn

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Tel: 0161 3063621

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Nick Smart
Tel: 01635 280385