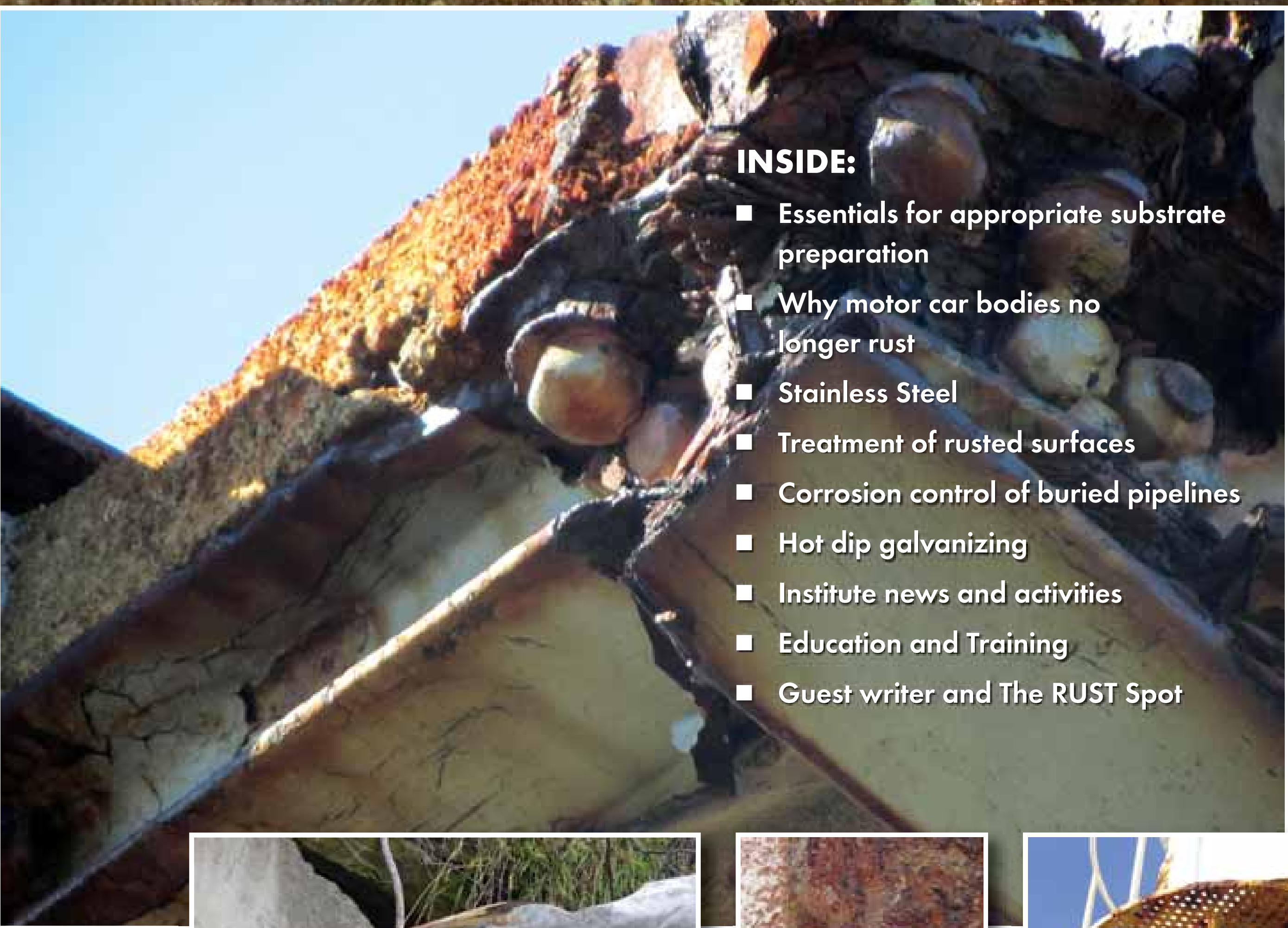
Vol. 2 Issue 1 No. 1 | 2016

Corrosion Exclusively



INSIDE:

55 YEARS OF EXISTENCE
Est. 1960

CORROSION INSTITUTE SOUTHERN AFRICA

Vol. 2 Issue 1 | 2016

Corrosion Exclusively

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EDUCATION AND TRAINING

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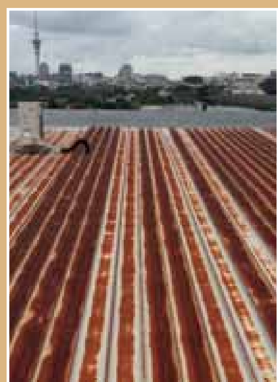

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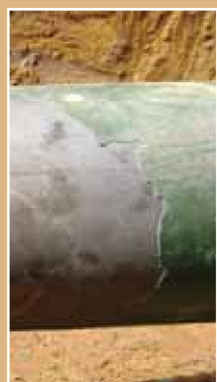

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President's Comment

The launch of our new Corrosion Exclusively magazine and Scientific Journal last year has come with positive response from industry and academia respectively and the enthusiasm of the team to ensure they both grow in esteem, invigorating for me as the recently elected president. As you well know, these sources of information are for you our members and therefore it is essential that you comment to the relevant editors regarding the content you wish to be published or to provide them with exciting corrosion news, technical articles and or scientific papers for possible inclusion in future issues.

