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Another period passes between issues of Corrosion Management with as much speed, if not more, than the previous one, the passage of time seems to be ever increasing as one grows busier and without doubt older. ICorr activity remains high since I last wrote with much going on in the area of training and certification, branch events and general administration and organisation. This all comes on top of the other day-to-day activities of all organisations where the majority of senior personnel are volunteers. However as ever there are times when there is much which is pleasurable, for example the recent NACE National Conference this year was held in San Antonio Texas. Here the weather proved to be as unpredictable as it had been in the UK, i.e. it rained on the first day to make all the attendees from the UK feel at home, but all was not gloom there were invitations to dine with NACE and their other partners in corrosion from around the world at the NACE Alliance Dinner. The event was held in The Tower of The Americas some 750 feet from ground level where we dined among the invitees and looked down onto the top of low cloud that supplied the rain beneath. This evening brought together senior members and officers from NACE, ACA, EFC and ICorr and other like-minded organisations whose commonality is the desire to improve relations, to spread the word on the impact of corrosion on infrastructure and to work together wherever possible to bring the message to those that need to hear it.

There followed during the week further meetings and discussions with other bodies and individuals where we shared information to better understand one another’s aims and goals and also to strengthen ties and improve interaction and relations, there was even time for ICorr officers to meet and discuss the many items which are on-going within The Institute, this was indeed an opportunity not to be missed as face to face meetings are so much more productive than phone calls and e-mails. I returned via Houston landing in the UK on Saturday last with more to do than when I had left the previous Sunday and with a quick turn around needed to leave again Monday morning for another overseas trip.

Much is changing at ICorr and we continue to build on what has been put in place by previous generations of ICorr members and officers, it is truly significant that ICorr which is primarily run on a volunteer basis has achieved so much over the years, and continues to punch above its weight among like organisations where often fulltime staff and officers are able to bring to bear their high quality managerial skills. However through closer relations and better understanding we all benefit through the process of the work done by others, by sharing, talking, meeting and networking the combined efforts inspire and improve our own position, this I feel is what comes out of meeting with like-minded individuals and organisations. No one or no one group can work in isolation, this the 21st century and the world shrinks every day and the ability to communicate better improves, we need to work together as individuals and as groups and organisations to be better informed and better educated on the subject closest to our hearts, i.e. corrosion and its control.

I hope to see you all again soon during my final year as President at one of the many events The Institute have planned for 2014.

Trevor Osborne,
President of the Institute of Corrosion
LONDON BRANCH – CYCLIC TESTING, AN UP AND DOWN HISTORY

On 13th February 2014 at The Naval Club, Mayfair, London Branch was treated to an enthusiastic presentation on how coating failures have influenced the way products are tested to meet the rigours of offshore environments. Under the Chairmanship of John O’Shea, the presentation was given by Neil Wilds, Technical Manager, Protective Coatings RD &I Laboratory, for International Paint Ltd. Neil Wilds described the history of paint testing from early outdoor weathering and basic salt spray tests through to the more rigorous cyclic testing. Neil pointed out that natural tests were likely to give the best indication of performance but they took a long time; thus accelerated laboratory tests were essential to provide good material comparisons over a shorter term, even though they only gave an indication of performance in the most aggressive of marine environments.

Neil went on to confirm that cyclic tests can now build a better picture of performance and detailed the revisions that were gone through for the latest testing standards such as Norsok M-501 and ISO 20340. Further Neil described the move to include more mechanical testing and the use of more complex ‘T-Bar’ test specimens which include structure features that most commonly occur with coating failures found in service. For the future, to achieve the sort after ‘30 year+ guarantees’, Neil suggested that this would require much more collaboration between end users, test houses and manufactures, than presently exists.

An interesting question time followed and on behalf of the 28+ attendees, a vote of thanks to Neil was given by David Deacon, Consultant to SPC and Branch committee member. At the end, there seemed to be general agreement that the large majority of coating failures were due to poor application and that this could be the basis of several further meetings; appropriately, the meeting then adjourned to enjoy the traditional hospitality of the London Branch.

Future Branch technical meetings to be held at The Naval Club, 38 Hill Street W1J 5NS are detailed in the magazine diary. All are welcome, but please note that The Naval Club requires gentlemen to wear jacket and tie when attending evening meetings.

LONDON BRANCH – WALKING TOUR OF MAYFAIR WITH A HORSE, A PIGEON AND A GLEAMING TORSO!

Friday 2nd May – 5.45 for a 6 o’clock start

Once again London Branch are pleased to invite members of the Institute to an intriguing and educational evening. It will awaken your curiosity when we once again explore the endlessly fascinating area east of Hyde Park. In fact, this time we start at Marble Arch in order to discover some now almost forgotten celebrities of the northwestern part of Mayfair, individuals who however in their life time got themselves involved in everything from spying and international diplomacy to illicit affairs and Olympic wrestling. Find out what Princess Diana, Tom Jones and most of Margaret Thatcher’s cabinet have in common and learn of the incredible achievements of GI Joe, the pigeon. Meet the lady who could outride and outheat most men and the king who did not intend the French Revolution to get in the way of his royal ambitions. And find out which cellar contains more than 60,000 bottles......!

The tour will terminate at the Naval Club for well deserved refreshments, including chilli and rice. There is no charge for this evening and members are invited to bring along family and friends.

Once more, the tour will be led by Ingrid M Wallenborg, a Blue Badge tourist guide, who has been a brilliant leader for us in recent years.

Meet by the actual Marble Arch, near Marble Arch U/G station [Central Line]. 2nd May 17.45 This Event will go ahead whatever the weather conditions.

Further information can be obtained from John T O’Shea, Chairman of London Branch.
On 12th December 2013, London Branch held its now traditional Christmas Luncheon at the prestigious Royal Overseas League in St. James's. More than 180 hosts and guests enjoyed the opportunity to discuss the state of the corrosion world over an excellent lunch, and if the high attendance was anything to go by, it is good health. The guest speaker, Mr. Robbie Glen, provided some hilarious anecdotes related to his career as a prison governor, and London Branch was grateful for the additional event sponsorship provided by Messrs Corrosion Control, Correx, CTS Europe, Speciality Polymer Coatings, Telpro and Winn and Coales. This thoroughly enjoyable event is due for a repeat on Thursday 11th December 2014.

Sadly, Fred Palmer, a stalwart supporter of ICorr, died last year, and a tribute was paid by David Deacon. Fred was a driving force behind initiating the Luncheon and he would have been proud to see such an excellent attendance at the event, now celebrating its 25th anniversary. John O’Shea, London Branch Chairman, presented engraved whisky tumblers to Ian Walker of International Paint Ltd. for the Company’s generous support of the New Entrant Engineers’ Training Programme run during 2013 by London Branch. John also presented a personally engraved desktop memento to ICorr President, Trevor Osborne, who was mentor for the winners of the case study. Trevor, in turn, then presented case study winners, Dan Mobbs, Ibrahim Al Saieg, James Redmile and Istvan Bartha with matching engraved desk-top mementos. John O’Shea also presented personally engraved tankards to Andy Taylor, Jim Glynn and Paddy Corr, for their dedication to London Branch Committee.
Technical Topics No.45:

MOTOR CAR CORROSION PART 2 AND “NATURAL CAPITAL”

By Douglas J Mills, Technical Secretary

My last TT generated some interest. In particular Roger Hooper made some comments which he has no objection to my sharing. “After reading your article on Motor Car Corrosion a couple of points came to mind. In the 1970s I was working on the corrosion of car exhaust systems at British Steel research and I can say that the major cause of increased life is due to two (related) factors. Firstly, virtually all exhaust systems are made from stainless steel now, this was unheard of before we pioneered the work with Jaguar. Secondly, virtually all exhaust systems have a catalytic converter encased in stainless steel that rapidly raises the exhaust gas temperature and, therefore, reduces the amount and residence time of condensate in the back end of the system. It is this acidic condensate that used to be the primary cause of exhaust failure by internal corrosion. I replied to this as follows “Thanks for your comments about my most recent TT. Re exhaust systems they are certainly a lot better in the modern car. Thirty years ago I was down the muffler outlet every two years regular as clockwork. Now ........ well I have had my Renault Megane for eight years now Done 120,000 miles (total mileage a bit over 150,000) and I cannot remember having replaced the exhaust system during that time.”

