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News from the Asia Pacific Region

ASIAN - PACIFIC MATERIALS & CORROSION ASSOCIATION

THE WORLD CORROSION ORGANIZATION

AUSTRALASIAN CORROSION ASSOCIATION INC. SEMPER TUENS

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COVER PHOTO
Courtesy of Wolfchester. Bristle Blaster.

President's Message

Michael Boardman
Australasian President

One of the problems facing an Association that has an extremely broad range of pursuits is trying to be all things to all people. Luckily, we are all united by the collective quest of corrosion mitigation. The ultimate forum of this quest has to be our annual Conference, that place where we are able to share our ideas, learn new things and generally catch up with our fellow members.

I make no excuses for putting in a plug for the Wellington Conference. It is the one-in-eight year opportunity the New Zealand Branch has the pleasure of being your hosts and they are determined to make this conference a memorable one. I have been privy to some of the planning that has been going on for the last few months, from the arduous task of preparing the technical presentation timetable, through to the exciting social functions. For those of you from across the Tasman, use the opportunity to take some time out to explore New Zealand. Remember, some of our wines are world class, we have no snakes and we will be coming into summer.

I was recently invited to attend a coatings and corrosion summit in Jakarta. This was a three day conference organised by the Jakarta sections of NACE, SSPC and ASCOATINDO (Indonesian Coating Association). The theme was "The integration of knowledge, professionals and industries". Their aim was to provide a series of keynote presentations across the spectrum of corrosion mitigation, through to technical sessions where sponsors and exhibitors were able to openly talk about their products to a captive audience. This I found to be somewhat alien to the way we do things down in the bottom right hand corner. I also had the opportunity to bore a different race of people on the cost of corrosion, as did Mr Tushar Jhaveri from NACE India. It would seem that with India's emergence as one of the fastest growing economies on the planet, they too have their concerns. Interestingly, the official corrosion language is still English, although Robert Herbert (NACE President) was telling me that the Chinese were busy translating NACE publications into Mandarin. Overall, the Indonesians were most hospitable; Jakarta was frenetic but looks like it has a smog problem to address at some stage.

Our Executive Officer Mal Brooks has recently resigned, Mal has been with the ACA since 2003 and in that time he has moved the Association forward and has initiated a number of significant changes at the Centre. Not to be outdone, Alicia Semple has also tendered her resignation, however she has been working hard on the transition and handover programmes for the conference and the Journal. I wish both Mal and Alicia good fortune in their future endeavours, their efforts are to be applauded.

I have a sneaking suspicion that this is my last opportunity to address the members in print, as President. I am looking forward to meeting you all in Wellington in November, where they may give me some microphone time!

NMT Electrodes (Pty) Ltd in South Africa and NMT Electrodes (Australia Pty) Ltd no longer manufacture MMO and Platinised Titanium Anodes for Titanium Electrode Products Ltd UK and Titanium Electrode Products Inc. USA.

The NMT Electrodes companies will continue manufacturing the Telpro Brand of anodes for CP application, which will be sold exclusively through Titanium Electrode Products (Australia) Pty Ltd. We wish to thank our customers for their loyal support over the years and look forward to servicing them in the future.

Visit us at booth 14 at Corrosion & Prevention 2008

WHAT'S RUSTING

Publications Director's Message

This issue you are reading is the last to be compiled by Alicia Semple, who has recently resigned her position as our Operations Manager. Alicia first worked on Corrosion & Materials in 2004 on a part-time basis and was persuaded to accept the staff position of Publications Co-ordinator by Mal Brooks in 2005. She has been responsible for the content, layout and printing of our Journal since the October 2005 issue and I'm sure readers will agree that she has developed and maintained a very high standard of quality and timeliness.

On your behalf, I would like to go on record to thank Alicia for her excellent work; not only on our various publications, but also for the unseen role she played behind the scenes with Mal, in ensuring the smooth running of our recent Conferences. Our loss is Enterprise Care's gain who has appointed Alicia as their Publications Manager.

I also echo our President's comments in also applauding the efforts of recently resigned Executive Officer Mal Brooks, who I have had the pleasure of working with in various capacities. Until their replacements are appointed, member's patience is requested as the remaining staff try to maintain service from the Centre.

Fortunately the groundwork that Mal and Alicia have put in place means that our 2008 Conference should also be a success. It now relies on your support and indications at the time of writing suggest this has been forthcoming. The rest of the 2008 Conference Committee look forward to welcoming you to Wellington – "the greatest little capital in the world".

Willie Mandeno
ACA Publications Director/
C&P08 Conference Convenor

Dear Editor,

Re: CORROSION & MATERIALS - AUGUST 2008, CATHODIC PROTECTION OF STEEL IN CONCRETE IN AUSTTRALIA

I read with some interest the above article by Atef Cheaitani et al concerning the history of the application of cathodic protection systems to steel reinforcing.

The first impressed current concrete CP installation in Australia, was I believe installed by Allen Jennison and myself in the mid 1970's. At the time we were Qld and NSW Managers respectively for Wilson Walton International.

A high school was built in the Lismore area about 1965. The school was in a flood plain and was constructed so that all school areas were located on the first level. Within 5 years flooding occurred twice to the point where the lower level floor was completely submerged.

The first level floor was constructed using an "omni plank" method. This consists of a precast reinforced concrete plank which sit on steel formwork, with the gaps between the planks infilled with hollow cinder bricks. The concrete is then poured and the planks become part of the floor structure. It is cheap and quick.

After about 10 years, rust staining and spalling of the ceiling was observed. Investigation showed corrosion was occurring of the reinforcing of the omni planks. The investigation also revealed the cavities in the cinder bricks contained water. It was concluded, at times of flooding, water was entering the cavities and staying there. The structural integrity of the concrete slab was questionable and additional supports were installed.

We were approached regarding installation of a CP system to control the corrosion. The system design involved installation of small silicon iron anodes in the cavities. A cable connection had to be made to each steel reinforcing member which was achieved using a stud welder. All the installation work had to be completed during school holidays including reinstatement and painting. We worked around the clock and walked out the morning the kids walked in.

The above was, to my knowledge, the first concrete CP system installed in Australia. The TR had auto control, and would only operate if water entered the cavities. The system was commissioned in 1978 and, to my knowledge, there have been no floods since.

I trust this is of interest to your readers.

Regards,
Bill McCaffrey
Cathodic Protection Services

DO YOU HAVE NEWS FOR WHAT'S RUSTING?
SEND YOUR SUBMISSIONS TO:
wesley.fawaz@corrosion.com.au

Argonne scientists discover networks of metal nanoparticles are culprits in alloy corrosion

Oxide scales are supposed to protect alloys from extensive corrosion, but scientists at U.S. Department of Energy's Argonne National Laboratory have discovered metal nanoparticle chinks in this armour.

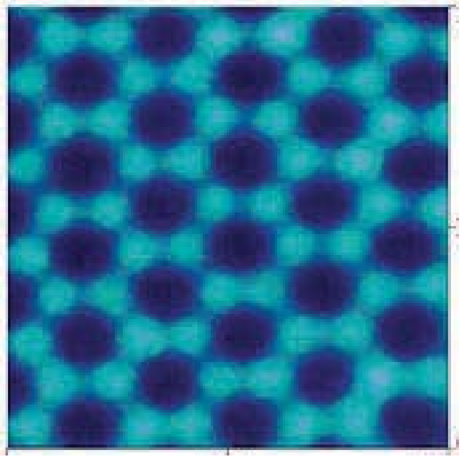
Oxide scales develop on the outer surface of alloys at high temperatures creating a protective barrier that keeps destructive carbon-bearing molecules from slipping into the alloy. The diffusion of carbon into oxide scales should be negligible, but studies have shown that carbon can sneak through the oxide line of defence leading to brittleness and corrosion.

"The United States loses four percent of the gross national product due to alloy corrosion," said Argonne Distinguished Fellow Ken Natesan, who leads the Corrosion and Mechanics of Materials Group in Argonne's Nuclear Engineering Division. "A network of continuous metal nanoparticles allows the carbon to dissolve and diffuse through the protective oxide scales without the need of a crack or a pore."

It was commonly believed that carbon-containing molecules escaped into cracks or pores in the oxide scales, but using three separate techniques – nanobeam X-ray analysis at the Advanced Photon Source, magnetic force microscopy at the Center for Nanoscale Materials, and scanning electron microscopy at the Electron Microscopy Center– Natesan, along with Argonne scientists Zuotao Zeng, Seth Darling and Zhonghou Cai, discovered networks of iron and nickel nanoparticles embedded within the oxide scales.

Carbon can easily diffuse through the metals and create a path for carbon atom transport that does not involve defects in the scale.

"By examining the oxide scale, we find the metal nanoparticles," Zeng said. "If they are eliminated we can create a more corrosion-resistant and longer lasting alloy."



Based on the study, Argonne has developed laboratory size batches of materials that exhibit as much as 10 times longer life than commercial alloys with similar chromium contents, Natesan said. At present, 50-lb batches of the alloys have been cast successfully by an alloy manufacturer and will be commercialized in due course. The Argonne-developed alloys are of considerable interest to the chemical, petrochemical and refining industry.

The findings might also have broad influence on not only metal dusting and carburization, but also in other research areas such as alloy development and surface coatings for high-temperature fuel cell applications.

Funding for this research was provided by the U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, Industrial Technologies Program. Argonne's scientific user facilities such as the Advanced Photon Source, Electron Microscopy Center and Center for Nanoscale Materials are supported by the U.S. Department of Energy, Office of Science.

A paper based on this work has been published recently in Nature Materials.

Attention Blast Cleaners and Applicators

Skills Tech Australia and the Australasian Corrosion Association Inc are seeking expressions of interest from blast cleaners and applicators to have their experience and knowledge assessed for the trade qualification of "Blast Cleaner and Coatings Applicator".

The core group of personnel so registered will become the first group recognised as trade professionals. This group will be joined by those trained under MEM 30305 Certificate III Engineering Surface Finishing as Blast Cleaners and Coating Applicators, upon completion of their three years apprenticeship. This in turn will provide the Industry with Skilled Trades people and provide a career path that will raise the standard of workmanship.

The RPL (Recognition of Prior Learning) process involves those who are currently working in this environment. It will provide you with trade qualifications that recognises the specialist work performed.

For those of you who already hold Trade qualifications we would also like to hear from you to register with us.

If you or your company are interested please register, or for further information, please contact the Australasian Corrosion Association Centre, or Skills Tech Australia, Mark Arundell 0417 198052, John Mahony 0418 762745,

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IN BRIEF

New Corrosion Centre for USA

Rice University in Houston, Texas, has established a National Corrosion Center where researchers will develop better technology for preventing corrosion, particularly as it affects the oil and gas industry. Rice will collaborate with NACE International in the venture.

"Anything made with steel corrodes, so our system of highways and bridges, our pipelines for transporting water, oil and gas, our buildings, our aviation and transportation industries are all at risk," said Emil Peña, executive director of the new center and also of Rice's Energy and Environmental Systems Institute.

"We will focus on corrosion prevention and mitigation technologies that not only have the potential to improve the reliability and safety of just about everything made of steel, but also can save billions of dollars in repairs and rebuilding. This research even has biomedical implications."

With Rice's expertise in nanotechnology, Peña is optimistic about developing nanocoatings that can keep water away from steel surfaces.

The Center is seeking government and private corporate funding.

'Smart bridge' replaces collapsed structure

The replacement span for the Minneapolis bridge which collapsed into the Mississippi River last year is now complete.

The new $234 million I-35W crossing reopens a major transportation artery in and out of Minneapolis.

According to the Associated Press, the new bridge contains 323 sensors that will detect and collect data on small structural problems before they become big ones. The technology will monitor how the bridge handles the stresses and vibration of traffic loads and Minnesota's harsh climate and salt corrosion.

Other sensors will activate an anti-icing system and security sensors are meant to detect intruders in unauthorized areas.

Also, the new bridge is concrete instead of steel and is built with redundant systems so that if one part fails it won't collapse, unlike the older span, which was vulnerable to structural problems anywhere on the bridge.

New CSIRO Chief

Dr Megan Clark has been appointed as the new Chief Executive of the Commonwealth Scientific and Industrial Research Organisation (CSIRO).

Dr Clark will succeed Dr Geoff Garrett, whose term as Chief Executive ends on 31 December 2008.

Senator Kim Carr, Minister for Innovation, Industry, Science and Research welcomed Dr Clark's appointment, saying her experience in science, research and business would allow her to represent the CSIRO on the national and international stage.

"The Government is very pleased that Dr Clark has agreed to lead the CSIRO," Senator Carr said.

"Her vast leadership experience in the development and application of science and technology in a business environment will be an invaluable asset for the CSIRO and for the nation.

"Dr Clark understands the work of CSIRO and appreciates the unique challenges the organisation faces.

"Her experience will also be critical to the central role the CSIRO will play in helping to revitalise Australia's national innovation system," he said.

Dr Clark is currently the Vice President Health, Safety, Environment, Community and Sustainability at BHP Billiton. She has been appointed as Chief Executive of CSIRO for a five year term commencing in January 2009.

Savcor ART Appointments

Savcor ART (QLD) are pleased to welcome Dr Craig Wilks, Daniel Johnstone, Mike Mackinlay, Eva Jouvencon, David Watson to their team in Brisbane.

Dr Craig Wilks joins us with a background in research and development of composite material systems. Craig will focus on project delivery and technical development of repair technologies utilizing composite materials. His experience in this field will be utilized for rehabilitation projects on both steel and concrete structures.

Daniel Johnstone has transferred from the pipeline asset division of Brisbane Water and will undertake R & D and projects focused on updating analogue systems to new, remotely monitored digital systems using his degree and experience in electronic engineering. His experience in this area dovetails with Savcor's existing ReCon and MCon technologies for remote monitoring and control, and will assist with assimilation of new technologies available from the acquisition of FuturTec.

Mike Mackinlay returns to Savcor as a Project Supervisor initially responsible for the Northern Pipeline Interconnector project but incorporating the numerous bulk water transfer pipelines being constructed with Savcor designed cathodic protection systems and products. Mike previously worked for Savcor for more than 5 years in their Cooper Basin Oil & Gas operations.

Eva Jouvencon initially joined the company on a part time basis, assisting with project QA. With her qualifications from QUT in construction management, she was rapidly put to work as an assistant project manager and now heads up major project estimating and ISO9001 compliant project delivery. Our recent ISO14001 accreditation for Environmental Management will come under her remit.

David Watson joins the team to provide field technical services as the division expands it's operations in both metropolitan and regional Queensland.

Incospec & Associates Appointments

Paul Reid (Manager W.A)

Paul Reid has been in the resources industry for over 15 years. Primarily within the resources sector combined with the last 6 years in the oil and gas industry, Paul has a comprehensive technical background gained via working in many locations around the world. Paul has also completed his NACE Levels1 & 2 Coating Inspector Programs.

Ben Coleman (Manager W.A)

Ben Coleman is in his final stages of his MBA from UWA and is experienced in both offshore and onshore project coordination for construction, drilling and DSV vessels. Ben has experience in construction, sales and marketing for the petroleum industry. He has also completed his NACE Levels 1 & 2 Coating Inspector Programs.

John Flackett (Guardian Programmer)

John has over 20 years experience in computing and electronics, and has provided consultancy and software engineering services to a wide range of industries. His main area of expertise is in Artificial Intelligence (in which he holds a PhD). John also has extensive knowledge and experience of object-oriented software technologies and is a certified CISCO software instructor.

Steve Marks (General Manager)

Steve has operated and managed many businesses for the past 25 years covering a multitude of industries. With background in international marketing, a Director of a Bendigo Community Bank and a qualified AMF mechanic, he also holds a NACE Level 1 CIP certificate and is a licensed builder. Pursuing diversification in his leisurely interests, with a vision to expand Incospec services internationally and focus on the Guardian system to ensure steady growth for Incospec in the coming years.

Alex Shepherd (Sales & Marketing)

Alex has joined the Incospec team from a background of Sales and Marketing in the Telecommunications Industry and is currently learning the ropes from some of the industry's best.

PB acquires C&I business from Sigma

Parsons Brinckerhoff (PB) has added considerable strength to its power team and its overall service offering to its energy market area clients with the recent acquisition of Sigma Energy Solutions' Control and Instrumentation (C&I) business.

PB General Manager Markets Energy John Bergantino said Sigma's capability was a welcome addition to the PB team at a time when the number of major power projects PB is working on is rapidly increasing.

"Sigma is strong in control and instrumentation and is highly respected in the industry.

"PB clients – particularly power generators, water processing plants, mining projects and mineral refineries – will benefit from the Sigma team's expertise and experience.

"This acquisition includes not only the transfer of a significant number of key Sigma staff, but also intellectual property dating back to the 1980s and the novation of Sigma's C&I contracts.

"PB will leverage off Sigma's work in power stations in Queensland, New South Wales, Victoria and South Australia.

"PB and Sigma have already cooperated on several projects – the most recent example is Kogan Creek Power Station – and we have established a solid working relationship.

"We will continue to strengthen this relationship through current projects and the backlog of work which the Sigma team brings to PB.

"This transition will be seamless – we will continue to provide the same high level of service to Sigma customers as they have come to expect," Mr Bergantino said.