This year unfortunately started off on rocky ground with respect to the global economy. Our most popular corrosion courses being sourced from NACE International in the United States has caused the corrosion institute to adjust their prices to alleviate the results of the exchange rate. However, there is no sign of reprieve for the ever eroding South African Rand and therefore the institute is working hard at sourcing a bouquet of local courses and getting these courses recognized by the Sector Education and Training Authority (SETA) and independently examined by the South African Qualification and Certification Committee (SAQCC) for Corrosion. If we are to combat the effects of corrosion to infrastructure in our precious country, we need to ensure sustainability of the institute whilst still achieving one of our primary goals of expanding the knowledge and competencies of the labour force and in so doing increase the supply of skilled labour in southern Africa, providing for greater productivity and employability.

Other activities of the Institute also aim to extend the recognition of corrosion as a problem requiring specialised attention and to promote standardisation in corrosion control technology. We are actively involved in promoting study and scientific research into corrosion and materials protection technology and encourage reporting, discussion and publication of corrosion experience and knowledge. Our inclusive membership structure encourages participation of a broad range of stakeholders in our activities, operating on all levels and in all sectors of the industry.

CorrISA also has some other surprises in the pipeline this year which I am really looking forward to sharing with you in the next publication of Corrosion Exclusively.

In closing, even though it looks like its going to be a difficult year for most, the corrosion institute is looking forward to welcoming you at our monthly technical evenings at the Coré in Midrand. It's a great place to spend some time with people who feel the same way about preventing corrosion and who knows, you might even learn something new or realise an opportunity or two.

Edward Livesey
President

OBJECTIVE OF THE MAGAZINE

"The objective of *'Corrosion Exclusively'* is to highlight CORRISA activities, raise and debate corrosion related issues, including circumstances where inappropriate material and/or coatings have been incorrectly specified, or have degraded due to excessive service life. Furthermore, it shall ensure that appropriate materials or coatings, be they metallic or otherwise, get equal exposure opportunity to the selected readers, provided these are appropriate for the specified exposure conditions on hand."

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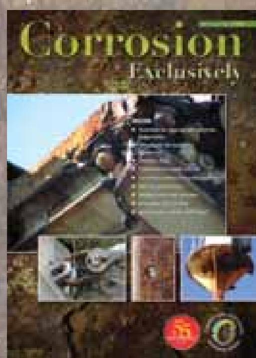
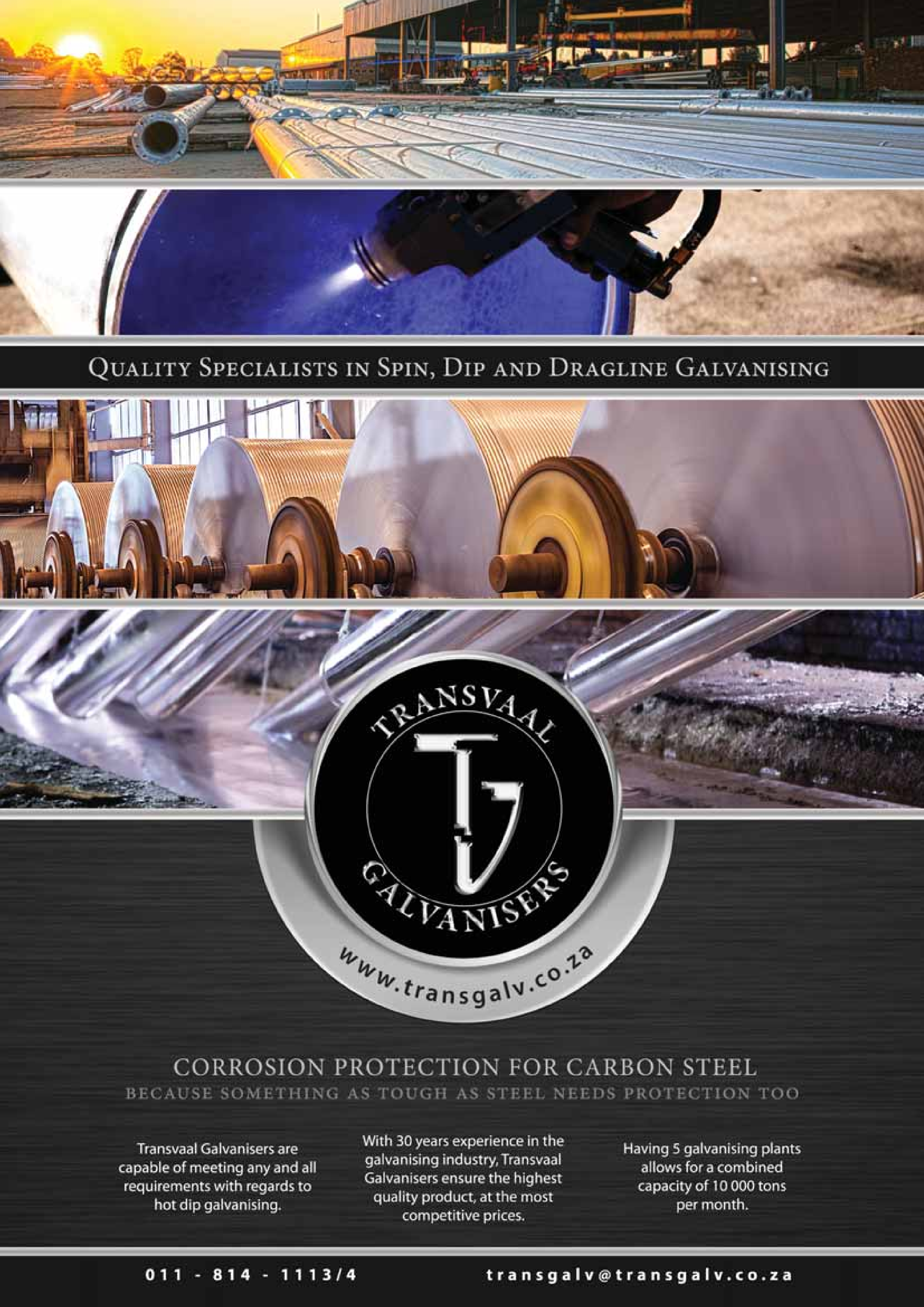