Roger also questioned the contention that filling tyres with nitrogen reduces the corrosion of tyre wires by limiting the availability of oxygen. He wrote “Surely the primary requirement for corrosion is water and in my experience the Insides of tyres are invariably dry. Furthermore, tyre wires should never protrude through the rubber so the presence or absence of oxygen seems to be a very unimportant factor”. I replied “re wires in tyres well I think you would agree that if there is no oxygen around corrosion will not occur. Ok there is oxygen on the outside. But maybe the slow diffusion of nitrogen outwards reduces the solubility of the external oxygen in the tyre. I take your point that wires should not protrude through the rubber. But still, even within the rubber, corrosion of the wires can occur. And this is what causes many blow outs. I worked on a project once where they were trying to zinc coat the wires rather than copper coat - latter led to a nasty galvanic situation (small anode, large cathode)”.

Incidentally talking of zinc I mentioned some time ago concerns about the lack of thickness of galvanising on the London Eye. Anyway it seems still be plying its circular trade (see picture). Close to the Eye is Portcullis House, Westminster where I recently attended a discussion meeting of the Parliamentary and Scientific Committee entitled “How do we value our Natural Capital?” The talks were mainly discussing ways of putting numbers on nature (and the environment) and on natural resources. Easy in some cases eg clean air has a demonstrable health benefit (look at the smog in Beijing-supposedly will cause 55000 early deaths).

Similarly clean water must be beneficial and can be quantified. More difficult in others (carbon emissions is obviously global issue). But a few specific examples were given eg an attempt was made to show how one can quantify what the effect of putting in a new by-pass would be. And to show how you could use numbers to help to decide where to plant new woodland to the best advantage. Questions I might have asked are “how could this be applied to the building of HS2?” Or “what would be the effect of removing the green belt in places around London and allowing more building of houses in the South East to deal with the dire shortage and the outlandish prices?”.

Corrosion is of course a natural process relating to the environment. So maybe the working group which was set up (the Natural Capital Committee) by the Government a couple of years ago to quantify nature (two members of which, Julian Harlow and Rosemary Hails presented at the meeting) should take this into consideration? Air quality affects corrosion - I once (twenty years ago) did a quantifying exercise to work out the effect of reducing emissions from burning oil and coal (particularly) on corrosion (IMPACTs) on materials (metals, polymers, stone, art works etc). So does water, a global issue being acidification of the oceans. The effect of this on metal corrosion and coatings is important and a about six years ago I contributed to a Royal Society report on this.

I note there is an upcoming meeting about global warming/alternative energies and one of the talks is entitled “Acidification of the Oceans - a Silent Storm”. So that particular concern is still very relevant. In relation to corrosion I believe it is an area which requires some urgent laboratory work. As usual any comments on this month’s TT please write to Douglas@harrbridge.freeserve.co.uk.
Steven Plant of Plant Integrity Management Limited was the guest speaker during the Aberdeen branch meeting held on the 28th of January 2014. Over 60 delegates including engineers, scientists, managers, students, business owners and other professionals with interest in corrosion attended this meeting. After a safety brief and introduction by the branch chair, Steven outlined the agenda for the night. He stated that he would provide a background to Ageing and Life Extension (ALE), explain its relevance to corrosion, give an illustration of corrosion ALE issues, discuss the purpose, structure and content of S1117 and finish with a technical review of the key sections of this recent Energy Institute (EI) guideline document.

Steven started by explaining the basics of ALE distinguishing between “ageing” and “life extension”. With the aid of a series of flow charts, diagrams and graphs he explained the scope of both concepts in relation with an asset’s typical life cycle. He went on to give a detailed explanation of ALE in relation to Corrosion Management (CM) placing emphasis on the level of detail during assessments, importance of high quality inspection reports, defined asset boundaries/responsibilities and touched on the importance of data management. He finished by outlining ALE corrosion issues giving examples of how these can be addressed in practice.

“The document S1117 is intended to provide the industry with an accepted good practice guidance and build on the existing Corrosion Management Guidance” Steven mentioned as he set out the aims and objectives of the EI Guideline document. He continued to give an overview of S1117 stating that the document was structured in the same way as the current EI Corrosion Management document. In the concluding part of the presentation, Steven explained the content of the nominative sections of the document together with the Annexes. He finished by summarising the main objectives of the S1117 guidance document stating that the ultimate aim of S1117 will be to eventually incorporate into the current EI corrosion management guidance and potential other corrosion related guidance in circulation. Questions on various aspects of the presentation followed immediately after the talk as the session progressed from Q&A to a lively discussion session.

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.
DEVELOPMENT OF A CORROSION INHIBITOR MICELLE DETECTION METHOD: A REVIEW WITH CASE STUDIES

ABERDEEN BRANCH MEETING FOR FEBRUARY 2014

The February 2014 branch meeting was held on the 25th of February and well attended by delegates from different technical disciplines. Cameron Mackenzie of Lux Assure was the guest speaker for the night and covered a novel technique deployed in combination with other traditional techniques to establish corrosion inhibitor availability.

The speaker referenced a National Association of Corrosion Engineers (NACE) article published in 1971 and used this as evidence to establish that the link between micelles and corrosion had been widely reported for more than 40 years. He explained that the Critical Micelle Concentration (CMC) was an important parameter in the use of this technology and used a traffic light system to illustrate how CMC can been used to establish corrosion inhibitor availability.

Cameron narrated a short story of a meeting in 2008 that proved to be the start of a research “journey” culminating in the development and application of the CoMIC™ and MMICA™ products in the field. He used this narrative as a prelude to aptly present a development timeline and history of the micelle detection methodology.

He placed emphasis on the need for investor support and an appetite for the end user to take a “risk” on innovative solutions, stating that these were essential if any Research and Development (R&D) project was to be successful.

Cameron explained the CoMIC™ technology giving details of how it could be deployed as a Corrosion Management tool and used as part of an overall inspection/monitoring programme together with other chemical analysis techniques. He outlined the components of CoMIC™ and explained how it worked in practice. He explained the difference between field and lab measurements outlining the limitations and challenges of obtaining useful field data.

Cameron covered practical case studies setting out the situation, explaining practical field implementation of the technique and presenting the results for each case. He presented over six case studies ranging from routine offshore production pipeline application of the technology to specific application of the method to investigate the effect of corrosion inhibitor availability by pigging activities.

To sum up, Cameron explained that CoMic™ is a novel technology for analysing the in situ dosage of corrosion inhibitor relative to performance potential. He stated that the method is non-invasive, fast, versatile and complementary with the ability provide valuable corrosion management data from large pipeline networks to simple single point trending. Compositional elements detected by the technique and possible limitations of the technology were some of the topics discussed during the Q&A session that followed the presentation.

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.
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THE FUTURE OF QUALITY CONTROL, PAPERLESS SYSTEMS AND IRIS REPORTING FOR THE PROTECTIVE COATING INDUSTRY

Prepared by: Ian Patterson / Director of Paint Inspection Ltd

Paint Inspection Ltd is involved in many projects across the country so when we had the opportunity to submit an article for the magazine deciding which one to select was a tough decision as they all have their uniqueness and something to offer for an article. Eventually we decided to put an article together which affects us all and is always a hot topic the subject being “Quality documentation and the control of it”. Quality control and traceability is an important factor in our Industry particularly when it comes to coating projects.

Over the years Inspectors and Inspection companies have used either word or excel type documents to report inspections and testing but this type of reporting does have its flaws and will eventually be phased out as we move towards a paperless/cloud based system.

Three years ago we began creating an internal online reporting system for our Inspectors to use, with senior inspectors able to access the report as it was being worked on and once authorised made available for the client to collect from the client area. This client area would hold all their reports for access when required. The overall feedback was positive with our clients, liking the report format and how it was stored and available at any time.

This got us thinking about creating a reporting system that the whole industry could use and this developed into IRIS (Intelligent Reporting Inspection Software) with Paint Technology Solutions Ltd.

When we first started the build with Paint Technology Solutions Ltd in 2011 we had to decide what unique features the system would have alongside reporting in line with Industry standards (ISO, SSPC, NACE, ASTM, AS etc). One of the key subjects was traceability and visibility and a reporting system which in essence becomes a project management tool that all parties involved in the project could engage with and have access to.

So whilst we were researching a majority of the international standards we were also looking at the platform for the project in which clients, project managers, senior inspectors and other inspectors etc could access the project data as the works are in progress. We decided to provide two options for the project:

- The second version was an editable system where the project Inspectors and senior Inspectors could access the same project where the inputting of data would take place e.g. adding the specifications, creating & building reports, adding test and inspection data along with issuing of journals, corrective actions/NCR & RFI etc. This cloud based software provides real time reporting allowing inspectors, project managers and asset owners to be fully informed on the progress of works from anywhere in the world in real time. IRIS provides incredible flexibility, allowing multiple inspectors to work on multiple specifications at multiple sites all within a single project.