Huntsman opens new Asia Pacific Technology Centre

Huntsman Corporation, a manufacturer and marketer of differentiated chemicals, has announced the official opening of its Asia Pacific Technology Centre (ATC) in Shanghai's Minhang Development Zone in China. The new Centre will initially accommodate research and technical experts from Huntsman's Polyurethanes and Performance Products divisions. The ATC team will draw on the expertise of its counterparts at Huntsman's Technical Development Centres in Europe and the USA, to speed the introduction of new technology platforms into the Asia Pacific market. The company's team of regional specialists will provide extensive developmental and testing support to customers, providing custom-made solutions for Asia Pacific markets.

Since its beginning Loresco® has continued to supply the cathodic protection industry with the finest earth contact backfill on the planet. With on-going research, they are setting new standards within the industry for cathodic protection systems' quality and performance.

Stemming from over 50 years of experience, they have produced a super-conducting premium earth contact backfill called Loresco SC-3. Designed specifically for demanding CP systems which mandate a low resistivity medium, their top of the range backfill, SC-3, provides anode beds with the highest quality electric contact between the anodes and the earth.

Not to be cast in the shadow of their premium backfills are their industry leading technologies. These technologies help design and install replaceable deep well anode systems. The versatility and performance in all field conditions coupled with the simplicity of installation guarantees an economical deep system. Part of these technological advancements includes anode bed venting systems. The Loresco® Allvent™ micro slotted vent pipe is at home in deep well and shallow offset systems alike. For more information, please visit our website below.

With more than 25 years of partnership with Loresco, the team at Anode Engineering have been able to support their products and technology in Australia, New Zealand and South East Asia. For any enquiries regarding Loresco products, please contact Anode Engineering or visit our website below:

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Toll Free	1800 446 400
Site	www.anodeengineering.com
Email	sales@anodeengineering.com

AkzoNobel announces double acquisition

AkzoNobel is to invest almost EUR 50 million in its performance coatings activities after agreeing two acquisitions which will concern the company's Car Refinishes and Industrial Finishes businesses. The two deals involve the purchase of durable paint and bright films manufacturer Soliant LLC and the resilient floor coatings business of Lord Corporation, both of which are based in the United States. Soliant is a supplier of specialized films used in the automotive, marine, architectural and signage industries. Lord Corporation is a technology company active in a number of industries including coatings. The transaction includes all intangible assets of the company's resilient floor coatings business that generate revenue in the US, Europe and China. This business supplies coating systems that can protect or preserve the qualities of polymeric and wood flooring. Both deals are subject to regulatory approval, which is expected by the end of September.

Predicting Corrosion Damage Evolution from Microstructure in a Deterministic Sense: A First Order Example for Aluminium Alloy AA7075-T651

N. Birbilis[1], M.K. Cavanaugh[2], R.G. Buchheit[2]
[1]ARC Centre of Excellence for Design in Light Metals. Department of Materials Engineering, Monash University, Australia
[2]Fontana Corrosion Center, The Ohio State University, Columbus, USA

ABSTRACT: Corrosion and corrosion fatigue of aircraft components remains a critical issue for the service readiness of aging aircraft. The favourable mechanical properties of most engineering alloys arise as a result of a heterogeneous microstructure that compromise corrosion resistance, ultimately resulting in localized corrosion. Understanding the factors that govern extent, rate and morphology of damage accumulation is essential in developing models to predict corrosion and corrosion fatigue resistance. The electrochemical properties of AA7075-T651 have recently been investigated on a phase-by-phase basis. As a result, quantitative microstructural characterization of AA7075-T651 takes on a critical importance in the understanding of corrosion damage accumulation, based on localized chemistry (and hence electrochemistry) of the alloy.

This work presents results of a study using analytical microscopy involving scanning electron microscopy (SEM), transmission electron microscopy (TEM), scanning transmission electron microscopy (STEM), energy dispersive x-ray spectroscopy (EDXS), and electron backscattered diffraction (EBSD) to reveal what phases, intermetallics and particles constitute AA7075-T651; allowing characterization and discrimination on a chemical basis. Knowledge of the type of localized chemistry that exists may be coupled with electrochemical results and used to typify damage accumulation processes on the nano and microscale; giving rise to relevant mechanisms and a first order mechanistic basis for corrosion prediction.

1 Introduction

Aluminium alloy AA7075-T651 is commonly used for several key components of aircraft, however the large population of intermetallic particles within this alloy compromises corrosion resistance, ultimately resulting in localized corrosion [1-2]. Understanding the factors that govern the extent of corrosion damage accumulation is critical given that localized corrosion is a precursor to corrosion fatigue crack initiation [3-4].

Previously in this journal we presented the electrochemical properties of a range of intermetallics common to AA7075 on an individual basis [5]. Such data may serve as critical input to models designed to predict corrosion, and to provide a physical insight into the overall electrochemistry of the bulk alloy. It was found that the electrochemical characteristics of intermetallics vary significantly

in terms of corrosion potential, breakdown potential (if applicable) and the ability to sustain oxygen reduction or dissolution (self corrosion) reactions [6].

As a result, quantitative microstructural characterization of AA7075-T651 takes on significant importance for interpreting the electrochemical response of the alloy. Knowledge of the type of intermetallic-matrix interaction expected and the extent of the resultant charge transfer that occurs may be used to typify damage accumulation. This knowledge may be exploited further to develop predictive models for damage accumulation and subsequent integration into a fracture mechanics approach for investigating corrosion fatigue via use of the appropriate analytical expressions [7]. The microstructures developed in commercial high strength aluminium alloys such as AA7075-T651 are complex, incorporating a combination of equilibrium and non-equilibrium phases [8-9]. Typically, AA7075 has a chemical composition incorporating up to ten elements. Such elements principally include Zn, Mg and Cu, however appreciable and specific amounts of Fe, Si, Cr, Ti, Zr and Mn are often present (as deliberate additions and as impurities). In the past, the microstructure of Al-Zn-Mg-Cu alloys has been thoroughly characterized [9-15], along with the corresponding physical metallurgy [8]. The literature quotes evidence supporting the presence of the following intermetallics in 7000 series alloys (not all are simultaneously present, and temper and precise composition will regulate the types and proportion): $MgZn_2$, Mg_2Si, $Al_{20}Cu_2Mn_3$, $Al_{12}Mn_3Si$, Al_7Cu_2Fe, Al_2Cu, Al_2CuMg, Al_3Fe, $Al_{12}Mg_2Cr$, $Al_{20}Cu_2Mn_3$, Al_6Mn, Al_3Ti, Al_6Zr, Mg_2Al_3, $Al_{32}Zn_{49}$, and Mg(AlCu) [9-10, 13-17]. The role of these intermetallics with respect to mechanical properties is beyond the scope of this paper, since we are concerned with primarily identifying particle types and distributions for the purpose of ascribing electrochemical parameters. Those intermetallics that may be vital in the development of mechanical properties may not necessarily impact the corrosion response of the alloy, and vice-versa.

As noted above, commercial AA7075-T651 contains a large number of varied intermetallic particles. Such particles may be precipitated phases, largely based upon the principal alloying elements (Zn and Mg). When they are homogeneously dispersed, their effect on localized corrosion behaviour has been difficult to discern. However, when they are concentrated on grain boundaries, they may affect intergranular corrosion and stress corrosion cracking susceptibility [12, 18-19]. The precipitated phase in 7000 series alloys is $MgZn_2$ (η).

Constituent particles primarily evolve from the presence of Fe, Mn and Si. They are comparatively large and irregularly shaped, and can be formed during alloy solidification, whilst not being appreciably dissolved during subsequent thermo-mechanical processing. Rolling and extrusion tends to break-up and align constituent particles into bands within the alloy. Constituent particles are often found in colonies made up of several intermetallic crystals or several different compound types. Because these particles are rich in alloying elements, their electrochemical behaviour is significantly different from the surrounding matrix phase [6]. In high strength Al alloys, pitting is nominally associated with some fraction of the constituent particles present in the alloy [20-23]. Typical examples include Al_3Fe and Al_7Cu_2Fe. Such particles are not significant in the development of mechanical properties in Al alloys, and, as a result, the size distribution and density of such particles has not received specific attention in the literature in any great detail.

In regards to localized corrosion, the intermetallics of particular interest are those which appear in the greatest proportion, by size or by frequency; since ultimately along with their corresponding electrochemical characteristics, will dominate the corrosion response of the alloy. This paper identifies these particles, and reveals (in a simple first order sense) how this knowledge can be used by the corrosion engineer.

2 Experimental Details

Commercial AA7075-T651 was supplied by Alcoa (PA, USA). Specimens were taken from approximately 10mm below the surface of a 76mm thick rolled plate. The face or plane incorporating the longitudinal direction (often called the LT face) was studied here. Typically, this face is exposed on aircraft wing skins and planks.

SEM, EDXS and a collection of EDSD Patterns were carried out using a Philips XL-30 FEG-ESEM. The specimens used were 10x10x10mm in size and metallographically mounted in conductive bakelite. Surface preparation included successive polishing down to a 0.05μm surface finish employing a vibratory polisher and a gamma alumina suspension. TEM was carried out using a Philips TF-20 FEG operating at 200kV. Discs of 3mm diameter were punched from alloy sections carefully ground to a thickness of ~150μm, and twin-jet electropolished into thin foils using a 25% Nitric acid 75% Methanol electrolyte at -35°C.

3 Results and Discussion

3.1 Quantitative Microstructure Characterisation

The vast number and corresponding size distribution of intermetallics in AA7075-T651 demands techniques capable of quantitative examination across this size distribution. As a result, both SEM and TEM based methods were employed in this work. The ability to assess chemical composition along with structural information was considered of principal importance in the development of accurate intermetallic identification, since the positive identification of a phase is not readily possible by EDXS alone. However, the crystal structure of most intermetallics in aluminium alloys is unique and has been defined previously [8-9].

The general microstructure of AA7075-T651 (via SEM) may be seen in Figure 1. The image shows (constituent) particles aligned in the direction of working. Owing to the use of imaging via backscattered electrons, light particles along with darker particles are visible when compared to the matrix. Such particles were generally >1μm in diameter, making them well suited to spot EDXS and EBSD analysis.

An example of such analysis is carried out on a 'dark' particle, as seen in Figure 2. In the lower of the SEM images, corresponding

to a backscattered electron image, the particle appears to be a 'black hole'-like feature, however in the secondary electron image above, it is seen that the particle is indeed solid and well defined. The EDXS/EBSD analysis revealed that this particle was Mg_2Si.

By repeating the characterization process shown in Figure 2 with a number of particles, it was possible to identify a sufficient sample, along with quantification of their physical characteristics such as size, shape, location and number density.

In contrast to SEM analysis, TEM analysis does not reveal any significant presence of 'constituent' particles. Constituent particles are nominally large and either destroyed by the TEM sample preparation process (grinding / polishing), or simply fall out of the TEM foil in the thin regions under investigation.

The general microstructure of AA7075-T651 may be seen in the montage of scanning TEM (STEM) images seen in Figure 3, where a grain boundary triple point is seen towards the right of the montage and the grain boundary and neighboring grains are seen to the left.

On the submicron level, the STEM images revealed a dense population of (strengthening) particles, $MgZn_2$ (η). These particles appear as light particles in Figure 3, the images of which were collected using a high angle annular dark field (HAADF) detector. Identification of n phase has been covered in Reference 24, whereby diffraction spots arising from such particles were visible when orienting near the <110>a zone axis. This study did not focus on distinguishing between η (which is known to populate the grain boundary) and the transition phase η' (which is known to populate the grain interior). The difference between η and η' is a slight difference in lattice parameters whilst the composition is nominally identical [8]. Furthermore, for the purposes of corrosion, it is postulated that the electrochemical response of both forms of the precipitate are similar.

3.2 Intermetallic Distribution

The results of the microstructural characterisation are summarized in Table 1, where $\overline{d}$ is the Mean Particle Equivalent Diameter and N_A is the Particle Number Density. The Mean Particle Equivalent Diameter is used since intermetallic particles do not have a

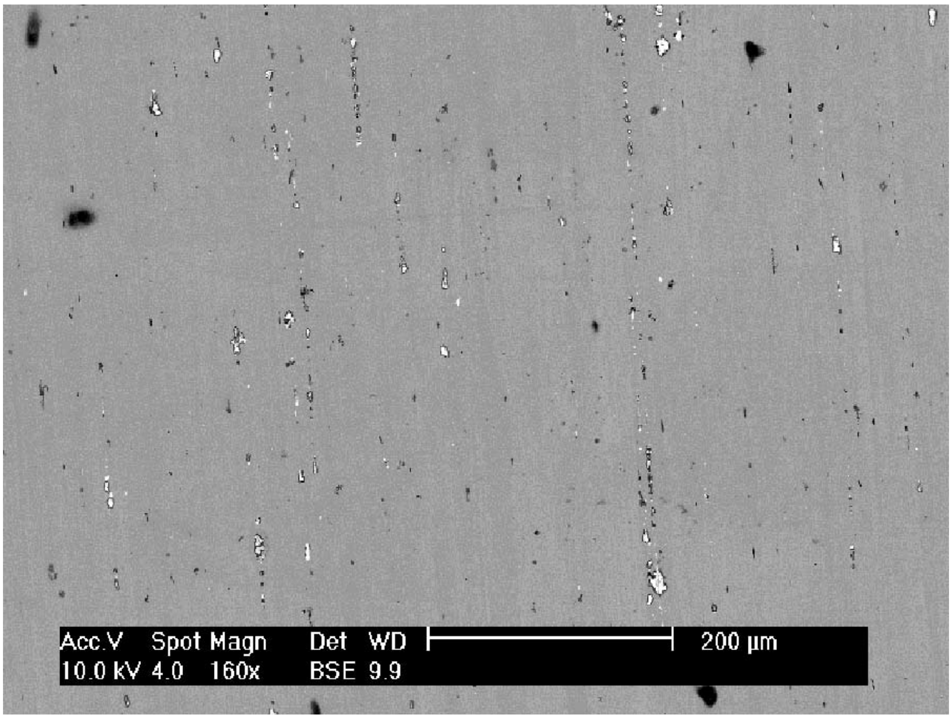

Figure 1. General microstructure of AA7075-T651 when viewed via SEM (BSE mode)

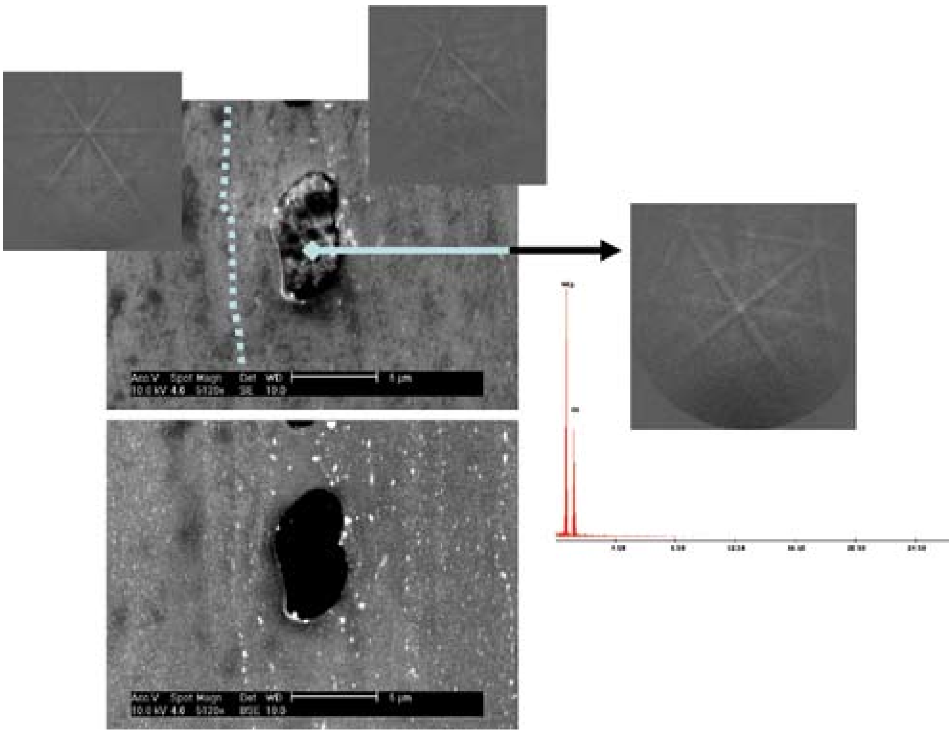

Figure 2. SEM images showing Mg_2Si particle in AA7075-T651 matrix, Secondary Electron Image (above), Backscattered Electron Image (below). The EDXS spectrum and associated EBSD of the particle are shown, together with the EBSD of two grains in the vicinity of the particle (SEM image is tilted and therefore particle appears slightly elongated in vertical axis).

nominal aspect ratio of 1. These values are presented together with the mean Nearest Neighbour Distance ($\overline{dist}_{N.Neighb.}$), Particle Area ($\overline{A}_A$) and the Mean Aspect Ratio.