Cover: A collage of corroded components due to a number of reasons.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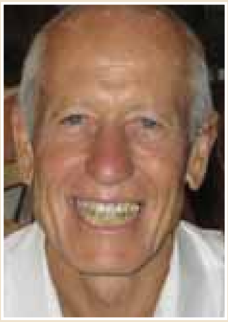
Editorial Comment



Phew! The second edition of Corrosion Exclusively has been produced, arriving slightly later than we had anticipated but I guess with many of the contributors enjoying their holidays and not being informed as to our anticipated early publication date for the first issue of 2016, they did well to contribute.

This issue of CE brings with it a new Institute President as in Ed Livesey of Joberg Water with his first address, while Bruce Trembling (now prematurely retired) moves onto immediate past President and Don Slade of NUI aligns himself as 1st Vice President. Vernon de Kok due to his physical location has remained at 2nd Vice President.

As the objective of the magazine in the long term is to incorporate all facets of corrosion and its control or prevention, we include in this issue a steel that generally needs no introduction with three articles on stainless steel supported by SASSDA and two of them written by a well-known corrosion consultant in the Western Cape, Simon Norton of Chemical Investigation Services.

We have two international contributions, one from Brendan Pejkovic, the Technical Services Manager of the Australian Corrosion Association Inc., with an article on the "Painting of Rusted Surfaces". Our Guest Writer Warren Brand, a NACE Level 3 Inspector, contributing Editor for the Journal for Protective Coatings and Linings (JPCL) and blogger for Paint Squared, sent us his article "Kindness... the missing ingredient from any paint specification".

Together with the article from Warren Brand on protective coatings, we again look at substrate preparation being the secret to quality control with any protective paint system, with an article on finely graded abrasives improving productivity and cost but also a method of lowering the amount of dust from the abrasive blasting process.

"Corrosion Prevention of buried pipelines", an international contribution from Shivananda Prabhu a Graduate Engineer from University of Mysore, Karnataka, India, promises to address a number of corrosion control coatings and systems used with some success in buried pipelines.

"From the kettle" introduces a regular column supporting the hot dip galvanizing industry. The first of many surface conditions explaining what it is, its severity and whether or not it should be accepted / rejected.

The "Rust Spot" introduces a personality profile known to many, particularly in the Western Cape, Mr Dan Durler.

Africor our local corrosion conference is set up for 25 to 29 July in Midrand, Johannesburg and the Australian Corrosion Association invites you to a Corrosion & Prevention conference in November in Auckland this year.

Lynette van Zyl the incumbent Manager of CorrISA is together with her team of ladies in an industry mainly dominated by men is starting to find her feet, which no doubt will in the near future have a positive impact on this extremely important industry.

Graham Duk the Western Cape Chairman gives an account of their activities.

Other activities of the Institute include feedback on both the Johannesburg and Cape Town Awards Event last year, the last Golf day, some courses held in both centres and then going forward the education programme, awards event, golf day, fishing day and any other activity for 2016.

Lastly, we pay tribute to the passing of Barry Williams a stalwart of the Corrosion industry.

Terry Smith

Why do "finely" graded abrasives improve productivity and save costs?

Charles Dominion – Simple Active Tactics SA (Pty) Ltd

"More bullets per kilogram" is the catch phrase ecoblast, a national supplier of abrasive blast media, uses to explain to their customers why their standard 30/60 (0.2 – 0.6mm) graded abrasive blast media is so efficient. This article explains why fine abrasives impart more energy than coarser products to surfaces being pneumatically grit blasted and can drastically reduce the cost of high quality surface preparation.