The continued development of IRIS will eventually see the option to complete detailed coating condition surveys in accordance with standards and to meet the type of environment and required service life and then provide paint manufacturers product data on approved systems. We are also in the early stages of building a Contractors quality assurance package which will allow the site team to add test data from dry film thickness readings and ambient readings etc including photos onto an iPad or smart phone through the App function. This process will then build a contractors report in the cloud system covering the project requirements and will also run in line with the inspection package for a single project, this visibility for all can only improve the experience between client and contractor whilst ensuring the quality control documentation is available at any time for all to see.

IRIS Reporting with Paint Technology Solutions Ltd was launched this year at SSPC and NACE in North America as well as being rolled out across the UK.

This new and dynamic coating project management reporting system will change how Inspectors and companies report and in turn can only but improve the overall performance of quality control to extend any asset service life.

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if you require further information then please contact Andrew at andrew.patterson@painttechnologysolutions.com or visit www.iris-reporting.com
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11
INFLUENCE OF SULPHURIC ACID ANODISING ON THE FATIGUE STRENGTH OF A 7075-T73 ALUMINIUM ALLOY

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2 Department of Chemical Engineering & Materials Science, University of California Irvine, Irvine, CA 92697-2575.

Abstract

The influence of a sulphuric acid anodising process on the fatigue behaviour of a 7075-T73 aluminium alloy has been investigated. Single edge circular notch (SECN) fatigue specimens were used enabling localisation of fatigue damage and assisting detection of fatigue crack initiation and growth. Elastic finite element modelling was performed to quantify the stress concentration factor and von Mises equivalent stress distribution of the notched region. A surface replication method in combination with scanning electron microscopy (SEM) was adopted for in-situ monitoring of the fatigue damage. It was shown that the presence of pitting, developed during the anodic coating pre-treatment, adversely affected the fatigue performance. SEM surface examinations after fatigue cycling indicated the presence of micro-cracks, developed at pit sites. Interestingly these sites were not found to be the source of crack initiation when examined post SEM fractographic analysis. Thus, the stress concentration effect of the corrosion pits was found to be predominant leading to a reduction in fatigue life of approximately 60% for the anodic coated versus untreated specimens.

Introduction

The effects of pre-existing corrosion pits, anodic coatings and, a combination of the both, on the fatigue performance of high strength aluminium alloys has been extensively studied by several investigators [1-4]. It is well understood that since the anodic layer grows out of the substrate material and adheres extremely well to the base material, that cracks in the anodic layer can accelerate fatigue crack initiation and growth. The thicker the coating the more pronounced this effect. Whilst sealed anodic coatings improve the corrosion resistance, this treatment has been shown to cause fracture at lower strains than in coatings where no sealing is applied. In either case, cracking in the anodic layer can consequently reduce the fatigue strength.

The present work is concerned with an assessment of how localized pitting corrosion, which occurs during the anodic coating process, can influence fatigue crack nucleation. Recent studies, for example, Pao et al. [5] reported on the effect of pre-existing corrosion pits on the crack nucleation kinetics of a high strength 7000-series aluminium alloy, of varying temper conditions. It was reported that presence of the pits both reduced the fatigue crack nucleation lives by a factor of 2-3 at a given stress level and lowered the fatigue crack nucleation stress thresholds by half. Dolley et al. [6], in a study on a 2024-T3 aluminium alloy examined the effects of pitting corrosion (pre-existing flaws) on the reduction in fatigue life. It was concluded that fatigue life was strongly correlated to the initial pit size. Shazad et al. [7] examined the influence of pickling and chromic acid anodizing processes on 7050-7451 aluminium alloy, reporting that in the high cycle fatigue regime the fatigue strength of the pickled and pickled and anodized specimens was reduced by 32% and 43%, respectively. It was observed that a large majority of cracks initiated at pre-existing corrosion pits and very few from strain cracks in the coating for the anodized specimens. The present authors [8,9] reported on the influence of the following liquids on the localized corrosion behaviour of 7075-T73

(a) liquid degreasing,
(b) non-etching alkaline cleaners,
(c) high pH caustic cleaners,
(d) low pH acid-based deoxidizers and,
(e) low pH sulphuric acid solution.

It was concluded that the designated solutions (a, b) did not cause any corrosion damage while the category (c, d) solutions did. Specifically, the (c) high pH caustic etch solution was the most aggressive resulting in severe general and localized attack after short exposure times in the 60-120 s range.

It was also noted that the larger pits (of the order of 10-20 μm) initiated during the pre-treatment processes, did grow in size during the subsequent electrochemical anodic coating process. For the smaller pits (on the order of 1-5 μm) the anodic process had a smoothing effect where the film growth tended to passivate the pits.

The specific objectives of the present study were as follows: (1) develop a test coupon that localizes fatigue damage to one location to assist with crack nucleation detection and captures the effect of multiaxial stress conditions indicative of a majority of engineering applications, (2) perform three dimensional linear elastic finite element modelling, (3) perform uniaxial fatigue tests in conjunction with a surface replication method for crack nucleation detection on samples to gain a comprehensive understanding on the effects of pre-existing corrosion pits and the anodic layer on fatigue crack behaviour and (4) undertake SEM examinations to identify sites of crack initiation.

Materials

The as-received material consisted of a 7075-T73 aluminium alloy hand forged billet with a 152 mm square cross section and a length of 381 mm. A stabilized (overaged) T73 temper condition was achieved by solution heat treated at 471°C for 7 hours, water quenched at room temperature, artificially aged for 6 hours a 107°C, and stabilized for 8 hours at 177°C. The chemical compositions and mechanical properties of the alloy are provided in Tables 1 and 2, respectively. Details of the microstructural analysis using SEM and energy dispersive spectroscopy (EDS) and the observation that second phase particles were shown to induce pitting corrosion during solution exposure can be found in [8].

Table 1 Chemical composition (wt%) for 7073-T73 alloy

<table>
<thead>
<tr>
<th>Alloy Type</th>
<th>Cu</th>
<th>Fe</th>
<th>Si</th>
<th>Mn</th>
<th>Mg</th>
<th>Zn</th>
<th>Cr</th>
<th>Ti</th>
<th>Zr</th>
<th>V</th>
<th>Al</th>
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</thead>
<tbody>
<tr>
<td>7075</td>
<td>1.5</td>
<td>0.26</td>
<td>0.07</td>
<td>0.020</td>
<td>2.4</td>
<td>5.6</td>
<td>0.19</td>
<td>0.02</td>
<td>-</td>
<td>-</td>
<td>Bal</td>
</tr>
</tbody>
</table>

Table 2 Mechanical properties for 7075-T73 alloy

<table>
<thead>
<tr>
<th>Grain Direction</th>
<th>Yield Strength MPa</th>
<th>Tensile Strength MPa</th>
<th>% Elongation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Longitudinal</td>
<td>381.3</td>
<td>460.5</td>
<td>15</td>
</tr>
<tr>
<td>Long-Transverse</td>
<td>368.9</td>
<td>449.5</td>
<td>12.5</td>
</tr>
<tr>
<td>Short Transverse</td>
<td>402.7</td>
<td>477.2</td>
<td>7</td>
</tr>
</tbody>
</table>

Fatigue Coupon Design

A single edge circular notch (SECN) geometry was developed for the present study. This design localizes fatigue damage and allows for easier observation of crack nucleation and growth. A schematic of the SECN specimen is illustrated in Figure 1.

An important consideration taken into account in this study was the raw material thickness and the area from the hand forging from which the coupons are extracted. For example, it has been shown that uniaxial fatigue testing of smooth coupons machined from a thin plate stock compared to those machined from a thick hand forging could provide an increase in fatigue life of up to two orders of magnitude for the same high strength aluminium alloy [10-13]. To account for this variation the coupons for the present study were extracted from the centre section of the hand forged billet.

Finite Element Modelling

3-D linear Finite element modelling (FEM), using COSMOS© Design Star Version 4.0, was conducted on the SECN coupon geometry to determine the stress distributions at the notched region. The stresses in the model were evaluated using an applied load of 2.224 kN. The model consisted of ten-noded tetrahedrasolid elements with a with a element size of 76 microns in the local stress critical (notch) region and 1.09 mm for the global elements. This element size was verified to be accurate as finer mesh density models converged to predict same level of stress. The model predicted a maximum von Mises equivalent stress at the notch of 196.5 MPa with the 2.224 kN applied axial load at the pin joints. The net section stress (load/cross sectional area) was calculated as 73.8 MPa. A ratio of the maximum local stress and the net section resulted in a stress concentration factor (Kt) of 2.65 for this configuration.

Figures 2 and 3 illustrate close-up and mesh density views of the FEM analysis, respectively.

Fig.1 Schematic of SECN fatigue coupon

Fig.2 FEM, close-up view of SECN fatigue coupon.