It should be noted out that intermetallics not seen in sufficient quantities to generate a statistical analysis such as Al_2Cu, Al_6Mn and $Al_{20}Cu_2Mn_3$ were not included in the analysis. However, such particles were identified in TEM analysis at very low N_A. Other particles such as the dispersoids Al_3Ti, Al_3Zr, $Al_{12}Mn_3Si$ and $Al_{12}Mg_2Cr$ were not able to be easily identified or characterized in the alloy, and are thus likely to appear at low N_A and small $\overline{d}$. A total of <1% of particles were indeterminate. It should be noted, that unlike for 2000 series alloys, Al_2CuMg (S-phase) is not a precipitated phase in the form observed here. In this case, S-phase was present as a constituent particle that likely formed during alloy processing and at elevated temperatures (above those used for age hardening). This is suggested by the low N_A and relatively large $\overline{d}$ values for S phase. In some cases, Al_7Cu_2Fe contained small amounts of Mn which substituted for Fe, with the Fe + Mn content accounting for 10 atomic % of the intermetallic. Mn was nominally present in such cases at less than a few weight %, and at times not present at all. Therefore, the intermetallic is referred to as Al_7Cu_2Fe, since it maintains the same crystal structure.

Figure 4, shows that the number density for the n phase is greater than that for the other constituent particles Al_7Cu_2Fe, Mg_2Si and Al_3Fe by almost four orders of magnitude.

Conversely, Figure 5 shows that the mean equivalent diameter $\overline{d}$ for n is smaller than that for Al_7Cu_2Fe, Mg_2Si and Al_3Fe by nearly two orders of magnitude.

The results above correspond well with those of Poulose and co-workers [12] who carried out investigations exclusively on n phase. As shown in Figure 5, the ability to generate particle size distributions for each individual particle type allows for a more comprehensive insight into specific particle characteristics. For example, if all particles were classed together, then the size range of η phase would dominate the distribution, since it is present in the

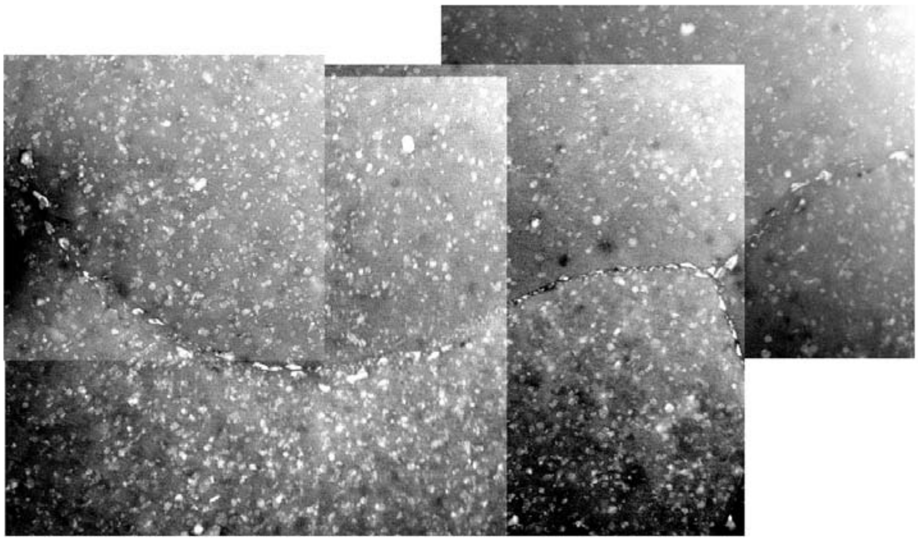

Figure 3. Montage of (dark field) STEM images showing the general structure of AA7075-T651

Table I. Summary of two dimensional microstructural chracterisation results

Particle	$\overline{d}$ (µm)	Mean N_A (#/mm²)	$\overline{A}_A$ (µm²)	Mean Aspect Ratio	$\overline{dist}_{N.Neighb.}$ (µm) Standard deviation in parentheses
$MgZn_2$	0.052	3.5 x 10⁷	0.0017	1.64	0.1 (0.05)
Al_7Cu_2Fe	1.7	1651	3.6	1.55	11.2 (8.6)
Al_3Fe	1.69	571	4.1	1.37	17.8 (14.0)
Mg_2Si	2.13	856	4.6	1.56	15.5 (11.1)
Al_2CuMg	5.1	101	11	1.91	43.9 (30.5)

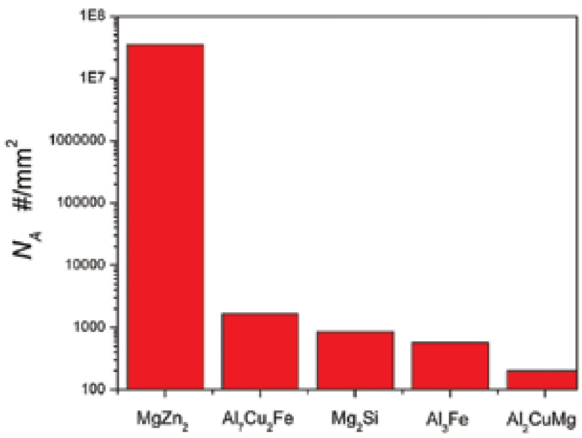

Figure 4. Number density for intermetallic particles in AA7075-T651

greatest abundance. The distributions for $\bar{d}$, the mean equivalent diameter of each particle, are seen in Figure 6.

The large differences between the range of sizes for the precipitated phases (η) and the constituent particles are clearly obvious. The constituent particle sizes approach 10µm.

3.3 Alloy and Particle electrochemistry

The overall electrochemistry of the alloy will be dependent on the relative proportions of the intermetallic particles, along with their individual electrochemical properties, and the ensuing electrochemical interaction with the matrix. A useful way of considering these factors is through examination of the data in Table II. In the Table are particle sizes and spacings, the areal density of the intermetallics, and electrochemical parameters as previously measured in 0.1M NaCl (for more details, refer to [6]).

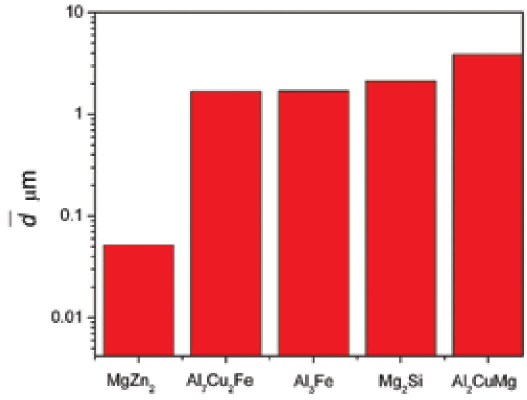

Figure 5. Mean equivalent diameters for intermetallic particles in AA7075-T651

Table II. Summary of electrochemical results collected in 0.1M NaCl

Particle	$\bar{d}$ (µm)	N_A (#/mm²)	Area occupied per 1mm² of alloy (mm²)	$E_{corr}(V_{SCE})$	I (current density) at E_{corr}(AA7075-T651) (A/cm²)
$MgZn_2$	0.052	3.5×10^7	0.09	-1.03	1.0×10^{-3}
Al_7Cu_2Fe	1.7	1651	0.009	-0.55	-3.1×10^{-4}
Al_3Fe	1.69	571	0.005	-0.54	-9.9×10^{-5}
Mg_2Si	2.13	856	0.001	-1.54	1.9×10^{-4}
Al_2CuMg	5.1	201	0.0002	-0.88	-2.1×10^{-6}

The corrosion potential values (E_{corr}) for the various intermetallics vary over a wide range (-1.54 to -0.54V_{SCE}). The typical E_{corr} of the bulk alloy (AA7075-T651) is nominally in the vicinity of -0.9 to -0.75V_{SCE} in NaCl solutions. Therefore at the stationary E_{corr} of the alloy, certain intermetallics assume the role of being 'anodic' (viz. less noble, with $E_{corr} < E_{corr(AA7075-T651)}$), whilst others are 'cathodic' ($E_{corr} > E_{corr(AA7075-T651)}$). A better sense of this is shown by the I values given in Table II. These values were determined on the premise that if we assume the E_{corr} of AA7075-T651 to be -0.8V_{SCE} in 0.1M NaCl, then the current density sustained by each intermetallic type (at a potential of -0.8V_{SCE}) may be evaluated. The current values were taken from polarization curves we previously published in this journal [5].

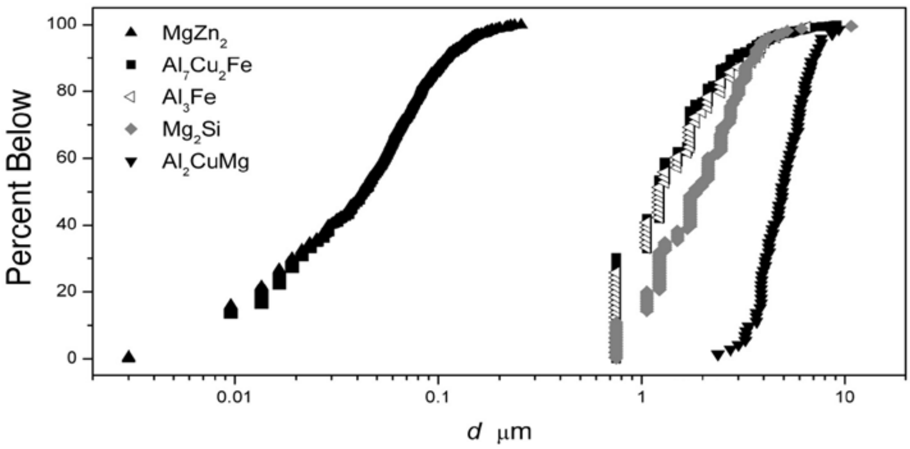

Figure 6. Cumulative distribution for the intermetallic particle size in AA7075-T651

The current each intermetallic type can support for a given potential can be combined with the quantitative microscopy to determine the current sustained by each intermetallic type per unit area of alloy surface (based on charge transfer alone). The results of this determination may be seen in Figure 7.

Figure 7 reveals that n particles may sustain a large anodic current density. This is consistent with 'self-dissolution' of n particles on the alloy surface in contact with the electrolyte. These particles are expected to be dissolved soon after exposure to the environment leaving 'cavities', and as a result may not have any further discernable influence on the corrosion of the alloy in terms of early pitting development. Similarly, Mg_2Si could

behave in a similar manner; however, in the case of Mg_2Si, significantly larger 'cavities' would be expected following particle dissolution since $\bar{d}_{Mg2Si} >> \bar{d}_{\eta}$.

This is evident in Figure 8, where corrosion damage in the form of cavities, associated with Mg_2Si particles can be seen following 10 hours immersion in 0.1M NaCl. The damage related to η was too fine to be observed in the SEM. Conversely, intermetallics which sustain a cathodic current appear to be surrounded by 'peripheral' type pitting. In such cases, the outline of the damage follows the morphology of the constituent particles. The damage takes the form of trenches that surround the intermetallic, which is corrosion of the matrix.

Figure 8 also shows that the 'sphere of influence' from cathodic particles allows for coalescence of corrosion damage from neighbouring particles. This leads to pits larger than those which may be expected from a single particle, emphasizing the need for detailed 2D and ultimately 3D stereology information prior to accurately predicting corrosion damage evolution. It should be noted that the analysis offered in this paper is based upon alloy microstructure and charge transfer considerations alone. The effects of local pH in solution and corrosive solutions other than NaCl have specifically been neglected. This was done in an attempt to provide a fundamental framework for which more sophisticated analyses leading to modelling could be carried out in the future.

4 General Discussion

From the results presented herein, it can be seen that constituent particles form a significant area fraction of the alloy. These particles possess comparatively large $\bar{d}$ values and can therefore contribute significantly to the early evolution of localized corrosion of AA7075-T651.

The results have allowed for a comprehensive insight into the microstructure-corrosion relationship for AA7075-T651. The microstructural analysis is applicable broadly in understanding commercial AA7075-T651, whilst the electrochemical analysis of AA7075-T651 is useful to those working in the corrosion domain.

The utility of these data towards the development of a mechanistic based model for corrosion prediction of AA7075-T651 is apparent. Hence, based on what we have (quantitatively) determined as being present in the alloy, we can present a phenomenological model that portrays the microstructure and corrosion morphology with immersion time (viz. the corrosion development) along with the corresponding E_{corr} measured in 0.1M NaCl solution. The development of corrosion damage accumulation upon AA7075-T651 may be phenomenologically given by the representation seen in Figure 9.

A simple model relating pit depth to the microstructural and electrochemical characteristics of particles can be developed based on corrosion cell principles and by taking advantage of several key assumptions and simplifications. Under immersion conditions, the anodic current and cathodic current supported on a surface must be equal. On this basis, Wei proposed a model based on Faraday's law relating the pit depth distribu-

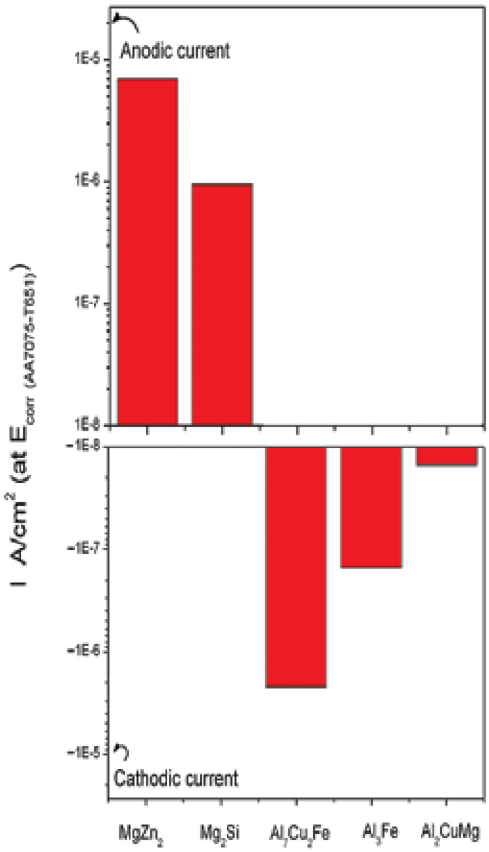

Figure 7. Current density ascribed to each intermetallic type in AA7075-T651 at E_{corr}(AA7075-T651) in 0.1M NaCl

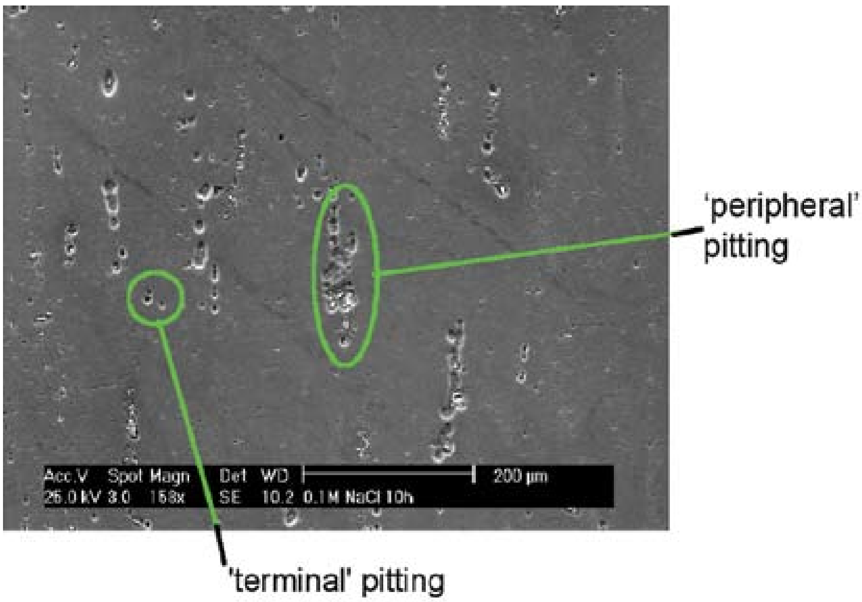

Figure 8. Corrosion damage upon AA7075-T651 following 10 h immersion in 0.1M NaCl.

tion, a*, to the average cathodic current density on intermetallic particles for predicting pit depths [25]:

$$a^* = a_{init} + \frac{V_m}{nF} \cdot i_{part} d_p \cdot (2\pi \cdot (r_p^*)^2) \cdot t$$

In this expression V_m is the molar volume of Al, *F* is Faraday's constant, *n* is equivalents per mole reacted, a_{init} is initial pit depth (equal to r_p* for cathodic particles), i_{part} is average current density on participating particle (from polarization testing), r_p* is the particle radius (the * denotes that this is treated as a distributed value for a population of particles, e.g., Figure 6), *t* is the exposure time, and d_p is the particle number density (N_A).

This model assumes a constant volumetric pit growth rate and hemispherical pit morphology, where pit growth predicted is limited by the cathodic current density of the cathodic intermetallics. It links current to mass loss and, ultimately, volume loss. In this simplified analysis, a_{init}, i_{part}, d_p are treated as single-valued parameters characteristic of the alloy, and r_p* is treated as a distributed variable with a distribution constructed from data shown in Figure 6.