Alluvial garnet took the abrasive market by storm in the 1980's. Sure, it's a great abrasive and its pretty pink colour makes it even more aesthetically pleasing. But its true value lies in the fact that it is a finely graded blast medium mined from alluvial deposits which have a natural particle size predominantly less than 0.6mm. Today, 30/60 garnet is world renowned as a premium blasting media and was the world leader in successfully proving the "more bullets per kilogram" philosophy. Yet there is still a mental block amongst some contractors in spite of all the practical evidence, that we should be abrasive blasting with "coarse" (>1mm) abrasives to achieve cost effective performance!

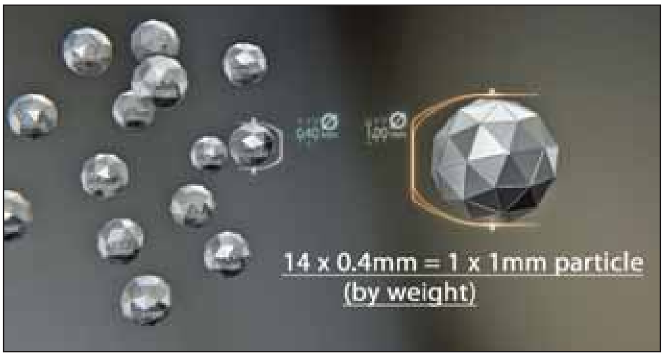
Why?

To understand how "fine" abrasives transfer more energy to the surface being blasted and are therefore more efficient, we need to look at two simple but important factors:

1. How many more particles per kilogram are there of a finer abrasive than in a coarser product?
2. What is the equivalent energy imparted on the blast surface from fine particles versus the coarser particles?

Number of particles (bullets) per kilogram

Let's take a simple example. If we take a particle which has a diameter of 1mm or a



Comparison between 14 x 0,4mm versus 1 x 1mm particle (by weight).

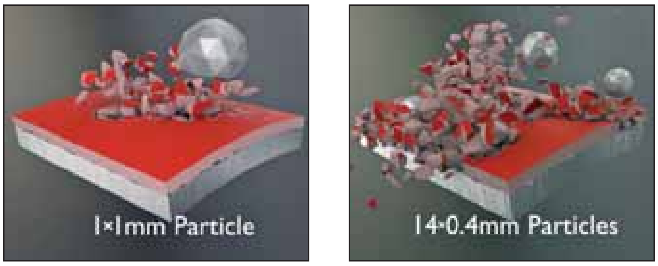
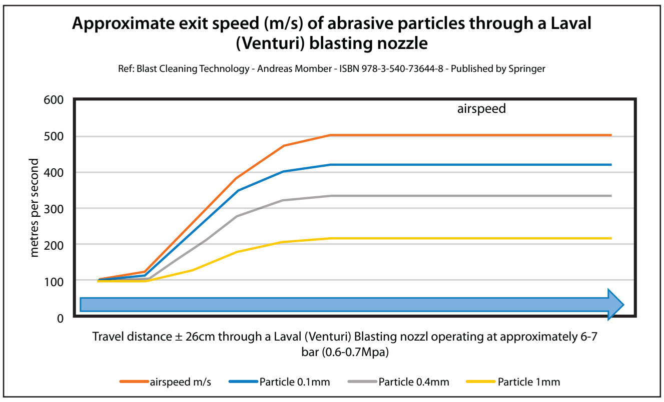


Diagram showing cleaning efficiency between large and smaller blasting particles. (Full animated graphic demo at www.ecoblast.co.za)



Approximate exit speed of abrasive particles through a Laval blasting nozzle.

	airspeed m/s	Particle 0.1mm	Particle 0.4mm	Particle 1mm
Abrasive and air travelling through a Laval (Venturi) Nozzle	100	100	100	100
	120	110	101	100
	250	230	184	129
	380	350	280	182
	470	400	320	208
	500	420	336	218
	500	420	336	218
	500	420	336	218
	500	420	336	218
	500	420	336	218
	500	420	336	218
Exit Speed m/s	**500**	**420**	**336**	**218**
Particle mass (kg)		1.78047E-06	0.00011395	0.001780467
Kinetic energy (Joules)		0.000157037	0.006432242	0.042462848
Number of particles (relative)		1000	14	1
Total Kinetic energy (Joules)		0.15703716	0.090051389	0.042462848
Increased energy benefit		**370%**	**212%**	**100%**
Particle volume mm^3		0.000523667	0.033514667	0.523666667
Particle specific gravity		3.4		
1mm^3 weight (gm)		0.0034		

Energy calculation.

cube 1 x 1 x 1mm we can work out its volume. We can take any shape but for simplicity, let's work with a sphere. Applying the formula for the volume of a sphere, $V = 4/3\pi r^3$, a 1mm diameter particle will have a volume of 0.52mm^3. And let's now calculate the volume of a particle with a diameter of 0.4mm. We find by the same calculation, the volume is 0.034mm^3. By simple division we can now establish that instead of 1 x 1mm particle, we can equilibrate conservatively 14 x 0.4mm particles (minimum) having the same mass.

How does this help us? We can all probably intuitively guess (correctly) that the 1mm particle has more energy on impact than one 0.4mm particle. But what is the energy difference between 1 x 1mm particle and the equivalent weight of 14 x 0.4mm particles?