Fig.3 FEM close-up of the notch area and mesh density distribution
Surface Processing

The following sulphuric acid anodic coating process was implemented for the SECN coupons. This is a typical process in accordance with the process given in [14].

**Table 3** Sulphuric acid anodic surface treatment process

<table>
<thead>
<tr>
<th>Solution Type/ Temperature</th>
<th>Exposure Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water Rinse/ 22°C</td>
<td>120 s</td>
</tr>
<tr>
<td>Liquid Degreaser/ 71°C (A) - Solution prepared as a 10% aqueous solution of liquid concentrate</td>
<td>600 s</td>
</tr>
<tr>
<td>Water Rinse/ 22 °C</td>
<td>120 s</td>
</tr>
<tr>
<td>Alkaline Cleaner 71 °C - Solution prepared as a 10% aqueous solution of liquid concentrate</td>
<td>600 s</td>
</tr>
<tr>
<td>Water Rinse/ 22 °C</td>
<td>120 s</td>
</tr>
<tr>
<td>Caustic Etch 71 °C - Solution prepared by mixing 30 g/l NaOH (solid granulated form)</td>
<td>120 s</td>
</tr>
<tr>
<td>Water Rinse/ 22 °C</td>
<td>120 s</td>
</tr>
<tr>
<td>Deoxidizer/ 22 °C - Solution prepared as a 10% aqueous solution of HNO₃ + Fe₂(SO₄)₃ liquid concentrate</td>
<td>120 s</td>
</tr>
<tr>
<td>Water Rinse/ 22 °C</td>
<td>120 s</td>
</tr>
<tr>
<td>Type-II Anodize 22 °C - Solution prepared as 15% aqueous solution of sulphuric acid (H₂SO₄)</td>
<td>1800 s</td>
</tr>
<tr>
<td>Water Rinse/ 22 °C</td>
<td>120 s</td>
</tr>
<tr>
<td>Seal/DI Water 93°C</td>
<td>900 s</td>
</tr>
</tbody>
</table>

Fatigue Testing

The fatigue testing was conducted on the SECN coupons using a servo-hydraulic fatigue testing machine in accordance with ASTM E467 Conducting Constant Amplitude Axial Fatigue Tests of Metallic Materials. All tests were conducted in laboratory air using a sinusoidal waveform at a frequency of 3 Hz and a load ratio of R=0.1. Fifteen SECN coupons were tested at various stress levels of which six were sulphuric acid anodized as per the treatment shown in Table 3. Also note the run-out stress level was only established for the untreated coupons. These coupons did not fail as the testing was stopped for logistical purposes.

**Results**

Surface replication was conducted to evaluate crack nucleation for both untreated anodic coated samples. Crack nucleation is defined as a size that could be detected using standard NDT techniques (e.g. dye penetrant) being around 127 to 254 microns.

![Fig. 4](image1) Fig. 4 SEM replica taken at notch root of untreated sample at 44,000 cycles. Note single origin fatigue crack (approximate length of 150 μm) annotated by white arrow.

![Fig. 5](image2) Fig. 5 SEM replica taken at notch root of anodized coupon at 21,623 cycles. Note high density (multiple origin) fatigue cracking nucleating at pre-existing pits (largest crack annotated by white arrow).
Figure 6 shows the fatigue behaviour in terms of maximum equivalent stress versus cycles to failure. Results indicate a notable reduction in fatigue life up to 60% for the anodic coated versus untreated coupons. Generally at all stress levels crack nucleation occurred at approximately 50% of the overall fatigue life. This substantiates the importance of distinguishing between cycles to crack initiation (Ni) and cycles of crack propagation (Np) and reiterating that most published SN data does not distinguish between the two.

**Summary remarks and conclusions**

The influence of a sulphuric acid anodic coating process on the fatigue crack nucleation behaviour of 7075-T73 aluminium alloy has been examined. A single edge circular notched (SECN) coupon was used to localise fatigue damage in the centre of the gauge section facilitating fatigue crack detection and replicating the effects of multiaxial stress conditions indicative of a majority engineering applications. FEM was performed on the coupon geometry to determine the stresses and stress concentration factor at the notched gauge section. The principal reason for conducting this study was not to create SN data that could be used for design purposes but rather understand the adverse effects of pre-existing corrosion defects on crack nucleation mechanisms and to compare these results to the behaviour of untreated specimens. Fatigue cracks were found to nucleate at pit sites, which were abundant in number on the treated surfaces. Based on the results of this study, fatigue life was decreased by up to 60% for samples subject to the surface treatment process described in Table 3 above, when compared to untreated samples. The results are in close agreement with previous investigators on the crack nucleation mechanisms and the overall reduction in fatigue life [Ref 5-7].

**Acknowledgements**

The financial support of Parker Aerospace, Irvine, California, is greatly appreciated.

References


PROTECTING PIPELINES FROM CORROSION UNDER INSULATION

In the petrochemical industry Corrosion Under Insulation (CUI) in pipeline systems 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. CUI prevention strategies provide long term and reliable prevention of CUI that move towards inspection-free and maintenance-free piping systems and significant maintenance cost reductions.

Coating with TSA (Thermal Sprayed Aluminium), using Metallisation flamespray equipment is one method that a number of operators within the petrochemical industry have adopted. TSA is found to be a cost effective solution compared to other systems when reviewed over the lifetime of the facility. One of Metallisation’s customers has an ongoing programme for applying TSA at a petrochemical plant, as a solution for the long term protection against atmospheric corrosion and CUI. One specific project is a three quarter mile long marine jetty pipeline that is used for the transportation of lube oil and is exposed to the harsh marine environment. Other projects on this site have included a full range of pipes and vessels, including work on live operating plant.

To ensure the success of the thermal spraying process, the preparation of the pipeline surfaces is critical. For this project the pipeline surface was prepared by grit blasting with garnet to give a sharp angular profile for the TSA to bond to. As part of the QA/QC process, the blast profile was regularly checked using Testex tape to ensure it meets the required 75-125 micron specification. The grit blasted surface was then given a visual inspection, using 10 x magnification, to check the surface cleanliness and finish. The pipes are also given a ‘tape test’, which checks for dust contamination of the blasted surface. The tape sample is then visually inspected against white and black backgrounds for signs of dust particles. The final quality test is a salt contamination test. Using a small flexible container a minimal amount of testing solution is applied and agitated on the surface of the blasted pipe. This solution is then checked for the presence of salt using a test kit pipette. Once all of these tests have been passed the pipelines are ready to be thermal sprayed with aluminium.

A huge advantage of the Metallisation equipment and process is the flexibility and long supplies, which provide a safe working environment and ease of use for the operators. In this project the gas bottles and compressor were situated in a remote supply area, which gave easy access to the gas cylinders and enabled manifolding for fewer cylinder changes. In elevated applications such as vessels and towers, the cylinders can remain on the floor while the spray system is elevated tens of metres. This situation therefore requires less complex scaffolding as the heavy bottles are not scaffold mounted. The 30 metre supply package, consisting of gas, oxygen and air, was fed from the overhead supply area down to the control panel. The pistol is then further 10m away from the control panel. This setup allows around a 60m length of piping to be sprayed without having to move the cylinders and air compressor, giving significant productivity benefits in a very difficult environment.

The contractor on this specific jobsite is using two Metallisation MK73 flamespray systems in different spray locations. Once the blasting and inspection is completed, the TSA application starts. Typically, blasting and inspection is completed in the morning taking approximately four hours. The TSA is applied in the early afternoon for around three hours and the final sealant application at the end of the day. The TSA is applied with a methodical work pattern with the pipe topside coated first, then the underside. The long supplies package allows the sprayer and wireman to move freely around the worksite in the most efficient manner to suit the specific area. The MK73 deflected extension is perfect for those difficult to access areas commonly found at petrochemical sites and has been designed specifically for this application area. It comes in three lengths, 150mm, 300mm and 450mm. The extension unit can spray directly forward or at a deflected angle up to 90° by varying the deflector air pressure. The deflection nozzle can also be rotated through 180° to allow spraying in a 360° arc around the pistol. The long supplies system provides flexible working conditions, particularly useful when spraying the underside of the pipes.

Following the application of the TSA, the pipelines in this specific application were sealed with Intertherm 50 sealer, which was applied until full penetration was achieved. In some CUI related environments, no sealer is applied, especially where the spray area is operational and hot. During the application of the TSA the operators periodically checked the coating thickness using a DFT gauge and made appropriate corrections along the way. The specification for this particular job was 250-500 microns. The QA/QC Inspector for the project also checked and recorded the coating thickness throughout the process. To support the QA/QC process the spray operators produced witness plates on a daily basis, which were then tested for adhesion to ensure it met the minimum 1000 psi – 6.9MPa coating thickness. Audit bond strength testing was also carried out periodically on the actual sprayed pipe sections.