Utilizing the current densities for the particles in Table II, along with the a_{init}, r_p* and d_p in Table I, pit sizes were estimated as a function of exposure time in 0.1M NaCl solution using Eq. 1. It should be noted that Eq. 1 does not account for anodic particles. However, to account for dissolution of anodic particles (like $MgZn_2$), a distribution of pits resulting from these particles was determined in a separate calculation by simply using Faraday's Law, assuming a hemispherical pit morphology and the anodic current densities found in Table 1. Once the size of these pits reached that size of particle, it was assumed that these sites do not propagate either as single pits or by pit coalescence. Though these pit sites are too small to serve as effective fatigue crack initiation sites, they were included in the analysis. In a heavily abridged manner, the combined results of both types of pits are seen in Figure 10, which shows predicted pit depth as a function of exposure time up to 1344 hours. The form of the model causes small particles to grow into smaller sized pits and large particles to grow into large pits. A large fraction of the pits never grow to sizes beyond 5 µm in diameter, and the maximum predicted pit depths approach the 40µm depth range for 1344h.

For the purposes of comparison, we have included benchmark data collected by profilometery [26], to compare the predicted versus actual damage occurring upon A7075-T651. Figure 10 shows a comparison of predicted and observed pit growth at the median and maximum of the pit depth distributions as a function of exposure time. This comparison shows that the constant volumetric growth behavior imposed by the model, slightly under-predicts damage depth observations at

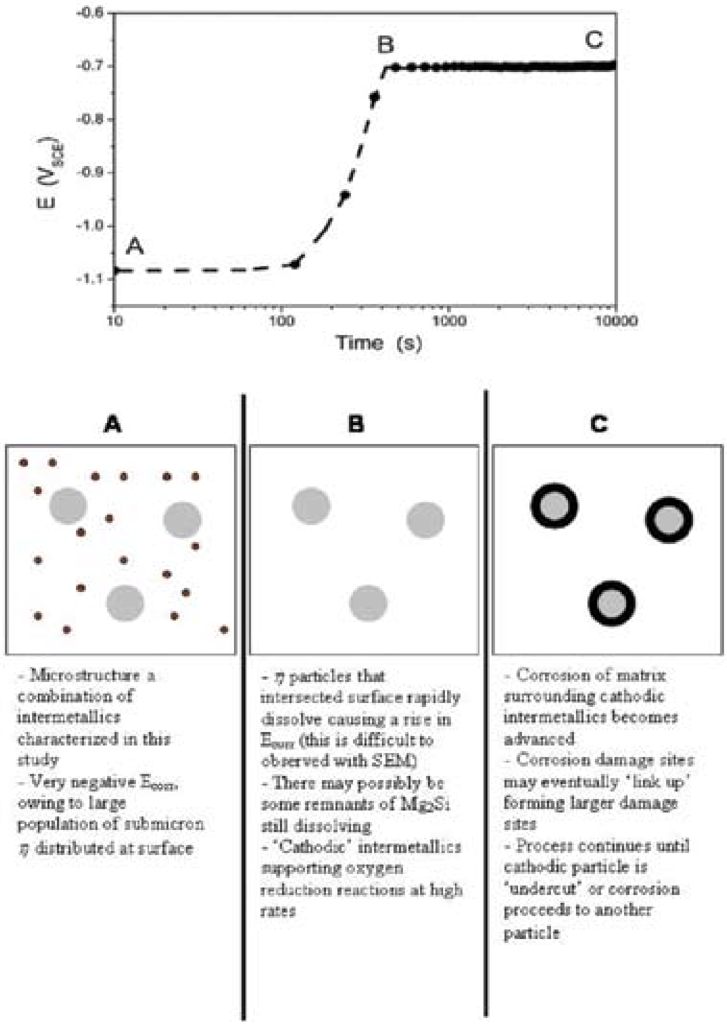

Figure 9. Phenomenological model of the early development of corrosion damage accumulation upon AA7075-T651.

short times. Nonetheless, the simple approach reveals a very good approximation overall to the median pit size evolved. However, of most importance in a failure analysis sense is the maximum pit depth. A very rapid initial accumulation of damage was observed in the first 100 hours, perhaps associated with dissolution of active particles (incl. Mg_2Si). At longer times, it appears that the model will over-predict damage accumulation, particularly at the largest damage depth. The lack of growth in the damage depth distribution suggests an influence of repassivation, which is not accounted for in the model. Also the empirically measured data for maximum pit depth represents a 'one-off' pit depth, which is always somewhat difficult to account for. More details regarding this aspect of the pit prediction are given elsewhere [26]. Nonetheless, this paper has shown that the initial pit growth kinetics can be captured (albeit using heavily abridged data) using a combination of microstructure and local electrochemical knowledge thus producing a very simple mechanistic model.

5 Summary

- Quantitative microscopy of AA7075-T651 revealed that, with the exception of η phase, constituent particles form a significant area fraction of

this commercial alloy. The intermetallics present in the alloy were identified by type and by physical characteristics. Such analysis was seen to be useful in terms of quantitatively understanding corrosion mechanisms.

- Intermetallics in AA7075-T651 nominally have markedly different electrochemical properties with respect to one another and the matrix. Based upon stereology and electrochemical considerations, h, Mg_2Si and Al_7Cu_2Fe particles form the 'watch list' for corrosion of AA7075-T651. However, Mg_2Si and Al_7Cu_2Fe particles owing to their respective $\overline{d}$ values are capable of influencing rapid early corrosion of the alloy (viz. constituent particle induced corrosion).
- Al_7Cu_2Fe particles present a particularly dangerous situation with respect to corrosion, since these particles can generate damage beyond their dimensions with overlapping 'spheres of influence', which leads to larger pits. Furthermore, the damage ascribed to such particles is not necessarily 'terminal', leaving behind finite cavities such as those expected from Mg_2Si. Instead, they may cause matrix corrosion which becomes so severe that undercutting occurs. This advanced stage of corrosion damage may lead to encapsulation of a neighbouring particle, and a final pit size capable of acting as a fatigue crack initiation site.
- A simple model has been formulated following the work of Wei based on the assumption of a constant volumetric growth rate of hemispherical pits, Faradays law and inputs from microstructural and electrochemical characterization experiments. For the simple case of constant immersion in 0.1M NaCl, pit depth distributions ranging up to 40 µm can be calculated.

6 Acknowledgements

The authors gratefully acknowledge the collaboration of Professors D.G. Harlow and R.P. Wei in the Department of Mechanical Engineering and Mechanics, Lehigh University, Bethlehem, PA. USA. NB wishes to thank the Victorian Government (DIIRD).

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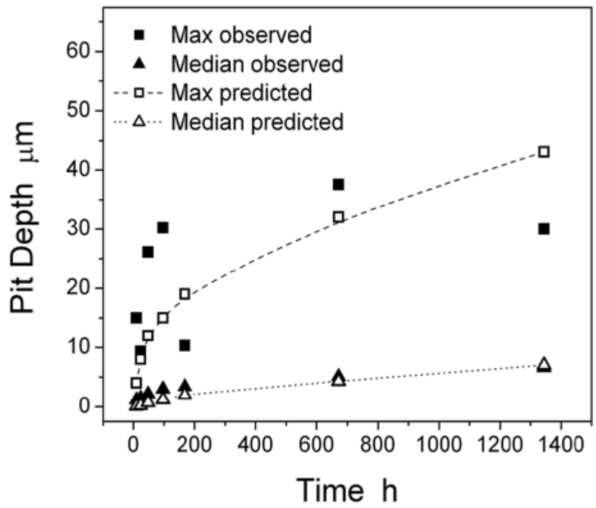

Figure 10 – Observed damage depth and predicted pit depth for the maximum and median of the respective distributions as a function of immersion time.

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ACA Course Timetable 2008

Full course descriptions and timetables are available from the ACA website at www.corrosion.com.au

ACA / ACRA Corrosion & Protection of Reinforced Concrete	
Sydney	05 - 06 November 2008
Cathodic Protection Advanced	
Perth	20 - 24 October 2008
Brisbane	03 - 07 November 2008
Cathodic Protection Monitoring	
Adelaide	02 - 04 December 2008
Coating Inspection Refresher	
Perth	05 November 2008
Coatings Selection & Specification	
Adelaide	09 - 11 December 2008
Corrosion & CP of Concrete Structures	
Brisbane	16 - 17 December 2008

NACE Coating Inspection Program Level 1	
Bangkok	24 - 29 November 2008 SOLD OUT
NACE Coating Inspection Program Level 2	
Melbourne	13 - 18 October 2008
Bangkok	01 - 06 December 2008 SOLD OUT
NACE CIP Peer Review Level 3	
Melbourne	18 - 20 October 2008
Protective Coatings Quality Control	
Newcastle	28 - 30 October 2008
NACE Basic Corrosion Course	
Kuala Lumpur	20 - 24 October

ACA Coating Inspection Refresher Auckland

ACA Coating Inspection Refresher Brisbane

Kupe Onshore Gas Processing Station

An aerial photo of the Kupe Onshore Gas Station during construction

PROJECT DETAILS

The application of coatings to a newly built onshore gas processing facility

Location: South Taranaki, New Zealand ACA

Member Partners: Origin Energy, TBS Coatings Ltd & International® Protective Coatings

Rack 84 with Chartek® 8 overcoated with Interthane® 870

Why is it being done

Origin Energy, who hold the Kupe gas field offshore license, are building an onshore gas processing facility which is situated in South Taranaki, New Zealand.

When did construction start

Mid 2007

When do you expect to be finished

Mid 2009

Who is involved

- Companies: Origin Energy let this project to Technip Oceania Pty who issued generic specifications for construction firms to price. Robt Stone & Co Ltd and Taranaki Engineering were the successful New Zealand based main structural contractors. The main painting applicators for Robt Stone & Co Ltd were Auckland Abrasive Blasting & Coatings Ltd and TBS Coatings Ltd, New Plymouth. Taranaki Engineering's painting applicators were TBS Coatings Ltd, New Plymouth and Edmonds Industrial Coatings Ltd Wanganui.
- Individuals: John Dick, Nigel Williams and Tony Vos from International® Protective Coatings spent many hours negotiating with contractors and applicators to secure this project. The International® Protective Coatings Applications Manager was involved in training applicator personnel to Chartek approved status and in commissioning of the plural component Chartek spray equipment. Ongoing site audit visits by International® Protective Coatings personnel has also occured during the course of the contract.

What process did you use to decide on materials for corrosion prevention

All coating systems used on the project were generically specified by Technip Oceania Pty Ltd, Perth. The key coating systems being:

1) Exterior exposed ambient steelwork was specified to be coated in inorganic zinc silicate / HB epoxy MIO / urethane. International® Protective Coatings sought and secured approval to use epoxy zinc in place of IOZ and supplied to the project Interzinc® 42 / Intergard® 475HS MIOX / Interthane® 870.

2) Steel piping and vessels destined to be insulated operating at up to 200ºC have been coated using Intertherm® 228

3) Mild steel pipe rack support structures and vessels requiring 30- and 60-minute hydrocarbon fuel passive fire protection were all protected using a system of Intergard® 251 / Chartek® 8 / Interthane® 870.

4) Mild steel vessel / column skirts requiring hydrocarbon jet fire protection, will be coated with Chartek® 7

What materials are you using and why

Fire proofing was a major component of the total project painting work and Chartek® 8, with its favourable characteristics of reduced loadings with no mesh reinforcement, were two key reasons for International® Protective Coatings securing the project supply.

Applicators elected to use Interzinc® 42 / Intergard® 475HS / Interthane® 870 on exterior exposed steelwork due to their extensive use of this system on prior projects and their trust of the International® technology.

What maintenance plans do you have in place

International® Protective Coatings will be involved in the ongoing maintenance of the Origin Energy facility.

What problems did you encounter and how did you overcome them

The Auckland based applicator (AABC) who secured the majority of the PFP work elected to set up brand new plural component spray equipment to apply 25,000 kgs of Chartek® 8. AABC were not trained Chartek® applicators prior to the Kupe project. International® Protective Coatings assisted by working with a preferred spray equipment supplier in approving the equipment set up and commissioning the new spray equipment. Training of AABC personnel was also carried out by the International® Protective Coatings Applications Manager to Chartek® approved applicator status. In New Zealand TBS Coatings Ltd are also Chartek® approved applicators.

8 LPG Bullets coated in Interzone® 485

Rack 81 with Chartek® 8 overcoated with Interthane® 870

GENERAL PAPER

Introduction to the Bristle Blasting Process for Simultaneous Corrosion Removal/Anchor Profile

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Mechanical Engineering Department
Marquette University
Milwaukee, WI 53233 USA

1 Introduction

Although many different surface treatment methods are available for cleaning and preparing metallic surfaces, maintenance engineers are constantly searching for improved/alternative methods, tools, and processes that can be used for on-site implementation. For example, while grit blasting is a widely used surface treatment process, this approach has numerous drawbacks. That is, grit blast equipment is expensive, cumbersome, and can compromise the comfort/efficiency of users and nearby workers. In addition, spent media must often be recovered, and certain commonly used grit/media (such as crystalline silica) can generate particulate debris that is harmful to the respiratory system. In spite of these drawbacks, grit blasting operations can be readily justified, especially when an open, expansive area must be treated. However, many on-site applications involve "spot repair", that is, the treatment of local surfaces where de-bond/failure of coatings has occurred, and further exposure/corrosion can jeopardize the long-term integrity or safety of structural components. In such cases, mobilizing and implementing grit blasting equipment can prove to be both costly and inefficient, and alternate corrosion removal processes are needed that can circumvent this effort, without compromising on the quality of cleaned and textured surfaces.

This article introduces a recently developed surface treatment method termed the bristle blasting process. The process involves the use of a specially designed rotary bristle tool, which is dynamically tuned to a power tool spindle that operates at approximately 2,500 rpm. Key issues that are discussed in this article include: 1) the underlying mechanical principles of the bristle blasting process, and 2) the performance and results that can be expected in a typical corrosion removal application. Chief advantages of the process lie in its inherent simplicity, low cost, and superb corrosion removal performance. A case study is reviewed that forecasts the cleaning performance and the life expectancy of the tool when used for removing corrosion from API 5L piping (ASTM A53-02 Gr. B), which is commonly used in petroleum industries. Surfaces generated by the bristle blast process are shown to

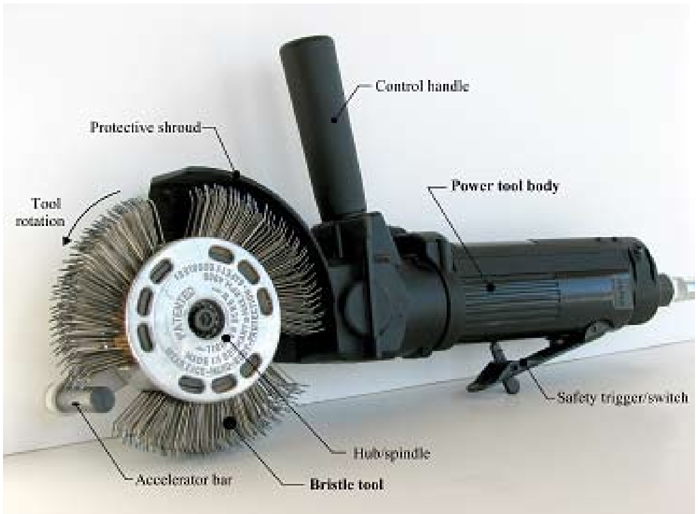


Figure 1. Overall description and key features of a bristle blasting system.

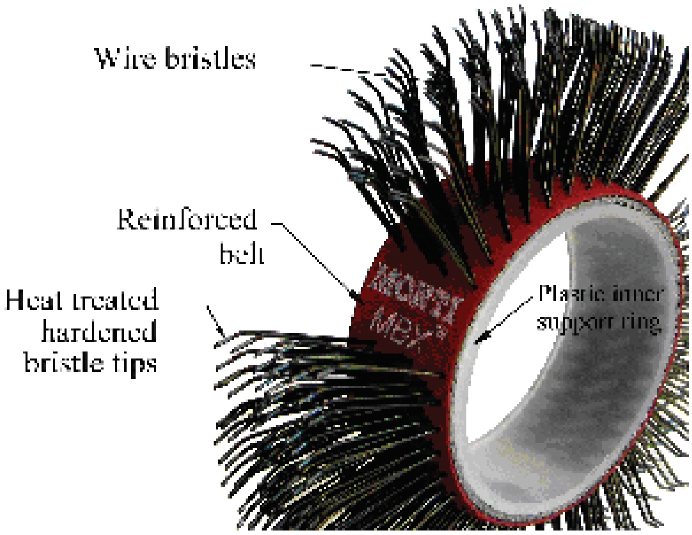


Figure 2. Design and construction of the bristle blasting tool. Tool shown is ready to be mounted on spindle.

be similar to both the visual cleanliness and texture that is characteristic of grit blasting processes.

2 Description of Equipment

Key features of the bristle blasting equipment are illustrated in Fig. 1 and consist of a specially designed rotary bristle tool which is attached to a power tool spindle that operates at approximately 2,500 rpm. The lightweight power tool can utilize either a pneumatic (tare wt. 1.18 kg [2.6 lb]) or standard electric (tare wt. 1.81 kg [4.0 lb]) power source. A safety switch and dust exhaust system (not shown) is included as standard equipment for the pneumatic version of the tool. The apparatus shown in Fig. 1 also features a specially designed accelerator bar that enhances the kinetic energy of the tool as wire tips impact the corroded surface.