To understand how the 0.4mm particles carry more energy, we need to delve a little deeper into the forces that create this useful energy required to achieve surface preparation cleanliness standards.

Energy (cleaning ability) of an abrasive particle

The energy (cleaning ability) of an abrasive particle to do its job is dependent and measured by its kinetic energy. Kinetic energy is measured in "Joules" (named after the English physicist James Prescott Joule). The formula to calculate kinetic energy is $KE = ½mv^2$ where m = mass (in kilograms) and v = velocity (in metres per second). Clearly from this equation, the velocity (v^2) of the abrasive particle plays an increasingly more important role than its weight (m)!

The abrasive blasting industry has indeed recognised the added efficiency of particle velocity and it is an industry standard to use a Laval (venturi) nozzle, based on rocket technology and which accelerates air and abrasives in the airstream up to around 500m/second. However, abrasive particles have inertia. Inertia is the resistance of the abrasive particle to change its speed and the bigger the mass (size) of the particle, the greater will be its resistance to change its speed. This phenomenon is depicted in the graph below which shows that smaller abrasive particles accelerate and exit the blast nozzle at a higher velocity than larger abrasive particles.

Using the above research, it becomes much easier to understand why finer abrasives are more efficient. If we simply calculate the energy transmission of fine abrasives versus coarser abrasives, we can see why!

We can see from the calculations that the impact energy of 1 x 1mm particle is about 6 times higher (0.042J) than a single 0.4mm particle (0.0064J). But if we take the collective energy of the same mass of 14 x 0.4mm particles, we can see that the smaller particles deliver 2.1 times the energy due to their higher velocity and concomitant energy. Translate the theory into practice and blasting costs could be more than halved!

So why don't we blast with abrasives at 0.1mm in size as, according to the theory and table above, we obtain the highest energy transfer from these smaller sizes? The answer lies in the fact that we still need to create a surface profile that is acceptable for most industrial coatings of say 50 – 100 microns. Ecoblast has worked out that this can be achieved, along with international garnet suppliers with a grade of 30/60 which delivers the best of both worlds – high productivity and acceptable surface profile.

Demands on the industry dictate that we should look at every avenue to save costs. This one is obvious.

Dust free substrate preparation a health and safety and environmental necessity

It is no secret that about 70% of the success of a paint system lies in substrate preparation and coating application.

One method of substrate preparation prior to painting is by sand blasting but when done in an uncontrolled environment can result in clouds of environmentally unfriendly dust which besides the health hazard to both the blaster and others in the vicinity can unnecessarily settle on other nearby assets causing damage or potential short to medium term failure.

Although the majority of the people of this world have become more environmentally friendly in most applications and where possible moved to a cleaner method of substrate preparation and application, some specifiers, customers and operations are still resisting. This resistance to change open air sand blasting of basic maintenance projects without the necessary controls can be seen to compromise the health and safety of staff members as well as pollute the general environment, the cost of which has got to run into millions of Rands each year.

Having listened to mine engineers, health and safety officers and power plant engineers describe their continual and unabated challenges with corrosion and the environmental issues surrounding the maintenance thereof we decided to investigate the possibilities of dust free sandblasting.

Our investigations were primarily aimed at lessoning the effects of sand blasting on the environment as well as the health and safety challenges that conventional blasting presents.

After intensive research which started around two and a bit years ago, we found the answer in the good old US of A. With the privilege of using dust free sandblasting straight out of the States, came an astronomical price tag in which most local industrial sand blasters and applicators could not afford to include in their quotations for fear of losing the project against a more cost effective yet unhealthy alternative.

This led us to the investigation and the development of our own locally manufactured sponge media which once developed we found would compete and perform better than the original product from the United States taking all aspects into account.

"Spongerite" was born. The product offers cost effective environmental relief to applicators and sand blasters.

Another Spongerite advantage is its massive saving in downtime, which is difficult to measure in terms of monitory value.

As the Spongerite media bounces onto the substrate causing no dust, it presents a completely safe and healthy environment for welding or other contractors in the vicinity to continue going about their normal activities.

Due to the concept being relatively new to the local industry we are challenged to educate all parties involved in this industry to ensure that they take full advantage of the process, to the long term benefit of the client or owner of the project.

Further value can be added by recycling the Spongerite media substantially reducing the overall cost of substrate preparation.

In South Africa the relevant parties have become extremely price sensitive as to the application of corrosion control. Rather than looking at a longer term solution, which may attract a higher cost, a short term solution is favoured at a lower cost bringing with it possible higher health hazards and lack of coating application quality.