Thermal spraying involves the projection of small molten metal particles onto a blast prepared surface. Upon contact, the particles flatten onto the surface, freeze and mechanically bond, firstly onto the blasted substrate and then onto each other, as the coating thickness is increased. To create the molten particles, a heat source, a spray material and an atomisation/projection method are required, in this instance the customer opted for the flamespray process.

For more information on the CUI or thermal spray equipment, contact:
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or visit www.metallisation.com
Article: Belzona 1331 and Belzona 1381 represent a novel class of erosion resistant coatings which utilise a formulated blend of thermoplastic filler rather than traditional ceramic filler. This alternative technology exhibits performance characteristics superior to traditional ceramic epoxy composite coatings.

Product testing demonstrates Belzona 1331 and Belzona 1381 have superior sliding and impact erosion resistance when benchmarked against traditional ceramic epoxy composite coatings. Wet film builds up to 2000 micron and excellent edge retention are achievable allowing full coverage of protrusions and weld bead in a single pass. Unlike some ceramic epoxy composite coatings which claim to be sprayable, Belzona 1331 and Belzona 1381 will not cause damage or wear to spray equipment. Belzona 1331 and Belzona 1381 can therefore be specified on large areas or for small pipeline diameters where brush or roller application is not practical.

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The repair was carried out by a team of two from Belzona Technosol, Belzona’s application division. Steel plates to cover the leak areas were prefabricated. After general cleaning to remove some contaminants, surface preparation by hand abrasion was carried out to ensure good mechanical adhesion. Belzona surface-tolerant epoxies were selected for this repair situation as these materials are easily applied on-line to wet and oily surfaces where only minimal surface preparation is possible. Tensile shear adhesion of Belzona 1831 (Super UW-Metal) when tested in accordance with ASTM D1002 to wet abraded steel is 1,600psi (11MPa) and to oily abraded steel - 1,300psi (9MPa).

Repair plates were pre-coated with Belzona 5831 (ST-Barrier) and allowed to solidify for 24 hours. Once cured, these plates and the repair area were wetted out using Belzona 1831 to ensure full contact and excellent adhesion. A layer of Belzona 1831 was then brush applied over the repair areas, plates lowered and pressure applied to allow the material to exude from the sides. Seeing material exude confirms full contact between the tank surface and the bonded plate and guarantees a long-term repair. Excess material was then cleared away and Belzona 5831 applied to the entire repair area to prevent future corrosion.

Chris Mills of Wessex Water commented: “We have been using Belzona cold plate bonding solution on GFS tanks and have saved a lot of time and money by doing so. We have also been able to repair tanks while they are still in service as the repair is a spark free repair.”

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DENSO VOID FILLER SOLVES CORROSION TRAPS AT SLOY POWER STATION

Scottish and Southern Energy were concerned that a build-up of moisture in small, difficult to access gaps at Sloy Power Station could lead to corrosion. The problem areas were the narrow gaps between the main water supply pipes and their concrete supports.

Following recommendations from anti-corrosion specialists Winn & Coales (Denso) Ltd they chose to use Denso Void Filler to fill these confined areas and therefore prevent the risk of corrosion. Pyeroy Ltd, operating from its Rosyth branch, was appointed by SSE to carry out the required work on site. They first used Densyl Mastic, a cold applied self-supporting mastic for sealing, filling and caulking applications to seal around the edges of the gaps. Denso Void filler, a semi-solid petrolatum compound specially formulated for pumping into voids, was then heated and poured into the gaps between the pipes and supports.

DENSO STEELCOAT CHOSEN FOR DERRY GAS PIPELINE

Firmus Energy, who are responsible for the supply of natural gas to Northern Ireland recently decided to upgrade the protection to a 360m long 273mm dia. pipeline carrying natural gas across the River Foyle in Derry/Londonderry. The pipeline, which runs alongside the Craigavon Bridge, was showing signs of surface corrosion where the earlier paint coatings had weathered.

Following consultation with McNicholas Construction Services Ltd, the contractors proposed the use of Winn and Coales (Denso) Ltd’s Steelcoat 100/400 system to provide long term protection form corrosion in the aggressive marine environment. The heavy duty Steelcoat system comprises Denso Hi-Tack Primer, Densyl Mastic, Denso Hi-Tack Tape, Denso Ultraceal Tape and Denso Acrylic Topcoat. It was chosen due to its proven properties for long term protection and its suitability for application to surfaces with minimum surface preparation.

The Denso Steelcoat system was applied by EB Gas Services of Newry under the supervision of McNicholas Construction Services. Surface preparation to remove old loose paint coating was carried out using hand scrapers and wire brushing.

It is reported that Firmus Energy were delighted with the completed application which included matching the Denso Acrylic Topcoat to the colour of the existing overall bridge structure.
AV Dawson Ltd, who were founded on Teesside, Middlesbrough, in 1913 are a multimodal distribution logistics supplier who operate a diverse range of haulage, shipping, warehousing and railhead facilities.

At their Ayrton railhead site they handle potash from a nearby mine in North Yorkshire which is very aggressive to steel structures. Consequently they have historically used anti-corrosion coating systems supplied by Winn and Coales (Denso) Ltd to protect roof trusses from corrosion.

When they recently replaced roof trusses in a section of one of the warehouses used for storing the potash they designed the trusses as hollow rectangular sections to allow easier application of Winn and Coales’ Denso Steelcoat 100 System. Denso Steelcoat 100 System consists of Denso Hi-Tack Primer and Denso Hi-Tack Tape and provides excellent long term protection to steel structures in aggressive environments. On this occasion, Denso Self Adhesive PVC Tape was used as an outerwrap to provide additional protection in the aggressive dusty atmosphere of the warehouse.

This system has been used in several applications at salt mines and salt handling facilities and has a proven history in providing long term protection in such environments.

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SUPPLIERS COATINGS

TINSLEY SPECIAL COATINGS
Enterprise House, Durham Lane,
Eaglescliffe TS16 0PS
Tel: 01642 784279 Fax: 01642 782891
Email: enquiries@tinsleyspecialproducts.com

SUPPLIERS GENERAL

AIRBLAST EUROSPRAY
25 King Street Industrial Estate, Langtoft, Peterborough PE6 9NF
Tel: 01778 560650 Fax: 01778 560724
Email: j.cook@airblast.co.uk
Website: www.airblast.co.uk

DOORBOS EQUIPMENT
Tel: 01642 673391 Fax: 01642 673210
Email: sales@doorbosequipment.co.uk
Website: www.doorbosequipment.co.uk

FERNOX
MAKES WATER WORK
Forsyth Rd, Woking, Surrey GU21 1SR
Tel: 01483 793200 Fax: 01483 793201 www.fernox.com

FM CONWAY LTD
Conway House, Rochester Way,
Dartford, Kent DA1 3QY
Tel: 0208 6368822 Fax: 0208 6368827
Email: sharon.howlett@fmconway.co.uk

GMA GARNET (EUROPE) GMBH
PO Box 9, Middlewich, Cheshire, CW10 9FD
Tel: 01606 836233 Fax: 01606 836610
www.gmagarnet.co.uk

JETCHEM SYSTEMS LIMITED
Cuba Industrial Estate, Stubbins, Ramsbottom,
Lancashire BL0 0NE Tel: 01706 828 888 Fax: 01706 828 000
Email: sales@jetchem.com Website: www.jetchem.com

LLEWELLYN RYLAND LTD
Haden Street, Birmingham B12 9DB
Tel: 0121 4402284
Email: research@llewellyn-ryland.co.uk

NEONICEL (BLACKBURN) LTD
Walker Industrial Park,
Blackburn BB1 2QE
Tel: 01254 503505

OCEANEERING INTERNATIONAL SERVICES LTD
Oceaneering House,
Pitmedden Road, Dyce,
Aberdeen AB21 0DP
Tel: 01224 758500

SCANGRIT
Eastfield Road, South Killingholme,
Immingholme, North Lincs DN40 3NF
Tel: 01469 574715 Fax: 01469 571644
Email: sales@scangrit.co.uk Website: www.scangrit.co.uk

RECIPROCAL ORGANISATIONS

ELSEVIER SCIENCE LTD
The Boulevard, Langford Lane, Kidlington,
Oxford OX5 1GD
Tel: 01865 843000 Fax: 01865 843010

INSTITUTE OF METAL FINISHING
Exeter House, 48 Holloway Head, Birmingham B1 1NQ
Tel: 0121 627387 Fax: 0121 6666316
Email: exeterhouse@instituteofmetalfinishing.org
Website: www.uk-finishing.org.uk