As shown in Fig. 2, the bristle blasting tool is constructed from steel wires that are bent forward and protrude through a fiber-reinforced polymeric belt which is fitted over a rigid plastic support ring. This assembly is then attached to the power tool spindle using an interlocking die- cast hub. The wire tips are heat-treated/hardened, which enhances the corrosion removal capability and longevity of the tool. Together, the bristle geometry, accelerator bar, and spindle speed are precisely tuned in order to provide an immediate retraction of the bristle tip from the corroded surface after impact. This dynamic response is unique to the bristle blasting process, and results in an impact crater that can be likened to those obtained during standard grit blasting processes.

3 Underlying Principles of Operation

The underlying principles of the bristle blasting process are based upon two fundamental concepts of mechanics. First, in order to remove corrosion and penetrate the substrate, the bristle tip must have an appropriate geometry, and must have greater hardness than the target surface. Second, upon striking a stationary surface, bristle tips exhibit rebound and retraction from the surface after impact. In this section, each of these important performance characteristics is briefly examined for a recently developed/commercially available bristle blasting tool system.

3.1 Bristle tip configuration and hardness

As shown in Fig. 3, the bristle consists of several different regions that each performs a specific function during the bristle blasting process. The main body of the bristle provides both mass and flexibility (i.e., stiffness) that is essential for the dynamic performance of the tool, whereas the bristle tip/shank is heat treated in order to obtain

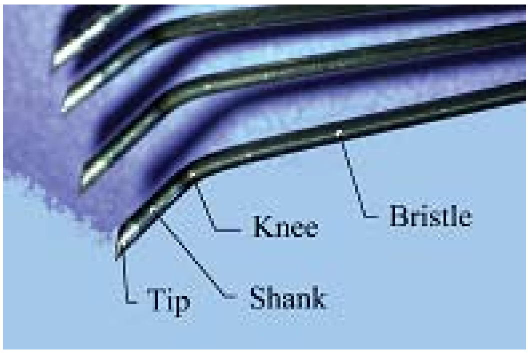


Figure 3. Functional regions of the bristle, including the bristle tip, shank, knee, and main body.

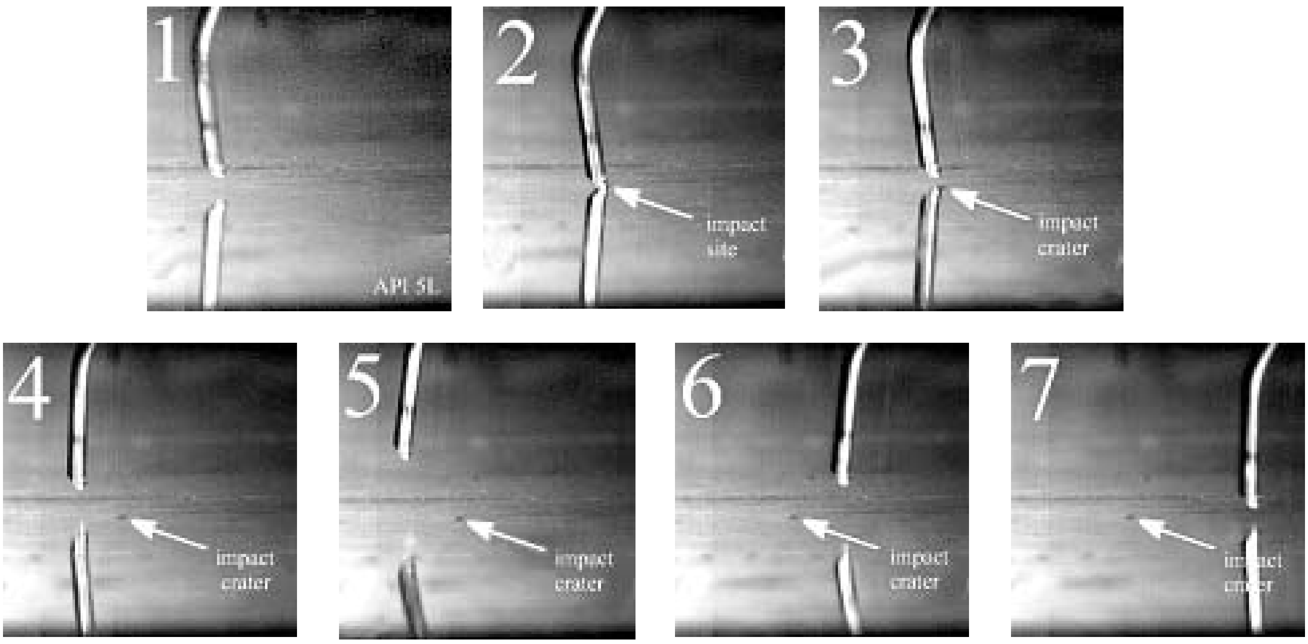
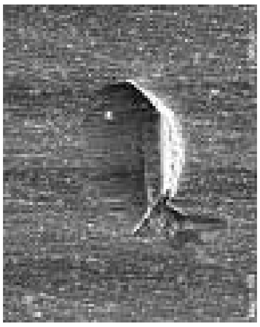


Figure 4. Seven consecutive frames captured from a high-speed digital camera depicting the approach of the bristle tip (Frame [1]); impact (Frame [2]); retraction (Frames [3], [4], and [5]); and continued movement of the bristle tip away from the contact region (Frames [6] and [7]).

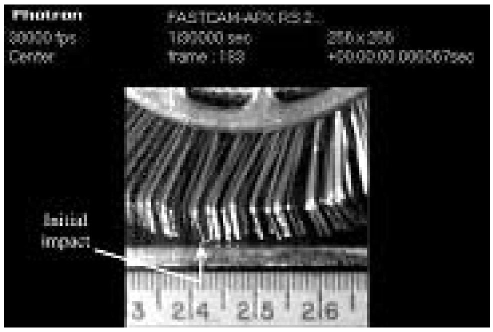
hardness (HRC ≈ 65) that is necessary for efficient corrosion removal performance. Also, the ground/sharpened bristle tips play a key role in exposing fresh surface and generating a receptive anchor profile (typically 65 < Rz(microns) < 85) that is needed prior to the application of paints and coatings. Finally, the shank provides an extended zone where hardness transition can occur, thereby reducing the brittleness and increasing the toughness of the wire prior to reaching the knee of the forward bent wire. Consequently, wire fracture/breakage is minimized for the duration of the tools service life.

3.2 Bristle tip impact/surface modification

The bristle blasting process features a unique property which generates surfaces that mimic grit blasting processes, namely, the formation of an impact crater. Together, the individual bristle and power tool are synchronized to yield a single primary impact and immediate retraction of the bristle tip from the target surface. The impact event occurs over an extremely short duration (approximately 0.0003 sec.), and a high speed digital camera is required to record and optimize the process. Thus, the photographic sequence of seven consecutive frames is shown in Fig. 4, which captures the complete impact event of a bristle tip prior to, during, and after contact with a flat-ground API 5L (ASTM A53-02 Gr. B) steel surface. This sequence of photographs clearly shows that the incoming bristle tip (Frame [1]) approaches the metallic surface (bristle is moving from left to right) and undergoes contact at the indicated impact site (Frame [2]). Next (Frame [3]), the bristle tip immediately retracts from the surface; that is, no score marking/striation is generated during the impact event. Careful examination of Frames [3], [4], and [5] reveal that the initial rebound/retraction of the bristle tip occurs toward the rearward direction, i.e., the position of the bristle tip is behind the impact site. At an instant later (Frames [6] and [7]), further bristle recovery occurs as the bristle moves forward and eventually returns to an equilibrium position prior to generating subsequent impacts. Details concerning the impact crater that was formed in Frame [2] are shown in Fig. 5(a), and indicates that "shovel-



5a



5b

Figure 5. Fig. 5(a): Photograph of micro-indentation caused by bristle tip impact with flat, ground API 5L surface, and Fig. (5b): Single frame of standard populated bristle tool in contact with flat surface.

Figure 6. Section of 150mm [6 in] diameter API 5L piping used for evaluating performance of bristle blasting tool.

ing" deformation is a characteristic signature of the bristle impact process. Finally, a high-speed digital photograph of a standard/populated bristle blasting tool is shown in Fig. 5(b), whereby the initial region of impact (arrow) can be clearly seen.

4 Corrosion Removal Performance

4.1 Surface cleanliness and morphology

The performance and outcome of surface treatment processes also depends upon the initial condition of corroded surfaces and the material composition of the parent metal that must be treated. That is, the process of corrosion removal and micro-indentation is closely related to constituents and properties of the material itself, such as percent carbon content, ductility, and tensile strength. In the present case study, performance of the bristle blasting process is examined within the context of severely corroded API 5L piping, which is widely used for onshore/offshore

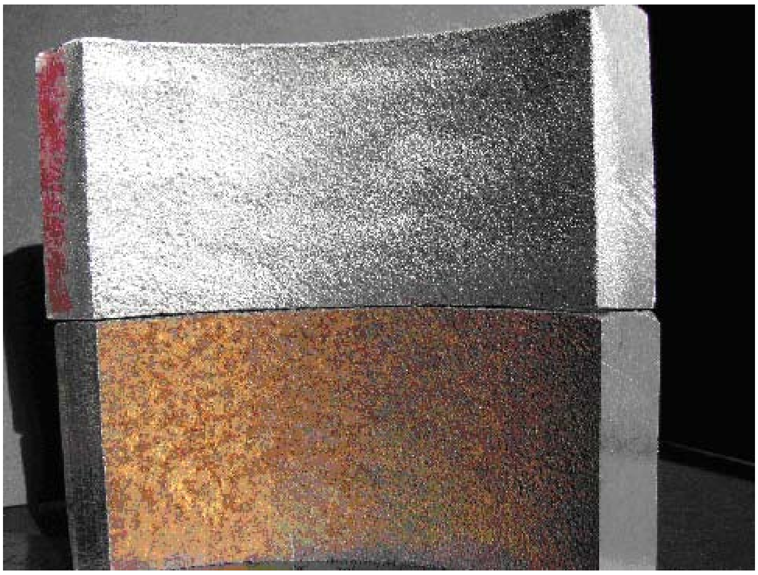
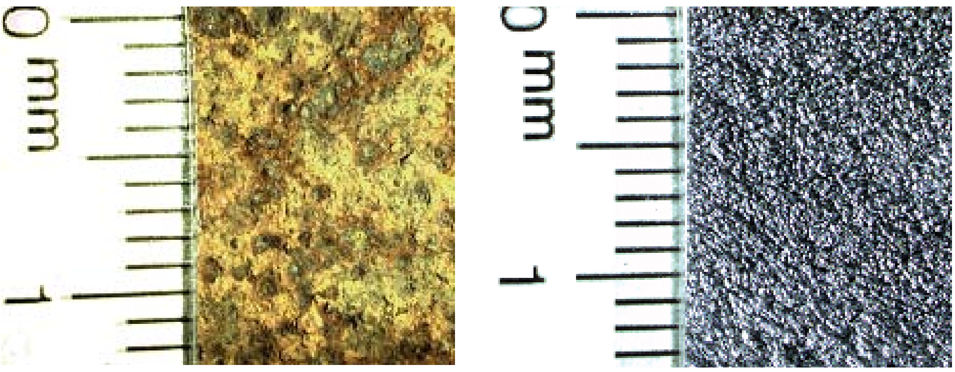
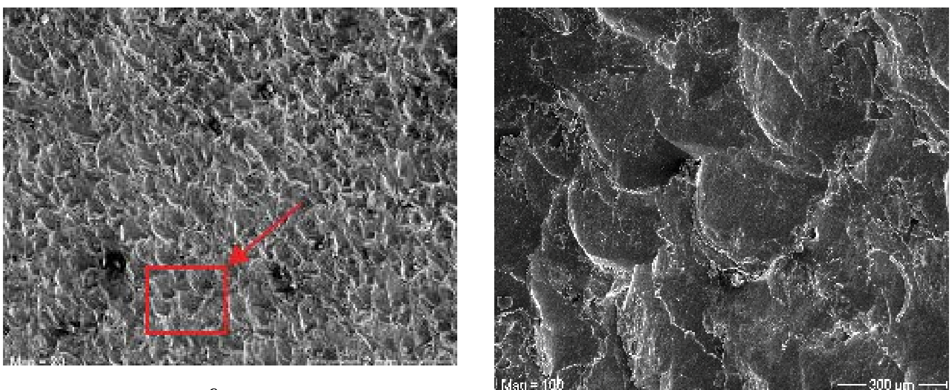


Figure 7. Interior of API 5L piping in as-received condition (bottom), and after bristle blast cleaning (top).



8a *8b*

Figure 8. Photograph depicting the extent of corrosion/pitting on the as-received surface of piping (Fig. 8(a)), and general appearance/cleanliness of the bristle blasted surface after corrosion removal (Fig. (8b)).



9a *9b*

Figure 9. Fig. 9(a): Scanning electron micrographs of the bristle blast treated surface shown in Fig. 9(b) at 20x, and Fig. (9b): Higher resolution scanning electron micrograph (100x) of region indicted by arrow in Fig. (9a).

applications in the petroleum industry. The specimen that was used in this study is shown in Fig. 6, and has an internal diameter of 150 mm [6 in] with corrosion uniformly distributed along the inside and outside diameter of the surface. An evaluation of the surface corrosion (see Fig. 6 inset) suggests that SSPC Condition D[ISO 8501-1] (100% rust with pits) adequately characterizes the initial condition of the corroded surface.

In Fig. 7 the result is shown after bristle blasting an interior section of the vessel wall. For comparison purposes, the initial condition of the corroded interior surface has been place directly below the cleaned coupon. One may observe that the cleaned surface has a uniform appearance and is free of any residual corrosion. The measured average cleaning rate for this application is approximately 1.1 m^2/hr. Further inspection of the initial condition of the corroded specimen is shown in Fig. 8a and depicts a significant depth of rust/scale along with corrosive pitting. The cleaned specimen (Fig. 8b), however, is corrosion-free, and indicates that no remaining corroded pits can be found on the treated surface.

In order to further examine the degree of cleanliness and the morphology of surfaces generated by the bristle blasting process, scanning electron micrographs of the treated surface are shown in Figs. 9a and 9b. Careful examination of Fig. 9a (20x) indicates that no corrosive pits remain, and that the treated surface has a uniform/repeated pattern consisting of micro–indentations. Each micro-indentation is evidently associated with the impact/rebound of bristle tips, and bears a strong semblance to the impact crater shown in Fig. 5a. Higher magnification (100x) of the region outlined in Fig.9a is shown in Fig. 9b, and clearly indicates craters that were individually formed by bristle tip impact during the cleaning process.

4.2 Material removal performance: Aggressiveness of the bristle blasting process

The removal of corrosion is inevitably accompanied by the removal of base/substrate material as well. However, substrate material is an integral part of engineered components that enables the structure to bear load and

resist failure. Consequently, removal of parent metal from corroded surfaces must be carefully understood and controlled, as this may create dimensional changes in sensitive regions of structural components. Specific cases where such concern may be warranted include, for example, the web and/or flange of I-beams, and similar load-bearing components that have thin cross-sectional dimensions.

The present case study examines the material removal performance of bristle blasting processes. As one may expect, the configuration/sharpness of bristle tips plays an important role in forming the crater/micro-indentation that appears in Fig. 5a. Thus, the initial chisel-shape of bristle tips appearing in Fig. 3 is subject to eventual wear during the corrosion removal process which, in turn, reduces the capacity of the bristle tip to penetrate the surface. In order to examine both the material removal performance and the role that progressive wire tip-wear plays in bristle blasting processes, considerable experimentation has been carried out, and a portion of these results are shown in Figs. 10 and 11.