What "Spongerite" has achieved in such a short period of time is rather remarkable. The Sponge Media (Sponge grit – normal grit that is enveloped in a sponge media which in turn envelopes all

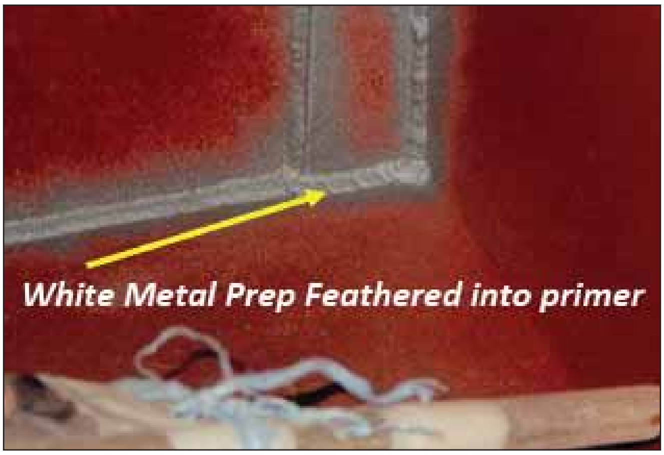
The behavior of the Spongerite media off the substrate.

dust particles on impact) is offered at about a 1/3 of the USA price because it is locally manufactured.

The most remarkable feature we believe is the blasting pot which had to be redeveloped to offer a robust "Africa Proof" solution at an affordable price to that of its American counterpart. This resulted in a pot which has a range of extra bells and whistles.

The immediate reaction from end users is that they have to buy another blasting pot. We have developed a programme where the existing pot can be reconfigured into a complete sponge blasting operational vessel and once reconfigured can within five minutes be turned back into a conventional sand blasting pot, in other words a "two in one" blasting pot.

The great news is that this reconfigured pot costs about 15% of the American reconfigured pot and is twice as fast. In fact, our tests



The appearance of the white metal preparation adjacent to the primer following blasting with Spongerite.

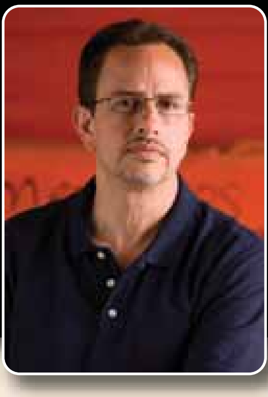
show that we have a blast rate of only 8% slower than that of the conventional application.

This Dust Free solution achieves exactly the same profiles and finishes that conventional methods achieve at virtually the same speed. It does however surpass conventional methods when it gets to feathering, particularly in the application for Non Destructive Testing. The paint edge does not need to be sanded before repainting. The feathering allows a smooth transition where the old and new paints meet.

In conclusion, Sponge Media applications will never take over the conventional market as a whole, but it has certainly come to stay, offering the full package of a corrosion control application backed by the environmental benefit it has to offer. Not only does it help protect the environment, but also removes all the salts and oxides from the substrate during blasting.

This can provide a very pure form of substrate cleanliness, envied by most applicators and resulting in adherent paint systems.

Richard Stone – Spongerite



Guest Writer

Warren Brand

Kindness: The missing ingredient in any successful coating application

It was 2010 and I had just turned 50 when I was left no choice but to walk away from our family business, an industrial tank lining company more than 50-years-old.

Love had turned to disdain and trust had turned to paranoia. A once prosperous business was in serious decline. I not only lost my family (which, ultimately, was a melancholy blessing), but I also lost nearly 4 years of salary – as my former family refused to pay me for loans I had personally provided to the company.

When I started Chicago Corrosion Group, I had no real model to follow. I simply had a sense that the industry, or more specifically owners, needed a bellwether – or independent, unbiased advocate helping them determine their optimal corrosion mitigation alternatives.

I had been in the coatings world for decades and knew a lot of folks. I was hesitant to reach out and ask for help and advice, partially because of the paranoia and mistrust fostered in my previous employ.

But as I tried to grow my company, I was stunned and on occasion left speechless, quite literally, by people's generosity and selflessness.

There are hundreds of examples, but I have space for only a handful.

A time sensitive opportunity had fallen into my lap – and I needed to move quickly to evaluate a failure. My kingdom for a Tooke Gauge!

I called a friend/mentor who we'll call Kal. Kal had been exceptionally kind and helpful over the years, despite the fact that in some respects we were direct competitors, although in different areas and he was fantastically successful, and I remain a work-in-process.

So I called Kal.

Kal: "Hey Warren! How are you? What's up?

We exchanged pleasantries, and I asked:

Me: "Hey Kal, do you mind if I ask what type of Tooke Gauge you prefer and do you have a preferred vendor for purchasing?"

Kal: "Hang on a second."

There's a long pause on the phone and I hear muffled conversation in the background.

Kal: "I'm going to overnight you ours. No one's using it right now."

Kal then went on for several minutes how he's making sure there are fresh batteries and going over how to use it.

And then, just this past summer, we were working on lining the interior of a small tank, roughly 100' (30.48m) in diameter by 50' (15.24m) tall open-top. When we first started, things were edgy. The owner, contractor and others hadn't worked with us before. We specified a coating system the contractor didn't want to use and were also providing inspection services. Our mantra in pretty much all things is, let's do what's best for the owner. And as the job went on, the attitude among all of the individuals began to change – as we were single-mindedly working towards a singular goal. By tacitly agreeing to do what was best for the owner (arguably, the kind thing to do), everyone started taking ownership of their individual tasks. Blasting to a white metal is exactly that – and no one tried to get by with an NACE 2 instead of a NACE 1. The quality of the work overall improved as did the demeanor of the workers. The mood shifted from adversarial to collaborative.