MPI GROUP
Peel House, Upper South View,
Farnham, Surrey GU9 7JN
Tel: 01252 732220 Fax: 01252 732221
Website: www.protectivecoatingseurope.com

QUALITY CONTROL

FM CONWAY LTD
Tel: 01642 673391 Fax: 01642 673210
Email: sales@doornbosequipment.co.uk
Website: www.doornbosequipment.co.uk

GMA GARNET (EUROPE) GMBH
PO Box 9, Middlewich, Cheshire, CW10 9FD
Tel: 01606 836233 Fax: 01606 836610
www.gmagarnet.co.uk

JETCHEM SYSTEMS LIMITED
Cuba Industrial Estate, Stubbins, Ramsbottom,
Lancashire BL0 0NE Tel: 01706 828 888 Fax: 01706 828 000
Email: sales@jetchem.com Website: www.jetchem.com

LLEWELLYN RYLAND LTD
Haden Street, Birmingham B12 9DB
Tel: 0121 4402284
Email: research@llewellyn-ryland.co.uk

NEONICEL (BLACKBURN) LTD
Walker Industrial Park,
Blackburn BB1 2QE
Tel: 01254 503505

OCEANEERING INTERNATIONAL SERVICES LTD
Oceaneering House,
Pitmedden Road, Dyce,
Aberdeen AB21 0DP
Tel: 01224 758500

SCANGRIT
Eastfield Road, South Killingholme,
Immingholme, North Lincs DN40 3NF
Tel: 01469 574715 Fax: 01469 571644
Email: sales@scangrit.co.uk Website: www.scangrit.co.uk

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Tel: 0121 627387 Fax: 0121 6666316
Email: exeterhouse@instituteofmetalfinishing.org
Website: www.uk-finishing.org.uk

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Website: www.protectivecoatingseurope.com

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www.gmagarnet.co.uk

JETCHEM SYSTEMS LIMITED
Cuba Industrial Estate, Stubbins, Ramsbottom,
Lancashire BL0 0NE Tel: 01706 828 888 Fax: 01706 828 000
Email: sales@jetchem.com Website: www.jetchem.com

LLEWELLYN RYLAND LTD
Haden Street, Birmingham B12 9DB
Tel: 0121 4402284
Email: research@llewellyn-ryland.co.uk

NEONICEL (BLACKBURN) LTD
Walker Industrial Park,
Blackburn BB1 2QE
Tel: 01254 503505
## ICATS REGISTERED COMPANIES