In Fig. 10, the material removed (gram weight) from a flat API 5L specimen is measured and reported by using bristle blasting tools that have acquired various periods of operation/in-service use. Thus, the material removed by tools having 3 different "ages", namely, 5 min. (triangle), 25 min. (square), and 72 min. (diamond) of service life are reported. The material removal process was carried out by inserting/penetrating the rotating tool into the specimen to a nominal depth of 4 mm, and allowing the tool to extract parent material from the specimen for several prescribed time intervals without interruption. At the conclusion of each interval, the specimen was weighed using a high-resolution electronic balance, and the differential material removed was recorded. The results indicate that the material removal capacity of the tool regularly decreases as its duration of use increases. Nevertheless, the tool retains the ability to remove material from the specimen even up to the time at which tool retirement is recommended (i.e., ~ 70 min.). As the tool progressively ages, one may expect that the texture/anchor profile performance of the tool will likewise be affected. Therefore, the relationship between surface texture (Rz, microns) and tool age (minutes of service) has been examined and is reported in Fig. 11. The results reported in Fig. 11 are the averaged value of 3 separately recorded texture measurements that were obtained using standard press-film replica tape. This result indicates that the new (i.e., as received) tool generates an anchor profile of Rz ~ 84 microns. However, with increased use,

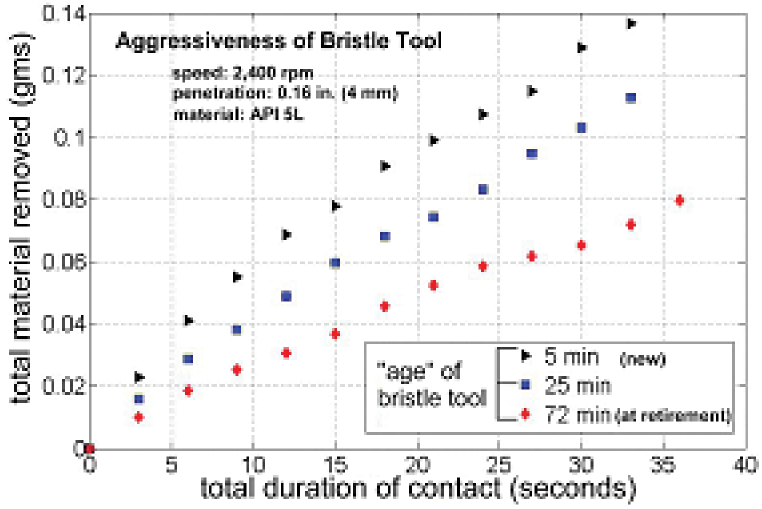


Figure 10. Measured material removal rate for API 5L flat specimen, using bristle tools having various periods of service. Approximate bristle tool specifications: face width: 22 mm, hub radius: 29 mm, bristle wire diameter: 0.73 mm, bristle length: 29 mm, total bristle population ~480.

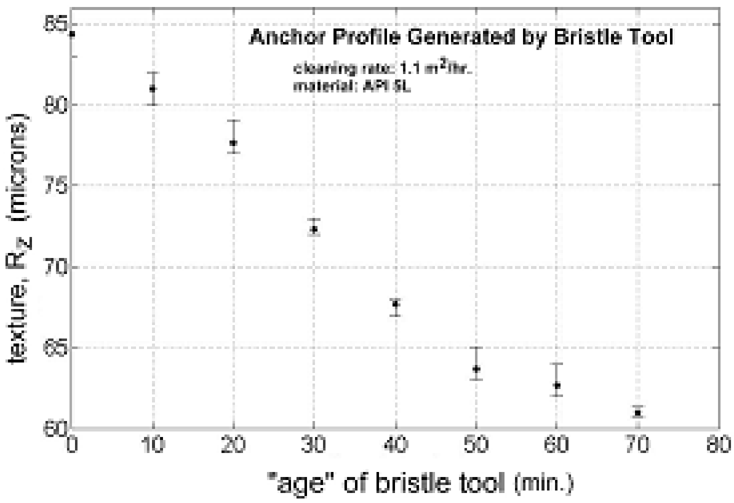


Figure 11. Variation of surface texture/anchor profile as bristle tool progressively ages. Approximate bristle tool specifications: face width: 22 mm, hub radius: 29 mm, bristle wire diameter: 0.73 mm, bristle length: 29 mm, total bristle population ~480.

the anchor profile performance of the tool progressively declines to Rz ~ 62 microns at the conclusion of the tools life.

5 Visual Cleanliness

The following observations are now offered regarding the performance and degree of cleaning of the bristle blasting tool in relation to visual standards that are currently used by trained/skilled users in the surface treatment community:

- **Comparison of bristle blasting process with surface treatment tools cited in Visual Standard for Power- and Hand Cleaned Steel (SSPC-VIS 3).**

Surfaces generated by the bristle blasting process exceed the cleanliness performance of all current power tool cleaning processes cited in SSPC-VIS 3, including hand tool cleaning by wire brush (SP 2), power tool cleaning by power wire brush (SP3/PWB), power tool cleaning by sanding discs (SP3/SD), and power tool cleaning by needle guns (SP3/NG).

In addition, the bristle blast surfaces obtained in this work also exceed the cleanliness and texture expectations of power tool cleaning to bare metal (SP 11), which encompasses both impact and profile producing media (i.e., rotary flaps, needle guns, etc.), and surface cleaning media (i.e., non-woven abrasives, coated abrasives, etc.). That is, surface specification SP 11 allows materials to remain at the bottom of corroded pits, while retaining/producing a minimum surface profile of 25 microns. Conversely, the results obtained in this work indicate that no corrosive pits remain after bristle blasting, and that the treated surface has a texture/profile that varies from 63 microns to 84 microns throughout the course of tool life.

• Comparison of bristle blasting process with surface treatment methods cited in Guide and Reference Photographs for Steel Surfaces Prepared by Dry Abrasive Blast Cleaning (SSPC-VIS 1).

Surfaces prepared by the bristle blasting process exceed the cleanliness of surfaces that is achieved by brush-off blast cleaning (SP 7), industrial blast cleaning (SP 14), and commercial blast cleaning (SP 6). The surface cleanliness obtained by using bristle blast cleaning however, does appear to be commensurate with near-white blast cleaning (SP10), and white metal blast cleaning (SP 5).

6 Conclusion

It has been shown that surface treatment performance of the bristle blasting process is dependent upon the overall time that is acquired by the tool during use. Consequently, use of the tool must be accompanied by a clear understanding of the need for periodic tool retirement, as warranted by the application. Based upon the results reported in this article, for example, both corrosion removal and an anchor profile can be sustained for 1 hr. (60 min.) duration when used for treating API 5L material systems. During this interval, an averaged cleaning rate of 1.1 m^2/hr. can be achieved along with a surface texture that (predictably) varies (Rz = 84 microns to Rz = 63 microns) over the duration of tool life. Consequently, the bristle blasting process is ideally suited for spot repair applications, or larger operations that may prohibit the use of traditional grit blasting processes.

7 Acknowledgments

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Altex's wide range of specialised products and coating systems are well supported by knowledgeable, skilled sales and technical teams.

Constant technical development and improvement is needed to meet the often conflicting demands of reduced environmental impact and health and safety risks. While at the same time increasing performance at equal or lower costs.

Altex Coatings has made a substantial investment and commitment to the development and licensing of world class technology and brands for these markets.

Altex Coatings has had a long-standing relationship with Leigh Paints in the UK who are the suppliers of the internationally renowned Firetex Range of Intumescent Coatings used to protect steel in both conventional(Firetex M77) and hydro-carbon fires (Firetex M90).

Contact: Monique Hopkins
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Marketing Co-Ordinator
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ANODE ENGINEERING

Anode Engineering is a specialised independent supply house providing Australian, New Zealand and South-East Asian industries with class leading products and services. Stemming from their long history within the pipeline industry, and backed by strong client and supplier relationships, Anode Engineering endeavours to support the continuous growth of various industries throughout the region. Supplying products ranging from anodes to vacuum lifters, from training of staff to the repair of locating equipment, the team at Anode Engineering has all of your industry needs covered. We supply products under the following categories: anodes, cathodic protection instrumentation, materials & equipment, corrosion probes and monitoring equipment & services, earthing and surge equipment & materials, exothermic welding, filter elements, holiday detectors, insulating equipment and fittings, pigs and pigging equipment, pipe and cable locating equipment, pipeline couplings and hot tap fittings, pipeline coating and repair systems, protective caps for nuts and bolts, pipe handling equipment, swain gear, vapour phase corrosion inhibitors and much more! The team also provides professional services for asset assessment and corrosion management. We provide design, supply, installation, commissioning and maintenance of cathodic protection systems.

With offices now in Western Australia, Melbourne and New Zealand, as well as Queensland, the A Team is at your service.

For more information please visit our website: www.anodeengineering.com or contact us on the following numbers.

Australia

PH: +61 7 3801 5521

FX: +61 7 3801 5523

Toll free 1800 446 400

New Zealand

PH: + 64 9 250 0086

FX: + 64 9250 1650

ATLAS SPECIALITY METALS

Atlas has been associated with specialty metals since 1918 and has worked with engineers, designers and architects over the years to enhance the unique and innovative characteristics of specialty metals, particularly stainless steel. It's no coincidence that we lead our market and it's this experience and expertise that stands behind the "Durinox™" product range.

Durinox™ reinforcing bar is a stainless steel reinforcing product used in construction, infrastructure and industrial applications where product longevity and protection in highly corrosive environments is required.

Depending on the appropriate grade selection, Durinox™ can withstand chlorine and carbonate attack from the most aggressive of environments, even seaside and marine applications. By using couplers or lapping, Durinox™ can even be appended to existing carbon steel reinforcing without fear of galvanic corrosion. When compared with standard carbon steel reinforcing, Durinox™ also provides dramatic savings in maintenance and repair: it requires minimal, if any maintenance, virtually eliminating the cost in time, money and efficiency of repeat inspections.

The superior strength and corrosion resistance of stainless steel may also allow for a reduction in the thickness of concrete, significantly lightening the weight and cost of a structure, and because Durinox™ is made from stainless steel, it can be installed flush with the concrete without risk of corrosion.

The durability of stainless steel is very attractive to asset owners eyeing off the 'triple bottom line': environment, social and financial. Durinox™ stainless steel reinforcing products stand up to the meticulous demands of all three tests.

For more information contact Leo O'Callaghan on 03 9272 9961 or visit: www.durinox.com.au

BASF

BASF's Construction Chemicals division is the leading supplier of chemical systems and formulations for the construction industry. Continuous innovation and tailor-made solutions ensure its customers are more successful. Its Admixture Systems strategic business unit specifically helps customers in the ready-mix, precast, manufactured concrete and underground construction industries. The Construction Systems unit offers a wide range of products for sports and industrial flooring, external renders and wall insulation, expansion joints, wood preservatives as well as specialist repair mortars, tile adhesives and waterproofing membranes. The division operates production sites and sales centers in more than 50 countries and achieved sales of €2.1 billion with approximately 7,100 employees in 2007.

Further information on is available at www.basf-cc.com.au

BBR CONTECH

Established in 1963, BBR Contech is New Zealand's most recognised provider of technical expertise and specialist contracting services in the construction and civil engineering industry. Its range of construction and remedial engineering activities include:

- post-tensioning technology
- ground anchoring
- construction engineering
- maintenance, repair and retrofit of concrete structures

BBR Contech has considerable in-house construction expertise and can also assist clients with comprehensive condition surveys and reports on deteriorated concrete structures.

BBR Contech works in close collaboration with its clients to deliver innovative solutions in a professional, reliable and effective way. As part of the international BBR Network and in conjunction with specialised local resources in branches throughout New Zealand, we are well positioned to provide tailored services for every project we undertake.

BBR Contech has won many industry awards in concrete related fields with respect to its innovation and excellence in both new construction and remedial engineering.

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www.contech.co.nz

BLASTQUIP / ALL BLAST SALES

Blastquip is a family owned and operated business which has been providing products and services to the Abrasive Blasting and Painting Industry for over forty years. The sales staff are all highly experienced and trained in the products they are selling. They can provide sound advice and back up support on all their products.

In the past two years Blastquip has increased its product range to include several new products and brands. Adding to existing extensive product range of G.M.A Garnet and other Abrasives, Blasting Units and Equipment, Operator Safety and Respiratory Equipment, Conventional Spray

Equipment and Testing Equipment, we have added the following new products. Tritech and Spraychief Airless Spray Equipment, DeFelsko Testing Instruments and an amazing new Environmentally Friendly, Biodegradable Paint Stripper and Graffiti Removal Product Range to name a few.

Blastquip offer full Blast and Spray Booth packages and have recently completed a full Blast Booth and Twin Spray Booth Operation at the Devonport Naval Base.

We have stores throughout New Zealand and Sales Staff based in Auckland, New Plymouth and Christchurch.

Please do not hesitate to contact Blastquip on 0800 100 493 or sales@blastquip.com for further information.

CORMON

Cormon Ltd has been supplying corrosion and erosion monitoring systems worldwide for over 22 years. As a British based company, with an international network of Cormon offices and representative agents, we pride ourselves on providing the best solution to fit our clients' needs. Through our well informed network of local offices, we provide sales, on-site support and commissioning services at a standard that compliments the excellence of our product range.

Cormon's Ceion technology permits operators to utilise highly sensitive, but rugged, internal corrosion / erosion monitoring in locations requiring a longer service life time, often equivalent to planned maintenance shutdown intervals.

One of the most successful applications of the Ceion technology has been the subsea corrosion and erosion monitoring spool RPCM, enabling real time monitoring of sand production and corrosion inhibitor performance.

Cormon is proud to support the Corrosion and Prevention 2008 Conference and to be a solutions provider to our clients, enabling real life monitoring of process specific concerns, such as scale formation or weld root corrosion.

Elizabeth Breakey
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Fax : 08 9429 8800
Address : 45 Ventnor Ave, West Perth, 6005 Western Australia
www.cormon.com

DENSO AUSTRALIA

Denso Australia are the Australian arm in Winn and Coales International, and are customer focused specialists in the provision of anti-corrosion coatings for; pipelines, marine structures, process plants and general infrastructure. The Denso mission is "to provide valued clients with optimum long life solutions for their corrosion, wear and sealing problems". This combined with a simple quality philosophy of "doing it right first time" cements our commitment to complete customer satisfaction. This year Denso Australia will be celebrating 40 years of service of manufacturing in Australia.

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DULUX PROTECTIVE COATINGS

Dulux® is an Australian owned and based company committed to the supply of quality protective coatings. Dedicated to, and servicing the Australia-Pacific region for over 50 years, Dulux® Protective Coatings manufacturers and markets a comprehensive and diverse range of coating products. Systems range from light industrial applications ideal for machinery and steel used in mild environments, to high performance systems for protection in chemically and environmentally harsh conditions.

To satisfy the diversity of the Protective Coatings industry, the Dulux® Protective Coatings family of products includes coatings such as etch primers and alkyd enamels through to epoxy primers and topcoats; zinc rich coatings, chlorinated rubber, acrylic and polyurethane topcoats; micaceous iron oxide coatings and specialist high performance systems such as ceramic coatings, polyurea and heat resisting product lines.

With this product range additional to the Dulux® level of experience and customer-focused support staff,

it's possible to provide tailor made solutions for most industry projects. The Dulux® support team provide advice to Specifiers, Project Managers and Applicators with information on everything from substrate preparation, through to application methods and maintenance scheduling. This product advice is carefully directed guidance for specific problems and difficult conditions.

Dulux® Protective Coatings also has the most extensive distribution network in the industry with state warehouses, over 50 company owned Dulux® Trade Centres and a large number of independently owned Trade depots located in most major regional centres. This ensures Dulux® are able to provide fast reliable service to customers right across the country. For 24/7 customer service, the Dulux® Protective Coatings website features easily accessible downloading of Product Data Sheets and Material Safety Data Sheets for the comprehensive range.

In fact, if your project needs protection then Dulux® Protective Coatings has the correct coating system to do the job. Worth doing, worth Dulux®.

www.duluxprotectivecoatings.com.au or call Dulux® Customer Service 13 23 77.

FORTEC NEW ZEALAND

Fortec New Zealand – take a look at the commitment that Fortec has made to ensure that customers throughout New Zealand enjoy the very highest level of service and technical support. The recent opening of the new Fortec Paints branch in Bromley, Christchurch marks a major investment in the local market and, with both Auckland and Christchurch we have the ideal one-stop-shop for all your paint and consumable needs.

As one of Australasia's leading paint manufacturers, Fortec has established a long-standing reputation for uncompromising quality combined with exceptional value for money. The foundation is a complete and diverse product range that's widely known for its excellent colour and local technical support network.

Kelvin Dick is our PMC coating specialist, with over 40 years in the industry. This provides an on-site technical support service that's second to none. If there's anything you need, don't hesitate to ask – this committed team will be more than happy to help.

Protec – Our Parent Company

Since 1978, Protec Pty Ltd has continued its commitment to product testing development through research and technology. Their dedication to ongoing product development is your guarantee that with Protec, you will receive the highest quality paints and finishes every time.

Their state-of-the-art manufacturing and laboratory facilities based in Adelaide, combined with their sales and distribution centers located throughout Australia and New Zealand, guarantee a level of service and technical expertise that is second to none.

Research & Development

Protec's dedicated commitment to ongoing research and product development is just one of our many strengths. Their fully equipped, independent and professionally staffed laboratories and research facilities continue to meet their customer's individual needs for new and highly innovative products, at very competitive prices.

Their superior technology is based on the latest advances in both local and international information and developments. Protec's ongoing testing and research ensures that only premium quality raw materials from around the world are used in our innovative product formulations.

Quality Assurance

We believe the manufacture of quality coatings is dependent on strict quality control – one of Protec's great strengths. Continual testing and upgrading of our formulae and ingredients ensure that all products conform to the highest possible standards. This guarantees that our customers receive the best quality finishes when they choose Protec products. Protec Pty Ltd is Quality Assured to AS/NZS ISO 9001.

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HEMPEL AUSTRALIA

HEMPEL's presence in Australia began with an agency agreement in 1968. In 1974 the company opened it's own office in Melbourne and today it services Australia, New Zealand, Melanesia and Polynesia, through a series of HEMPEL offices, distributors and dealers.

Protective Coatings

Over 30 years of product innovation have earned HEMPEL the recognition of being one of the leading protective coating suppliers around the world. The product range includes industry leading, Inorganic Zinc Silicates, Pure & Modified Epoxies, Polyurethanes, Polysiloxanes and Enamels. As well as specialist high temperature, high abrasion and fire resistant products.