And just last week, we literally flew in on an emergency basis to provide quality control on a critical pump housing (about the size of a small car) which had been blast and coated twice – and rejected twice - by the owner, our client.

When our inspector first arrived, we found the shop to be small – literally, a mom and pop operation. They were very guarded at first, and wouldn't let our inspector on site. However, after explaining that we were there to help – and not there to find fault. And working closely and kindly with them, they opened their hearts, and facility, so we could do our work.

Some may call this character or integrity. I like to call it kindness, because that's what it feels like to me.

Our entire business model, and, in fact, the way I strive to live, is to do the right thing – to do the kind thing. It's why I didn't sue my now estranged family. It's why I donate my time to teach self-defense at a local university. And while I've tried to behave this way in my personal life, it is only through my peers, friends and mentors within our industry that I now see it can be successfully incorporated into any business model.

I suspect for those who have continued to read to this point, that you have similar stories and, further, I suspect that if you look closely, that the jobs, situations, coating applications, and pretty much anything has been shrouded in the cloak of kindness.

I intentionally sign most, not all, but most, emails with "Kind Regards." This is an intentional meaningful act as much for the reader as for myself.

Many years ago, an acquaintance started working for a very large, privately-held coating company. He had been there only a week or so when his daughter was diagnosed with a very serious illness. The coating company at the time was privately held and self-insured, meaning that it incurred all of the expenses associated with illness. My friend had only been there a week or so, but the insurance didn't kick in for another week or two.

This came to the owner's attention, who then backdated the employees start date – so that he and his family would be covered. His daughter fought well and hard, but ultimately succumbed to her illness.

Can you imagine such an act of kindness today from a corporation? Can you imagine the kind of loyalty that type of behaviour from an employer might engender from its employees?

Even when I was thinking about starting a Midwest conference on corrosion (Engineered Corrosion Solutions, May 5, 2016 will be our third year), it was over breakfast with a coating rep. I was talking to him about the concept and he, quite literally, started to pull out his checkbook to write a check. And when I started to promote it, I cannot tell you how many people signed up, and agreed to pay, simply to be supportive of our efforts.

In a world that seems increasingly on edge, politically and otherwise intolerant, how can we, as coating professionals, make a difference? By simply trying to act kinder. By working to disagree agreeably – by doing the right thing simply because it's the right thing.

I remember decades ago while working as a newspaper reporter in California. There was a horrible case of a man attacking a woman with a hammer. An elderly, frail truck driver stopped and got out to help the woman. He ultimately saved her life and was injured, fortunately not seriously.

In interviewing him I asked him why he stopped, knowing he could be hurt or killed. I think of his response often, "It's what we do."

WARREN D. BRAND

warren@chicagocorrosiongroup.com

Professional Highlights

- Specified potable-water coating system for the tallest building in the world: Dubai's Burj Khalifa, UAE.
- Successfully and virtually singled-handedly, lobbied The State of Illinois to suspend the adoption of regulations pertaining to Underground Storage Tanks that would have negatively impacted thousands of small business owners.
- Worked for nearly 30 years in the coating industry from every hands-on task to obtaining the highest level of professional coating certifications from both NACE and SSPC
- Created business development company (W Brand Consulting) designed to provide business development assistance to supply-side owners.
- Developed Midwest technical conference on corrosion, Engineered Corrosion Solutions (www.engineeredcorrosionsolutions.org). 2016 will be its third year.
- Accomplished author, blogger and associate editor for Paintsquare (www.paintsquare.com).

Professional Experience

Chicago Corrosion Group, LLC 2010 – Present

Full service vendor-neutral technical consulting firm

Principal/Owner

CCG provides complex technical consulting services pertaining to corrosion, paint, coating and the maintenance and beautification of assets. In a few short years, CCG has had the privilege of working with some of the largest companies in the world.

Education and Affiliations

DePaul University, Kellstadt Graduate School of Business. (1995)

MBA in Entrepreneurship.

University of Illinois (1984)

BA in Journalism

Nace Certified Coatings Inspector CIP 3 – Peer Reviewed Inspector #139826

SSPC Protective Coatings Specialist #2011-816-212

Why motor car bodies no longer rust – Part II

In the first issue of Corrosion Exclusively, this topic was introduced and an in-depth look at the role the galvanizing of the steel substrate plays was discussed. As mentioned, most of the "modern" cars on our roads are primarily fabricated from galvanized steel – although a significant increase in the use of aluminium composites and high technology plastics is being noted.

To further understand why cars now have 10 or 12-year rust warranties, one must also look at the role of modern organic coatings and the application processes employed by the automotive OEM manufacturers.

The manufacturing process

The use of robotic mechanization has not escaped the automotive industry. In fact, it is probably safe to say that this industry has been one of the market leaders in automation projects. Manufacturing statistics for 2014 shows that South Africa produced a little over 4.1 million passenger vehicles for the year – amazingly this equates to only 6.1% of global production[1]. This combined volume production was achieved by 7 production facilities.