### ICATS REGISTERED COMPANIES WITH QUALIFIED APPLICATORS

<table>
<thead>
<tr>
<th>Company Name</th>
<th>Address</th>
<th>Telephone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alfred Bagnall &amp; Sons</td>
<td>6 Manor Lane, Shipley, West Yorkshire, BD18 3RD</td>
<td>01302 853259</td>
</tr>
<tr>
<td>AlpAccess s.r.l.</td>
<td>I.L. Caragiale, 21 Ploiesti, 100015, P.H. Romania</td>
<td>+44 (0) 722140858</td>
</tr>
<tr>
<td>APB Construction (UK)</td>
<td>First Floor Offices, Orange Business Centre, River Works, Grange Lane, Sheffield, SS0 OQP</td>
<td>01709 541000</td>
</tr>
<tr>
<td>APB Group Limited</td>
<td>Ryandra House, Ryandra Business Park, Brookhouse Way, Cheadle, Staffs, ST10 1SR</td>
<td>01538 755377</td>
</tr>
<tr>
<td>Armourcote Surface Technology Plc</td>
<td>15/17 Colvilles Place, Kelvin Industrial Estate, East Kilbride, Scotland, G75 0PZ</td>
<td>01355 248223</td>
</tr>
<tr>
<td>Austin Hayes Ltd</td>
<td>Carlton Works, Cemetary Road, Yeadon, Leeds, LS19 7BD, UK</td>
<td>0113 250 2255</td>
</tr>
<tr>
<td>B&amp;A Contracts Ltd</td>
<td>Dale Road, Hubberston, Milford Haven, Pembrokeshire SA73 3PR</td>
<td>01646 693489</td>
</tr>
<tr>
<td>BAE Systems Surface Ships Support Ltd</td>
<td>Room 213, Naval Base Headquarters, Building 1/100, Pier 21, Portsmouth, PO1 3BP</td>
<td>023 92850727</td>
</tr>
<tr>
<td>Barrier Ltd</td>
<td>Stephenson Street, Wallsend, Tyne &amp; Wear, NE28 6UE, UK</td>
<td>0191 262 0510</td>
</tr>
<tr>
<td>Beever Limited</td>
<td>Little Coldharbour farm, Tong Lane, Lamberhurst, Kent, TN3 8AD, UK</td>
<td>01892 890045</td>
</tr>
<tr>
<td>Bluhull Marine Ltd</td>
<td>Orange Grove Birbal Street Baxlan, BZN 9013 MALTA</td>
<td>+356 21445807</td>
</tr>
<tr>
<td>Border Coatings (Scotland) Ltd</td>
<td>Unit 7, Station Road Industrial Estate, Earlston, Berwickshire TD4 6BZ</td>
<td>01896 823106</td>
</tr>
<tr>
<td>Briton Fabricators Ltd</td>
<td>Watnall Road, Hucknall, Notts, NG15 6EP</td>
<td>01159632901</td>
</tr>
<tr>
<td>Cape Industrial Services</td>
<td>Cape House, 3 Red Hall Avenue, Paragon Business Village, Wakefield, WF1 2UL</td>
<td>01224 215800</td>
</tr>
<tr>
<td>Chemcsc Scotland Ltd</td>
<td>Wester Crosshill, Avonbridge Road, Falkirk FK1 3DF</td>
<td>01324 851987</td>
</tr>
<tr>
<td>Cleveland Bridge UK Ltd</td>
<td>Cleveland House, Yarm Road, Darlington, DL1 4DE</td>
<td>01325 502345</td>
</tr>
<tr>
<td>Coating Services Ltd</td>
<td>Parington Street, Mumps Bridge, Oldham, OL1 3RU, UK</td>
<td>0161 665 1998</td>
</tr>
<tr>
<td>Collins Engineering Railway Contracts</td>
<td>Salcombe Road, Meadow Lane Industrial Estate, Alfreton, Derbyshire, DE55 7RG</td>
<td>01773 833255</td>
</tr>
<tr>
<td>Community Clean</td>
<td>11 Old Forge Road, Ferndown Industrial Estate, Ferndown, Wimborne, Dorset, BH21 7RJ, UK</td>
<td>0845 6850133</td>
</tr>
<tr>
<td>Corrocoat</td>
<td>Forster Street, Leeds, LS10 1P</td>
<td>01132760760</td>
</tr>
<tr>
<td>D&amp;D Rail Ltd</td>
<td>Time House, Time Square, Basildon Essex SS14 1DJ</td>
<td>01268 520000</td>
</tr>
<tr>
<td>Denholm Industrial</td>
<td>21 Boden Street, Glasgow, G40 3PU</td>
<td>0141 445 3939</td>
</tr>
<tr>
<td>Donyal Engineering Ltd</td>
<td>Hobson Industrial Estate, Burnopfield, Newcastle Upon Tyne NE16 6EA</td>
<td>01207 270909</td>
</tr>
<tr>
<td>DRYC Coatings Ltd</td>
<td>Suite 5, 3 Shawcross Industrial Estate, Ackworth Road, Pontowish PO3 5J</td>
<td>023 9266 6165</td>
</tr>
<tr>
<td>Dyer &amp; Butler Ltd (Rail)</td>
<td>Mead House, Station Road, Nursling, Southampton, SO16 OAH, UK</td>
<td>02380 667549</td>
</tr>
<tr>
<td>ENC (Yorkshire) Ltd</td>
<td>Unit 3B Rotherham Road, Dinnington Sheffield, S25 3RF</td>
<td>01909 567860</td>
</tr>
<tr>
<td>Excel Contractors Ltd</td>
<td>11a West End Road, Bittemer, Southampton SO18 6TE</td>
<td>02380 444420</td>
</tr>
<tr>
<td>F A Clover &amp; Son</td>
<td>Bardolph Road, Richmond Surrey, TW9 2LH</td>
<td>0208 948 6321</td>
</tr>
<tr>
<td>Forth Estuary Transport Authority</td>
<td>Forth Road Bridge, Administration Office South Queensferry, EH30 9SF</td>
<td>0131 319 1699</td>
</tr>
<tr>
<td>GABRE (UK) LTD</td>
<td>9 Holme Road, Dromore, Omagh Co Tyrone, BT78 3BX</td>
<td>02882 897950</td>
</tr>
<tr>
<td>Hi&amp;H Painting Contractors Ltd</td>
<td>Unit 3 Bell Park, Bell Close, Newnham Ind Est Plymouth PL7 4TA</td>
<td>07837 382619</td>
</tr>
<tr>
<td>Harso Infrastructure UK Ltd</td>
<td>Unit 3 Manby Road, South Killingholme, Immingham, North Lincolnshire, DN40 3DX</td>
<td>01469 553800</td>
</tr>
<tr>
<td>Harrisons Engineering Lancashire Ltd</td>
<td>Judge Wilmy Mill, Longworth Road Billington, Clitheroe, Lancashire, BB7 9TP</td>
<td>01254 823993</td>
</tr>
<tr>
<td>HBS Protective Coatings Ltd</td>
<td>40 Manse Road, Belfast BT8 6SA</td>
<td>028 90708280</td>
</tr>
<tr>
<td>Herrington Industrial Services Ltd</td>
<td>Crown Works, Crown Road, Low Southwick, Sunderland SRS 2BS</td>
<td>0191 5160634</td>
</tr>
<tr>
<td>Hi-Tech Surface Treatment Ltd</td>
<td>Unit B, Deacon Trading Estate, Chickenhall Lane, Eastleigh, Hants SO50 6RP</td>
<td>023 80611789</td>
</tr>
<tr>
<td>Hyspec Services Ltd</td>
<td>Unit 3 Meadowfield Industrial Estate, Cowdenbeath Road, Burntisland, Fife, KY3 0LH</td>
<td>01592 874661</td>
</tr>
<tr>
<td>Industrial Coating Services</td>
<td>A1 House, Rolling Mill Street, Norton Canes, Cannock WS11 9UH</td>
<td>0845 474 0007</td>
</tr>
<tr>
<td>Industrial Painting</td>
<td>48-49 RCM Business Centres, Sandbacks Trading Estate, Dewsbury Road, Ossett, WF5 9ND</td>
<td>01924 272606</td>
</tr>
<tr>
<td>Company Name</td>
<td>Address</td>
<td>Phone Number</td>
</tr>
<tr>
<td>--------------------------------------</td>
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</tr>
<tr>
<td>International Energy Services Ltd</td>
<td>94 Awo lowo, Ikoyi, Lagos State, Nigeria</td>
<td>T: 0146 15636</td>
</tr>
<tr>
<td>Interserve Industrial</td>
<td>Unit 2, Olympic Park, Poole Hall Road</td>
<td>T: 0151 373 7660</td>
</tr>
<tr>
<td>J Murphy &amp; Sons Ltd</td>
<td>Hitchin House, Highgate Road, London</td>
<td>T: 020 7 267 4366</td>
</tr>
<tr>
<td>Jack Tighe Coatings</td>
<td>Sandall Lane, Kirk Sandall, Doncaster</td>
<td>T: 01302 88 0360</td>
</tr>
<tr>
<td>Jack Tighe Ltd</td>
<td>Redbourne Mere, Kirton Lindsey, Lincs</td>
<td>T: 01652 640 003</td>
</tr>
<tr>
<td>JPV (Painters) Ltd</td>
<td>Unit 8 Prospect Way, Hutton Industrial Estate</td>
<td>T: 01277 201 515</td>
</tr>
<tr>
<td>KAEFER Opus Ltd</td>
<td>Ethan House, Royce Avenue, Cowpen Industrial</td>
<td>T: 0191 438 5525</td>
</tr>
<tr>
<td>Keep Protective Coatings Ltd</td>
<td>Unit 4, James Park, Mahon Road, Portadown</td>
<td>T: 02838 338 151</td>
</tr>
<tr>
<td>Lanarkshire Welding Co.</td>
<td>82 John Street, Biggin Hill, Westerham</td>
<td>T: 01752 71 77 01</td>
</tr>
<tr>
<td>Mabey Bridge Ltd</td>
<td>Station Road, Chepstow, Monmouthshire</td>
<td>T: 01291 62 3801</td>
</tr>
<tr>
<td>Maclean &amp; Spiers Blasting Ltd</td>
<td>Unit D, East Fulton Farm, Darlulth Road, Linwood</td>
<td>T: 01505 324 777</td>
</tr>
<tr>
<td>M&amp;F Decorators Ltd</td>
<td>26 Jail Lane, Biggin Hill, Westerham</td>
<td>T: 0770 205 1729</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>NSG UK Ltd</td>
<td>Fourth Avenue, Deeside Industrial Park, Deeside, Flintshire CH5 2NR</td>
<td>T: 01244 833 138</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 26 526</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 5525</td>
</tr>
<tr>
<td>Nusteel Structures</td>
<td>Lympne Industrial Estate, Lympne, Hythe, Kent, CT21 4LR</td>
<td>T: 01303 268 112</td>
</tr>
<tr>
<td>Offshore Marine Services Ltd</td>
<td>Brumby House, Jalan Bahasa, PO Box 80148, B70 11</td>
<td>T: 0127 264 1237</td>
</tr>
<tr>
<td>Ormmac Coatings Ltd</td>
<td>Newton Charners Road, Thorcliffe Park Estate, Chapeltown, Sheffield, S35 2PH</td>
<td>T: 07976 373 2866</td>
</tr>
<tr>
<td>Over Rail Services Ltd</td>
<td>Unit 10 Millhead Way, Purdys Industrial Estate, Rochford, Essex, SS4 1ND</td>
<td>T: 0191 493 2600</td>
</tr>
<tr>
<td>Painto Ltd</td>
<td>Trianon, Westover, Ivybridge, Devon, PL2 9JH</td>
<td>T: 01282 415 323</td>
</tr>
<tr>
<td>PCM Nigeria Ltd</td>
<td>99 Rivoc Road Trans Amadi, Port Harcourt, Rivers State, Nigeria</td>
<td>T: +2348055297828</td>
</tr>
<tr>
<td>P H Shotblasting &amp; Spraying Services</td>
<td>43a Drumraine Road, Castlecaulfield, Dunagannon, Co Tyrone, BT6 5NY</td>
<td>T: 028 877 6 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 415 323</td>
</tr>
<tr>
<td>Port Painters Limited</td>
<td>Unit 3, Ringside Business, Holiel-Y-Rhosog, Cardiff, CF3 2Ew</td>
<td>T: 02920 777 070</td>
</tr>
<tr>
<td>PPC Ltd</td>
<td>Unit 2, Oyster Industrial Estate</td>
<td>T: 023 9221 5957</td>
</tr>
<tr>
<td>Pyroly Limited</td>
<td>Kirkstone House, St Omers Road, Western Riverside Route, Gateshead, Wear, NE11 9EZ</td>
<td>T: 0191 493 2600</td>
</tr>
<tr>
<td>Roy Hankinson Limited</td>
<td>Alexander House, Monkys Ferry, Birkenhead Wirral, CH41 5LH</td>
<td>T: 0870 789 2020</td>
</tr>
<tr>
<td>Stobbarts Ltd</td>
<td>Tarn Howe, Lakes Road, Dervent Howe Industrial Estate, Workington, Cumbria CA4 3YP</td>
<td>T: 01900 870780</td>
</tr>
<tr>
<td>Tees Valley Coatings</td>
<td>Unit 6, Lodge Bank, Crown Lane, Horwich, Bolton, Lancs, BL6 5HU</td>
<td>T: 01204 468 090</td>
</tr>
<tr>
<td>TEMA 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 869 784</td>
</tr>
<tr>
<td>Walker Construction (UK) Ltd</td>
<td>Park Farm Road, Folkestone, Minster, Maidstone, Kent, CT19 5DY</td>
<td>T: 01303 851 111</td>
</tr>
<tr>
<td>Warde Painters Ltd</td>
<td>Unit 5, Wimborne Building, Atlantic Way, Barry Docks, Glamorgan, CF63 3RA, UK</td>
<td>T: 01446 748 620</td>
</tr>
<tr>
<td>W G Beaumont &amp; Son</td>
<td>Beaumont House, 8 Bernard Road, Romford RM7 0HX</td>
<td>T: 01708 749 202</td>
</tr>
</tbody>
</table>

**Corrosion Management | March/April 2014**
William Hare Ltd
Brandleholme House, Brandleholme Road, Bury, Lancs, BL8 1JJ, UK
T: 0161 609 0000

Xeron Palmers Ltd
331 Charles Street, Royston, Glasgow G21 2QA
T: 0141 5534040

ICATS REGISTERED COMPANIES
Abbey Gritblasting Services
Unit 13, Clpton Commercial Park, Clpton, Woodbridge, Suffolk, IP12 3TP
T: 0191 262 0510