HEMPEL's range of protective coatings has been developed to ensure that the company is able to provide a total solution to clients needs with products for applications as diverse as wind turbines, mining structural and process plant, onshore and offshore constructions, bridges, rail cars, gas & petrochemical plants, and pipe coatings. This also includes:

- Marine Coatings
- Yacht Coatings
- Container Coatings

HEMPEL recognise that product development is an ongoing investment in the future of it customers and the company. It has invested significantly in 6 research and development centres based in Europe, the US, the Middle East and, most recently Singapore—its first Asia Pacific R&D Centre. Equipped with state of the art equipment, and often working on specific customer requirements, these facilities provide the innovation necessary to keep HEMPEL at the forefront of product development.

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INCOSPEC & ASSOCIATES

Incospec & Associates was established in 1981 to provide independent and authoritative consultancy in the field of corrosion engineering. The company has had many years of experience in protective coatings - both application and specification. Incospec, a NATA accredited inspection company, has the largest team of full-time coating inspectors in Australasia that can undertake QA audits, coating condition surveys, field inspections and project management. Incospec has the advantage of being totally independent which gives the ability to give unbiased opinion free from commercial restraints.

Incospec's widely adopted Guardian software, combined with condition surveys, provides a powerful asset maintenance and risk management tool.

Other services include cathodic protection, hazardous paint consulting, testing equipment, failure analysis, training, arbitration, microbiologically influenced corrosion (MIC). Incospec has offices in most states of Australia.

Come and meet the Incospec team at booths 26 & 27 at the 2008 conference.

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www.incospec.com.au

INTERNATIONAL PROTECTIVE COATINGS

International® Protective Coatings is the leading supplier of high performance Protective Coatings in Australasia and around the globe. International® Protective Coatings forms part of Akzo Nobel Pty Ltd, a market driven, technology based company specialising in Coatings and Chemicals.

Akzo Nobel is the world's largest supplier of coatings and serves the Marine, Protective and Yacht coatings markets under the brand International®. Akzo Nobel also produce Powder Coatings (Interpon), Aerospace Coatings, Coil Coatings, Decorative Paints, Car Finishes, Wood Coatings, General Industrial Coatings, Inks and Resins.

The Protective Coatings division supplies innovative coatings to the Mining, Oil & Gas, Water & Waste, Power and Infrastructure markets.

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METAL SPRAY SUPPLIERS NEW ZEALAND

"The Best Equipment, the Best Advice - for 25 years!"

Metal Spray Suppliers (NZ) Ltd, also know as MSS, began importing and selling metal spray equipment and consumables in 1983. MSS supply equipment required to apply metal, non-ferrous alloys and ceramic coatings. Our coatings are used for wear, abrasion, cavitation and anti corrosion, including high temperature coatings to extend boiler tubes life. MSS now has international standing with exports to over 14 countries worldwide as well as a large customer base here in New Zealand. Jacques de Reuck, the Managing Director has a passion for the metal spray industry. He likes to keep himself up to date with the latest technology and know-how in the industry by regularly attending national and international conferences on metal spraying or corrosion topics and has presented many papers to the industry on the work he has been involved in. MSS also enjoys a strong working relationship with Metallisation in the UK as well as other suppliers around the world. Jacques has dedicated his time to ensuring that his customer base are given the use of his years of experience and learned skills in the thermal spraying field. He offers training and support for all who purchase equipment and consumables from Metal Spray Suppliers.

For more information:
Metal Spray Suppliers (NZ) Ltd.
PO Box 47 409, Ponsonby.
Auckland. New Zealand.
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Fax: 00 64 (09) 378 1509
Toll Free: 0800 86 00 16
Email: jacques@metal-spray.co.nz
WWW: www.metal-spray.co.nz

NMT ELECTRODES (AUSTRALIA) & TELPRO AUSTRALIA

NMT Electrodes manufactures Mixed Metal Oxide (MMO) and Platinised Titanium Anodes for a wide range of Electrochemical applications. These include production of Chlorine and Sodium Chlorate; on-site production of Hypochlorite; Impressed Current Cathodic Protection (ICCP); Metal finishing (e.g. electroplating); Metal Winning (e.g. refining of metals such as Copper, Nickel and Manganese); Chemical manufacture (e.g. electrochemical manufacture of Chromic Acid); to name but a few.

NMT Electrodes owns and operates facilities in both Australia and South Africa and has a combined experience of over 20 years.

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METZ

Metz is an Australian owned company that was established in 1953. Since that time we have specialised in the materials that can be used to resist the aggressive corrosive effects of the harshest chemicals used in industry. Resistance to the action of highly corrosive chemicals is not a simple matter. Chemical composition (type and concentration of acid, alkali or solvent etc), temperature and other physical conditions determine which Metz material can best resist each particular corrosive environment.

Metz Acid Proof construction materials include epoxy and other specialty coatings and toppings, acid brick and acid resistant tile systems and acid proof concretes and mortars. Metz also supplies a range of the latest fluoro elastomeric coatings, caulking and sheet lining systems available. Most materials are manufactured in our Quality Accredited Melbourne facility and can be installed by Metz to provide a unique single point of responsibility solution for our clients.

For further information please contact your local Metz branch:

Sydney Office - John West

Ph: 02 9671 1311

Fax: 02 9671 4292

Melbourne Office - Bob Knowles

Ph: 03 9561 6144

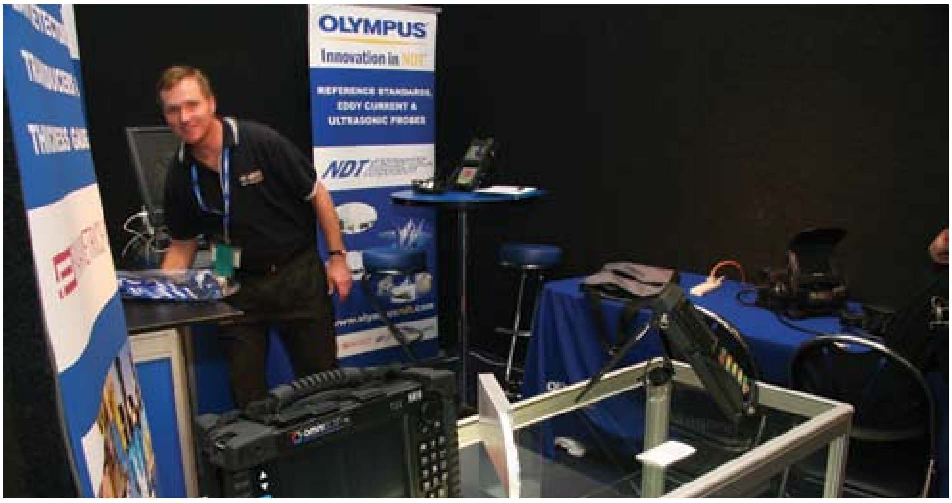
Fax: 03 9561 6944

Brisbane Office - Stuart Ellis

Ph: 07 3823 5555

Fax: 07 3823 5552

Website: www.metz.net.au



OLYMPUS NEW ZEALAND

Olympus New Zealand is a leading supplier of Inspection Maintenance Systems to the New Zealand market. The Olympus range covers high quality optical, electronic and precision engineering products for Remote Visual Inspection (RVI) and Non Destructive Testing (NDT) including: Videoscopes, Flexible Fiberscopes, Rigid Borescopes, Phased Array Instruments, and Ultrasonic and Eddy Current Flaw Detectors. Our products are mainly used in Inspection and Maintenance applications across a variety of industries such as Aerospace, Building & Construction, Engineering & Manufacturing, Power Generation and Defence.

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PANASONIC NEW ZEALAND

So much more than just a laptop… Panasonic Toughbooks are world renown for durability, quality and relentless performance even in the most demanding environments. Originally developed for the US military, Panasonic has been designing and manufacturing Toughbook notebook and tablet PCs for the past 14 years. Panasonic takes advantage of its own manufacturing technology to make many of its Toughbook components including batteries, DVD drives and screens to name a few. Fully rugged Toughbooks have an IP54 rating and meet US military standards for shock, vibration, dust and water resistance. They are housed in an extremely durable magnesium alloy casing which provides excellent protection for internal components and vital business data. 'Real world' features such as daylight visible screens, touch screens, a 7 hour battery life and integrated cellular communications add operational efficiencies to organisations while durability reduces costly downtime and associated expenses.

Come see us for a closer look and we will show you just how tough a fully rugged Toughbook is and how they can take a serious beating so your business doesn't. For further information on Toughbook visit:

www.toughbook.panasonic.co.nz
Contacts: Mathew Bambury: +64 9 272 0133; and Bill Adams: +64 9 272 0154

PEERLESS INDUSTRIAL SYSTEMS

Coating, Lining & Repair materials - Epigen and Prolong composite polymer ranges include linings for acid & aggressive chemical resistance, grouts & backing compounds, coatings for Potable Water & WWT facilities, process tank linings, non-skid flooring, pump repair & rebuilding materials, turbine & motor chocking grouts, joint sealants, adhesives, metal repair compounds and emergency repairs.

The company has long-term associations with clients in the water industry, mining, mineral processing, petroleum, refining, materials handling and storage industries.

Recent major projects include the full provision of the linings for the Merrimac Treatment Plant expansion and upgrade on the Gold Coast, North Auckland WWTP, with past notables being the WA21 innovative wastewater treatment plant expansion at Woodman Point in Perth's southern suburbs, and the provision of full lining materials for the Landers Shute Water TP north of Brisbane.

Water Industry products are approved to AS4020 and have a successful history dating back to the 1970's.

The Epigen Chemproof 4000 range of novalac epoxy products; a leader in the field of acid and aggressive chemical resistance; has been installed at major resource and processing sites throughout Australia.

Peerless Industrial Systems enjoy an excellent reputation in liaising with contract applicators, consultant design engineers and asset owners to qualify a protective system for their particular operating environment. Working with all parties ensures that the principal receives a system that achieves the maximum service life.

Peerless celebrated 60 years in 2007 and is represented in New Zealand and Asia.

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www.peerlessindustrialsystems.com

PETRO COATING SYSTEMS PTY LTD (PCS)

Petro Coating Systems Pty Ltd (PCS) is the leading supplier of anti-corrosion field joint coatings within Australia. PCS are the exclusive distributors for Dekotec Butylen Systems, Powercrete Epoxies and Raychem Heat Shrink Sleeves and offer a full range of anti-corrosion coatings including Petrolatum, Bituminous and Butyl Tape Systems and Marine Splashzone Protection Coatings. PCS also exclusively distribute Argus Machinery's high quality range of pig valve and multi-launch pig valve systems as well as the Deepwater Nu-Bolt/I-Rod System that provides a simple yet ingenious methodology for the prevention of crevice corrosion predominantly on pipe supports.

PCS products are used for the protection of field joints, pipeline specials, fittings and appurtenances as well as short runs of line pipe. PCS also offers in house coating services where we offer our clients preparations, coating and testing of anti corrosion coatings for short runs or specials. PCS products are specified and supplied into Australia's Petroleum, Gas, Refining, Mining, Plumbing, Water and Wastewater, Building and Construction Industries

and are exported internationally. PCS is renowned for supplying quality products supported by knowledgeable, professional service.

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PHILLRO INDUSTRIES

Phillro Industries are currently ranked as having one of the largest growth rates in Elcometer sales world wide. More recently they accepted an extension of the Elcometer brand into New Zealand becoming the Principal Australasian Importer and Distributor.

Phillro are also the only officially trained and authorised service and repair provider for the brand in the region.

As suppliers of quality spraying and finishing equipment, coatings inspection and concrete inspection equipment which includes the Elcometer range. Phillro are major distributors for Graco, ASM, Andreae, Ciemme and many other respected brands. Phillro Industries provide sales and technical advice of a diverse range of products for protective coatings industries as well as service and repair of the equipment for: Airless Spray, Plural Component, Automatic Spraying, Solvent Recovery and all of your accessories such as spray guns, hoses, fittings and safety products.

Whilst the spraying and finishing products are distributed Australia wide, the Elcometer range is now also distributed throughout the Australasian region.

All enquiries are welcome and Phillro can be contacted at sales@phillro.com.au or phone + 61 3 8645 2900.

PPG INDUSTRIES NEW ZEALAND

PPG Industries is a global leader in the diversified manufacturing and servicing of protective, decorative and automotive coatings, industrial and specialty chemicals, flat glass and fabricated glass products. Headquartered in the USA, and with 113 facilities in over 20 countries, PPG's acquisition of US-based Ameron Coatings and European Sigma Kalon has strengthened its position in the heavy duty protective coatings market.

PPG Industries New Zealand Limited is New Zealand's leading manufacturer and supplier of a broad range of industrial coatings with a proud and longstanding tradition of quality product and innovative technology. Utilising global resources, PPG Industries New Zealand Ltd offers applications for wood, general industrial, coil-coating and protective & marine coatings markets, developed for South Pacific climates. This wide range of surface coating options also include powdercoating, can & package linings and pre-prime coatings for timber.

Phone Toll Free 0800 263 766

www.ppgnz.co.nz

PRODIGITAL PTY LTD

ProDigital, this year, brings to you a new representation in Alicona Optical surface imaging equipment. Combine with 3D imaging software, precise measurements can be made with a resolution of up to 10nm making an instrument ideal for surface study of both homogeneous and compound materials.

Also continuing with Princeton Applied Research® and Solartron both global leaders in the manufacture of electrochemical instrumentation for research electrochemistry, applied corrosion, battery and fuel cell research, biomedical research, plating, sensor applications and materials characterization, now combine to offer the broadest range of single and multichannel potentiostats for every price range and application.

Both combine over 60 years of expertise and now being divisions of Ametek Inc and represented by ProDigital in Australia and New Zealand, these two outstanding instrumentation companies also offer SKP, LEIS, SECM and our recently released OSP and SDS systems.

Software, like PowerSuite, MultiStat, ZPLOT Corrware, combine to put the power in your hands covering a multitude of techniques or to build your own custom techniques if required.

ProDigital in now in its 12th year of providing local service and support and this year launched the new VersaStat III USB controlled single channel potentiostat with options covering low current to 20Amp boosters and impedance to 1MHz in one very low cost unit.

For further information please contact ProDigital Pt Limited at vinces@prodigital.com.au or +61 (0)2 9674 4222 www.prodigital.com.au

QUEST RELIABILITY

Quest Reliability is built on a foundation of leading edge science and technology that has innovated and shaped industries for almost 40 years. Today, with its advanced knowledge and expertise in the fields of materials engineering, structural integrity and risk-based asset management, Quest Reliability is leading the refining, chemical & gas, power and pipeline industries in improving asset reliability and performance.

Essential to its business philosophy and focus, Quest Reliability has:

- An unmatched global pool of engineering talent
- Superior analytical tools and best practices
- Advanced measurement systems
- Advanced Fitness-for-service software products
- A culture of customer responsiveness, understanding and respect

Quest Reliability applies its unique resources to developing and implementing risk-balanced, cost effective and practical solutions to our clients' asset integrity management needs.

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RHINO LININGS AUSTRALASIA

Since 1988 Rhino Linings has been manufacturing proprietary Spray Application Equipment and Premium Protective Linings Systems. Today our Dealership Network covers some 65 countries and 1500+ Dealers. Our highly trained and motivated dealers apply Rhino Linings premium protective lining systems for Automotive, Industrial, Military, and Light Commercial applications.

Australasian customers are well supported by our manufacturing facility in Queensland, Australia. Master Distributors are based throughout Asia and New Zealand, Indonesia, Sri Lanka, India, Singapore and the Philippines.

Rhino Linings flexible, seamless and impervious linings offer an incredibly strong and easy to apply solution meeting EPA requirements and provide long term cost effective protection for any company's assets. Rhino provides premium protection solutions for impact, abrasion, corrosion and containment problems. Such applications can include treatment tanks, factory floors, water/waste water treatment plants and mining applications in primary and secondary containment.

Beside formulating and manufacturing our own chemical systems and application equipment we have full time technical staff to assist customers and dealers in the application of our proprietary linings. We offer premium solutions for you industrial requirements.

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RUST-OLEUM INDUSTRIAL COATINGS

Rust-oleum Industrial Coatings, has been marketed in New Zealand by a company called Modern Maintenance Products NZ Ltd. since 1999, a company that was established back in 1993, as a supplier to industry, of repairs and maintenance materials.

Rust-oleum Corporation, an old established US based manufacturer has two distribution channels, one being its very large DIY Consumer Division, that distributes globally, a range of aerosol and specialist finishes to the retail sector, and the other being the industrial, which incorporates a wide range of protective coatings for Industry, including a range of high performance floor coatings and toppings, that are supplied directly to the applicator or end user.

In New Zealand, Rust-oleum protective coatings, have been targeted mainly in highly corrosive areas, and their systems are particularly suited to maintaining and recoating structures where existing coatings have deteriorated.

Several of their systems, allow remaining intact coatings, including cathodic protection, to remain on the surface, after a preparation specification has been met, and be encapsulated with an anti corrosive, direct to metal waterproof membrane, that withstands severe coastal environments, especially areas that do not get regular rain wash and are subject to high chloride build up.

Rust-oleum also produce a range of zero-VOC coatings called Sierra Performance, that are suitable for Hospitals and Food Manufacturing facilities, but can also be applied direct to steel and will cure at lower temperatures than most, allowing maintenance to be completed quickly and efficiently.

Rust-oleum Immersion Epoxy coatings have been applied extensively, such as in swimming pools, hot, cold, salt or fresh water, and extends premium performance. They can also be applied to immersed prepared steel substrates as well.

Finally, their concrete floor protection systems can meet the highest level of Industrial wear and tear eg: impacting 30 ton steel coils and containment of the most corrosive chemicals that can be found.

New Zealand has a very long coastline with a high corrosion area, not forgetting the geothermal activity in the central North Island and Bay of Plenty.

Rust-oleum anti corrosion protective coatings have been applied in many locations now, giving years of sound protection.

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SEACOATINGS AUSTRALIA

Sea-Coatings Australia specialises in the restoration, repair and maintenance of civil and marine structures. While restoration is our core business we also have extensive experience in new bridge and wharf construction.

We have operated continuously as specialist civil and marine contractors since 1975.

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- survey, inspection and structural reporting
- explosive demolition
- all diving operations - including cutting, welding, etc.

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SMPS (AUSTRALIA) PTY LTD

SMPS (Australia) Pty Ltd is a specialised independent company, based in Melbourne Australia. It was formed in March 2007, with specific aim to provide innovative Switch Mode Power Solutions to the CP Industry.

SMPS (Australia) is managed by professional engineers who have expertise and practical experience in a wide variety of DC power supply systems. The company primarily works with CP consultants and CP design engineers providing them with the opportunity to design and install cost effective ICCP systems.

The company's current focus is on the development and manufacturing of Current Multiplier™ DC/DC converters for use in DC Power Distribution System. The CM-PDS™ approach is a key factor in improving the efficiency of sea-water ICCP systems, and in significantly reducing the cross-section and weight of power distribution cable networks in such systems.

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Syntech Finishing Specialists is Australasia's leading surface finishing solution company.

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For further information contact:
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– Surface Finishing Specialists
09 820 2121

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Tinker & Rasor is an electronics firm manufacturing corrosion mitigation instrumentation and related products. Our product lines include Tinker & Rasor instruments, Detectron locators with accessories and Tinker & Rasor CP test stations and line markers.

Incorporated in 1948, Tinker & Rasor has been continuously manufacturing holiday detectors since the founding of the company. Our holiday detectors are in wide use throughout the world: Inspecting protective coatings used for the mitigation of corrosion, and in coating inspector certification programs.

Tinker & Rasor introduced our plastics division in 1998, offering a full line of cathodic protection test stations and line markers. These products have been very well received and are in service around the world.

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Tinker & Rasor quality is found in our products, our people and our customer service.

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VISISCOPE LIMITED

Visiscope Limited is a Wellington based company that specialises in Remote Visual Inspection (RVI). We offer a multitude of unique inspection services such as condition surveys, as- built checks. Other specialist core roles we do include, RVI Consultancy Services, RVI Solutions, RVI Training and equipment sales. We provide a nationwide service.

Remote Visual Inspection (RVI) is the science of inspecting objects or areas usually inaccessible to the eye without disassembling surrounding structures or machinery. It allows inspectors to discover hidden defects before they cause major problems. RVI makes it possible to inspect behind walls, and into complex machinery such as turbine and piston engines, pipes, airframes, tanks and vessels, and other difficult-to-reach areas.

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Please visit our web site for further details. We have some interesting case studies on our web site.

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Wattyl Australia manufactures and supplies high-performance protective and marine coatings solutions throughout Australia and New Zealand.

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Coating Inspection Part 3: Surface Cleanliness Part A

Series based on the ACA CIC Refresher Course manual that was recently updated by Dr Rob Francis for the ACA.

Surface preparation is considered to be the most important factor affecting the performance of the coating. The first goal of surface preparation inspection is to ensure application onto a clean surface free of contaminants. This chapter looks at the methods available to assess surface cleanliness.

1. INITIAL SURFACE CONDITIONS

The initial condition of the surface will greatly affect the appearance and quality of the surface after preparation has been completed. It is often necessary to grade the surface according to the amount of rust and mill scale present. The initial rust grades are described in ISO Standard 8501-1:2007 (which was first published as Swedish Standard SIS 05 5900-1967 and generally known as the 'Swedish Standard'. It has also been adopted as AS 1627 Part 9 and BS 7079). SSPC VIS 1 is very similar but not identical. These rust grades are also described in AS 1627 Part 4 and are as follows:

Grade A: Steel surface covered completely with adherent mill scale and little, if any, rust.

Grade B: Steel surface which has begun to rust and from which the mill scale has begun to flake.

Grade C: Steel surface where the mill scale has rusted away or from which it can be scraped, but with little pitting visible to the naked eye.

Grade D: Steel surface where the mill scale has rusted away and where pitting is visible to the naked eye.

Method: Using these descriptions and aided by the photographs in the Pictorial Standard, you should select the initial rust which comes closest to the condition of the surface being tested. For previously painted surfaces, these are normally classed as Grade C if no pitting is present underneath the paint, or Grade D if there is pitting underneath.

2. SURFACE ASSESSMENT AFTER BLAST CLEANING

All surfaces should be inspected immediately after surface preparation to ensure compliance with the specification. This will specify the type of surface preparation required according to various classes depending on the amount of rust and mill scale removed. There are four grades of blast cleaning described in the 2005 edition of AS 1627 Part 4, in ascending order of preparation, as follows:

Class Sa 1: **Light** or **"brush-off" blast cleaning** which removes loose mill scale, rust and foreign matter. The appearance approximates to Sa 1 of ISO 8501-1 (and is equivalent to SSPC SP7 or NACE No.4).

Class Sa 2: **Medium**, **thorough** or **"commercial" blast cleaning** which removes most mill scale, rust and foreign matter. After dusting, the surface should be greyish in colour. The appearance approximates to Sa 2 of ISO 8501-1. The finish is approximately equivalent to SSPC SP6 and NACE No.3. According to the description of SSPC SP6, no more than 33% of every 9 square inch area is stained, although this description is not in the Australian Standard.

Class Sa 2½: **"Near-white"** or **very thorough blast cleaning** where almost all mill scale, rust and foreign matter are removed to the extent that only traces remain in the form of spots. The cleaned surface will show varying shades of grey. The appearance approximates to Sa 2½ of ISO 8501-1and the preparation is approximately equivalent to SSPC SP10 and NACE No.2. According to SSPC SP10, no more than 5% of every square inch is stained, although this description is not in the Australian Standard.

Class Sa 3: **"White metal"** or **extremely thorough blast cleaning** where all mill scale, rust and foreign matter are removed. After dusting, the surface should have a uniform metallic colour when viewed at right angles to the surface. The appearance approximates to Sa 3 of ISO 8501-1 and the cleanliness level is approximately equivalent to SSPC SP5 and NACE No.1.

Method: Determining the condition requires comparison with the standard photographs in ISO 8501-1.

1. The initial rust/mill scale grade is determined as described in the previous section and you should turn to the section in the standard containing photographs of the cleanliness grades with this initial grade.

2. In assessing the blasted surface, viewing should be at right angles to the surface.

3. The photograph that most clearly approximates to the surface is the cleanliness standard. (NB: There are no photographs of initial grade A or B cleaned to Class 1 because of the wide variations in appearance.) The pictorial standards are taken from a flat steel plate and allowances should be made when assessing the appearance of irregular steel surfaces. It should be noted that the photographs are only a guide and a supplement to the written description which takes precedence in grading the surface.

Further Information: Determining surface cleanliness is subjective and requires experience. There may often be disagreement, especially with Class Sa 3. The type of abrasive affects the appearance of the surface. The photographs were produced with sand blasting which gives a brighter, whiter finish than other abrasives. Also profile affects appearance with a deeper profile giving more shadow than a shallow profile. Factors such as angle of the blast, lighting conditions, whether rounded or angular abrasive was used will all influence appearance and this effect is illustrated in ISO 8501-3.

SSPC Standard-VIS 1 (2002) shows photographs similar to those in the Swedish Standard but are slightly different as the SSPC descriptions are slightly different. It also shows surfaces cleaned with a number of different abrasives which show the variations in colour texture and general appearance under different lighting conditions . This Standard is used in the same way as the ISO Standard. While these alternatives have some advantages and may be preferable in some situations, you should remember that the ISO/Swedish Standard has been adopted as the Australian Standard and should be used in the case of disagreements. Jobsite standards are often used to overcome problems with shadows and hues caused by different abrasives, lighting and initial surface conditions or type of steel.

Accuracy: This is a qualitative rather than quantitative test and accuracy cannot be given.

Calibration: Not applicable.

3. SURFACE ASSESSMENT OF HAND OR POWER TOOL CLEANING

Manual and power tool cleaning can remove some rust, paint, scale, but will always be inferior to blasting so standards of cleaning are less important than for blasting. The best known preparation grades are those described in the 'Swedish Standard' (ISO 8501-1,). The appearance is shown in this Standard for original rust grades B, C and D (Such methods are considered to have little effect on adherent mill scale, grade A).

St 2 **Thorough scraping and wire brushing**. Loose mill scale, rust and foreign matter removed followed by cleaning. The result should be a faint metallic sheen.

St 3 **Very thorough scraping and wire brushing**. As for St 2 but much more thoroughly. After removal of dust the surface should have a pronounced metallic sheen.

Because of variety of different tools that can be used, and variations in initial surface conditions, the photographs may not be sufficient to describe specific cases and it is often recommended that special photographs or job site standards be produced as reference standards.

The SSPC also have visual standards for hand and power tool cleaned surfaces (SSPC-VIS 3). The three relevant standards are:

• SSPC-SP2 **Hand Tool Cleaning** with a wire brush.

• SSPC-SP3 **Power Tool Cleaning** with a power wire brush (SP 3/PWB), with a sanding disc (SP 3/SD) or a needle gun (SP 3/NG).

• SSPC-SP11 **Power Tool Cleaning to Bare Metal** (although slight residues of rust or old paint are allowed in pits) with rotary flaps or needle guns (if a profile is required) and with non-woven discs (to restore an existing profile in maintenance work). The profile should be at least 25 microns.

• SSPC-SP 15 **Commercial Grade Power Tool Cleaning** is as for SP 11 except that the random staining of rust, paint or mill scale is "limited to not more than 33% of each unit area".

These visual standards are used in the same manner as the standards for determining the condition of blast cleaned surfaces. Visual water jetting and wet abrasive blasting standards have been developed by NACE/SSPC and are used in the same manner. Part 11 of AS/NZS 1627 is in development and it is proposed to adopt SSPC-SP 12/NACE No. 5 .

Corrosion & Materials Technical Papers Required

Corrosion & Materials is seeking submissions of original research papers which are included in the autonomous, Corrosion and Materials Technology Section. *Corrosion & Materials* has now been added to the DEST list of refereed journals, thus papers accepted for publication in the Technology Section by affiliates of a University will be considered to meet the DEST criterion, and will contribute under the Institutional Grants Scheme to the determination of financial allocations to the Universities from which the publication originates. To meet the requirements for DEST recognition all manuscripts are peer-reviewed by international referees selected to ensure that this is done rapidly and to the highest standards.

If you have an original paper to submit please contact the ACA Centre on +61 (0)3 9890 4833 or aca@corrosion.com.au.

NEWS FROM ACA NEW ZEALAND BRANCH

At the Wellington Division meeting on 1 July 2008, to which members of IPENZ and SCANZ had also been invited, Mick Morris and Barry Eldridge of Zintec Corrosion Solutions discussed the use of their 'Zinga' product and showed pictures of transmission towers and bridges where it had been successfully applied in Australasia, and answered questions (for longer than their initial presentation!) Key issues which they raised in the presentation, and in their answers to questions, were:

- The product can be used as a primer (topcoated with other products to provide decoration, safety signage or corporate badging) or as a standalone coating product.
- The product provides some cathodic protection to steel surfaces, similarly to hot-dip galvanising, and can be applied (by brush, roller or spray) to give approximately the same zinc weight on the surface as hot dip galvanizing. Mr Morris effectively presented the product as producing the same effects in the same environments as hot-dipped galvanizing delivers.
- The product thins in service, by erosion and/or sacrificial corrosion (depending on the circumstances), typically at around 3 microns per year but this rate depends on the exposure environment. Similarly to galvanizing, there is no undercutting of the coating at steel surfaces which become exposed by this 'corrosion' of the coating.
- The coating is supplied in a single pack, which requires very thorough agitation to bring the zinc metal properly into suspension. (Volume solids is 58%, with the dry film weight 96% zinc.)
- The usable range of environment conditions for successful application is wide – temperatures of -15 to +45ºC (though not over ice!), and up to 95% RH. The system is so moisture tolerant that it can be applied to damp substrates, though this slows the curing process (a concept that is consequently used sometimes in application in very hot weather, dampening the substrate to get a sensible cure time.)
- As with all surface coatings, the initial surface preparation is important. Mr Eldridge demonstrated a bristle blast tool which they saw as having advantages over abrasive blast.
- Once applied, the surface preparation necessary for maintenance recoating (which should be done while there is still some residual coating on the surface, but can be applied over surfaces on which some rusting is starting to show through) was claimed to be simply a water blast, rather than preparation of a clean metal substrate. This has potential advantages in life cycle analysis terms by avoiding costs of blast containment and lessening the costs of access systems for blasting. The oldest Zinga application in Australasia is 11 years old, and no Australasian recoating projects over the top of an original Zinga coating were available for review. The product has been in use in Europe for 28 years.
- Extensive laboratory testing has been carried out prior to receiving APAS and NORSOK approvals. It was claimed that this includes testing in high-UV environments, but details were not available at the talk.
- It was noted that the zinc particle preparation used a particular patented process, which was not discussed, and that the binder system was also a proprietary secret.
- It was said that the lead content of the zinc is very low – sufficient for there to be approvals for the system for use in potable water containment systems.

ACA Auckland Division
September Meeting

The final Auckland Division technical meeting for 2008 was held on September 25th. The meeting was a site visit to CSP Coatings Systems Ltd., Ellerslie, a Fletcher Company specializing in grit blasting, hot-dip zinc galvanizing, industrial coatings and thermal metal spraying. Our host for the evening visit was Mr Ash Arya, Operations Manager at the largest hot-dip galvanizing plant in New Zealand.

The attendees were taken on a tour of the plant commencing with a viewing of the hot-dip zinc galvanizing plant in operation. The tour continued into the blast cleaning bays and then the new CSP polyurea spray coating system with which large galvanized steel components such as street lighting poles are being factory painted. Ash then gave the group a presentation that outlined the latest technological developments at CSP, including the results of recent laboratory testing carried out on the new CSP polyurea coating system especially for galvanized steel.

After an extensive discussion session, ACA Auckland Chairman Andreas Gabriel passed a vote of thanks to Ash Arya and his CSP team for the interesting visit. Mr William Bettle, Director of Syntech Distributors Ltd, Avondale, was then presented with the company's ACA Membership Certificate by Andreas. The attendees then enjoyed some great pizza kindly provided by CSP.

Attendees at the ACA Auckland site visit to CSP Coating Systems

The hot-dip zinc galvanizing bath in operation at CSP

ACA Auckland Chairman Andreas Gabriel (left) presents William Bettle of Syntech Distributors Ltd with his ACA Membership Certificate

ACA NZ Branch
August Technical Meetings

ACA NZ Branch recently welcomed Ike Solomon to New Zealand to address the Wellington and Auckland ACA Divisions on the 19th and 20th of August. His presentation was entitled 'Asset Corrosion Management – Meeting the Environmental Challenge'. Ike is a Senior Associate with Connell Wagner Consulting Engineers, based in Melbourne. He has 35 years' experience in corrosion control and asset management and he is a 33-year Member of ACA. The meetings in both centres were held jointly with the local Branches of IPENZ.

Ike's address covered a wide range of corrosion management issues, including climate change, engineering materials and the environment, infrastructure corrosion, asset corrosion management, and reducing our carbon footprint using modern corrosion technology. The theme of his address was that good corrosion control saves vast quantities of embodied energy that is used to produce the engineering materials employed in our valuable infrastructure. Green engineering requires that we reduce wastage of embodied energy in engineering materials. Corrosion of materials increases embodied energy usage and engineers must ensure that new engineering structures are truly durable, in order to reduce the carbon footprint and greenhouse gas emissions. Ike supported this theme using case studies, including an outline of a recently developed reverse-osmosis technology to minimise rising salt damp, a corrosion problem facing industry in Australia which causes premature failure of steel reinforced concrete structures. He concluded by noting that corrosion engineers will face many challenges in order to obtain a more sustainable approach to asset management, which includes buildings, bridges, pipelines and storage tanks.

The addresses in Wellington and Auckland were followed by extensive discussion sessions before Ike was thanked for his visit and presentations by the ACA Division Chairman.

Ike Solomon (2nd from left) in discussion with (left to right) Sean Ryder, Ron Berry and Manesh Patel, after his presentation in Auckland

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