Advanced Construction and Eng Resources Ltd (ACER)
5th Floor, Horton House, Exchange Flags, Liverpool L2 3PF
T: 0161 408 0155

A McKie Building & Engineering Ltd
19 Kyle Road, Irvine, Ayrshire, KA12 8JX
T: 01294 279586

BSM Consulting
11 Kingsmead, Nailsea BS48 2XH
T: 01275 854708

BAM Nuttall Ltd
St James House, Knoll Road, Camberley GU15 3XW
T: 0782 5798440

Celtic Specialist Treatments Ltd
Rosedale, Carelicken Lane, Langstone Newport, Gwent, NP18 2JZ
T: 01633 400194

Centregreat Engineering Ltd
11/12 Wyndham Close, Brackla, Brackla Industrial Estate, Bridgend, CF31 2AD
T: 01656 650481

C E Pittaway & Son Ltd
106 – 114 Flinton Street Hull HU3 4NA
Tel: 01482 329007

Coastground Ltd
Morton Peto Road, Capton Hall Industrial, Great Yarmouth, Norfolk, NR31 0LT
T: 01493 650455

Corroless Eastern Ltd
Greens Road, Greens Industrial Estate, Dereham, Norfolk NR20 3TG
T: 01362 691484

Darcy Spillcare Manufacture
Brook House, Larkfield Trading Estate, New Hythe Lane, Larkfield, Kent ME20 6CN
T: 01622 715100

D F Coatings Ltd
Unit 17, Willments Ind. Estate, Hazel Road, Woolston Southampton SO19 7HS
T: 0238 044 5634

E G Lewis & Company Ltd
Suite 5, 3 Shawcross Industrial Estate, Ackworth Road, Portsmouth PO3 5JP
T: 01792 323288

Farbuild Ltd
Trelawne Lodge, Vicarage Road, Wingfield, Diss, Norfolk IP21 5JR
T: 01037 640670

FMC Technologies NIGERIA
No. 22 Gerrard Road Ikoyi, NIGERIA
T: +234 (0) 8039740023

Forward Protective
Vernon Street, Shirebrook, Mansfield Notts, NG20 8SS
T: 01623 748323

Gemini Corrosion Services
Brent Avenue, Forties Road, Montrose, Angus, DD10 9PB
T: 01674 672 678

Galdris Construction Ltd
Galdris House, Pavilion Business Centre, Kensington Crescent, Innova Science Park, Enfield EN3 7FJ
T: 01992 763000

Hempel UK Ltd
Lillamart Park, Cwmbran, Gwent, NP44 3XF
T: 01633 874024

Kaefer C&D Ltd
Riverside House, Rolling Mill Road, Viking Industrial Estate, Jarrow, Tyne & Wear NE32 3DF
T: 01633 874024

Livis Ltd
Livis House, 50 Victoria Park Dartford, Kent, DA1 5AJ
T: 01322 220058

Malakoff Limited
North Nest, Nerwick, Shetland, ZE1 0LZ, UK
T: 01595 695544

Matthew James Services
Unit 4, Shibdon Business, Cowen Road Blaydon, Newcastle-Upon-Tyne, NE21 5TX
T: 0191 414 5700

Moore Steel Developments Ltd
Station Road, Thorney, Peterborough PE6 0QE
T: 01733 270729

Optimal Rail Ltd
Unit 5, Moorgate Crofts Business Centre Alma Road, Rotherham S60 2DH
T: 01709 331153

Paint Inspection Ltd
Milton House, 7 High Street, Fareham PO16 7AN
T: 0845 4638680

Park Farm, Holme-upon-Spalding-Moor, York, YO43 4AG
T: 01430 861628

Possilpark Shotblasting Co Ltd
Dalmarack Works, 73 Dunn Street, Glasgow, G40 3PE
T: 0141 556 6221

R.L.P. Painting
Heathfield House, Old Bawtry Road, Finningley, Doncaster, DN9 3DD, UK
T: 01302 772222

SCA Group Ltd
Woolsbridge Ind. Park, Three Legged Cross, Dorset, BH21 6FA
T: 01202 820820

Sherwin-Williams Protective & Marine Coatings
Tower Works, Kestor Street, Bolton, Lancs, BL2 2AL
T: +44 (0) 1204 521771

Shirley Industrial Painters & Decorators Ltd
Grand Union House, Bridge-Walk, Acoc’s Green, Birmingham, B27 6SN
T: 0121 706 4000

Specialist Blasting Services Ltd
Smiths Quay, Hazel Road, Woolston, SO19 7CB
T: 023 80438901

Stamford Construction Limited
Barham Court Business Centre, Teston, Maidstone, Kent MW18 5BZ
T: 07912037033

Stream Marine Training Ltd
Milin Craig, Abercorn House 79 Renifrew Road Paisley PA3 4DA
T: 01706 157960

Story Contracting Ltd
Burgh Road Industrial Estate, Carlisle, Cumbria CA2 7NA
T: 07730 764414

Tinsley Special Products
Enterprise House, Durham Lane, Eaglescliffe, Stockton-on-Tees TS16 0PS
T: 01642 784279

Torishima Service Solutions Europe Ltd
Sunnyside Works Gartsherrie Road Coatbridge ML5 2DJ
T: 0123642390

Transvac Systems Ltd
Monsal House, 1 Bramble way Alfreton, Derbyshire, DE5 4RH
T: 01773 831100

Wescott Coatings & Training Services Ltd
The Quadrus Centre, Woodstock Way, Boldon Business Park, Boldon NE35 9PF
T: 0191 5197380
### DIARY DATES 2014/2015

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
<th>Venue/Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tuesday 15th April</td>
<td>Corrosion Related Failures for Downhole Chemical Injection Lines</td>
<td>Venue: Palm Court Hotel, 5.30pm for 6pm. Details can be obtained from ICORR Aberdeen Branch. T: 01224 243360 E: <a href="mailto:ICORRABZ@gmail.com">ICORRABZ@gmail.com</a></td>
</tr>
<tr>
<td>Tuesday 29th April</td>
<td>Midlands Branch Meeting Laboratory Tour &amp; Presentation Visit to the Exova Corrosion Centre</td>
<td>Venue: Exova, Corrosion Centre, Dudley.</td>
</tr>
<tr>
<td>Friday 2nd May</td>
<td>London Branch guided walk 5.45 for 6pm start. Details inside Page 5.</td>
<td></td>
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<tr>
<td>Thursday 8 May</td>
<td>CED Working Day and Symposium on Coatings for the Corrosion Protection of Ancient and Modern Structures</td>
<td>Venue: Royal Armouries Conference Centre, Leeds Armories 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.</td>
</tr>
<tr>
<td>Tuesday 20th May</td>
<td>Insulation Inspector and Fire Proofing Inspector Training</td>
<td>Venue: Lumut, Western Malaysia. For more information contact: <a href="mailto:dave.griffiths@argyllruane.com">dave.griffiths@argyllruane.com</a></td>
</tr>
<tr>
<td>Tuesday 20th – Thursday 22nd May</td>
<td>CEDCORC – International Congress and Technical Exhibition</td>
<td>Venue: Weimar, Germany. See website for further details.</td>
</tr>
<tr>
<td>Thursday 5th June</td>
<td>London Branch Golf Day</td>
<td>Venue: Silvermere GC, Surrey. Details from Derek Hoskins <a href="mailto:dhoskins@waitrose.com">dhoskins@waitrose.com</a></td>
</tr>
<tr>
<td>Thursday 17th – 18th June</td>
<td>Institute of Corrosion and NACE, Great Britain Section, present a joint conference on Energy Security - Corrosion Matters.</td>
<td>Royal Overseas League, St. James London for more information email to: <a href="mailto:admin@icorr.org">admin@icorr.org</a></td>
</tr>
<tr>
<td>Thursday 9th October</td>
<td>London Branch joint meeting with LMS</td>
<td>Speaker: Dr Fred Parret FRSC; 'Dead or alive – what’s in the air we breathe'. Venue: Naval Club, 38 Hill Street, London 17.45 for 18.15 start</td>
</tr>
<tr>
<td>Sunday 2nd - Thursday 6th November</td>
<td>Call For Papers - 19th International Corrosion Congress</td>
<td>Venue: Jeju Island, Korea. For more information visit: <a href="http://www.19thicc.com">http://www.19thicc.com</a></td>
</tr>
<tr>
<td>Thursday 13th November</td>
<td>London Branch joint meeting with W&amp;JS</td>
<td>Speaker: Hesham Mahmoud; 'Top of line corrosion and mitigation.'</td>
</tr>
</tbody>
</table>

### BRANCH CONTACT DIRECTORY

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