So, what has mechanization got to do with improved corrosion protection? Simple – process uniformity and control. Efficient painting of a vehicle is a combination of quality with economy and ecology. Paint application is one of the most demanding aspects of automobile manufacture. Not only does the paint coating protect the body surface, but it also enhances visual appeal by adding colour and gloss – important selling points. The technology used must meet these high expectations of quality and cost efficiency, while remaining environmentally responsible. The entire manufacturing process has become an integration of leading edge technology to ensure a quality product.

In following a unit (vehicle) through this manufacturing process, several distinct zones are noted (*Figure 1*). The zones of interest with reference to this article will be: E-Coat, Primer Surfacer, Basecoat and Clearcoat application.

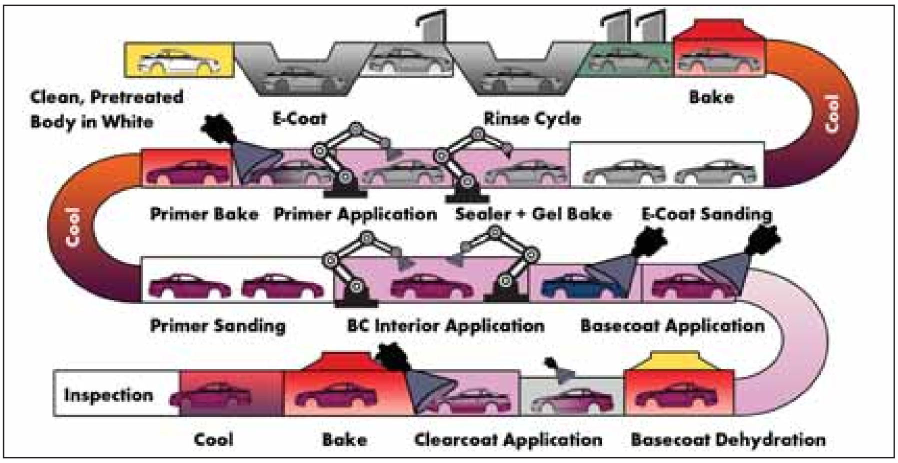


Figure 1: Manufacturing process.

Figure 2: Bottom mounted conveyor EC dip system.

Electrodeposition Coatings (E-Coat or EC)

In order to achieve the excellent corrosion protection, chemical resistance and coating flexibility that the EC system offers, the unit (*"body in white"* as it is known at this stage) must undergo a process comprising of 5 stages[2/3]:

1. *Pretreatment*. In order to clean and prepare the galvanized metal for painting, all residual grease and oils are removed by solvent and alkali degreasing washes.
2. *Phosphating*. The galvanized steel is sprayed with a solution of phosphoric acid at 50 – 55°C. The phosphate functional groups react with the iron/zinc alloy to create a phosphate salt which significantly improves the corrosion resistance of the base metal and also provides chemical bonding points for the EC paint.
3. *EC Bath (Figure 2)*. In a simultaneous combination of complex electro-chemical reactions, viz. electrophoresis, electrolysis, electrodeposition and electroendosmosis, an organic film of approximately 20µm DFT is "plated" onto the surface of the unit utilizing relatively high voltage and amperage conditions. Most modern tanks, up to 500m^3, are designed so that the unit is the cathode while the tank sides and bottom are charged anodically. The deposition process lasts less than 5 minutes. The chemistry of EC paints has changed significantly from the original

formulations of 1961. The modern two-component, lead-free, high performance waterborne emulsion epoxy systems are formulated as amine salt derivatives of bisphenol A epoxy resins with blocked isocyanate oligomers for the binder. These paint systems now offer excellent corrosion protection, outstanding film uniformity (even in box sections), total coverage of complex geometries and low VOC and HAPS free environmental advantages.

4. *Rinsing.* The deposition process is self-regulating as the film forms a layer with strongly reduced conductivity. In order to remove undeposited paint and ensure a smooth finish, the unit passes through several rinse and wash cycles. All of this "washed paint" is returned into the main system as elements known as permeate and ultrafiltrate, thereby reducing the waste effluent from an EC system.
5. *Curing.* This is the final stage during which the unblocking of the isocyanate oligomer occurs allowing for crosslinking and the formation of urethane and urea linkages. Curing cycles of 25 – 35 minutes at oven temperatures of 170 – 180°C are maintained.

Technology segmentation: waterborne vs solventborne

Before I discuss the role and chemistry of the primer surfacer and basecoat systems, it is important to note the change in technology from a solventborne coating to a waterborne coating.

In the early 1990's the first commercially viable waterborne systems were introduced at automotive plants in Britain and across the European Union (mainly Germany). The environmental advantage of these systems was the main driver for this change. These early systems were expensive to apply and necessitated a radical shift in mindset regarding automotive coatings. Application lines, paint kitchens and QA/QC systems all had to adapt to a more "sensitive" product. Thankfully R&D did not stop and the modern systems are far more robust and offer significantly greater advantages over many of the current solventborne systems.

Aspect	WB	SB
VOC Levels	Pro: ± 10% VOC content – 70% water	Con: ± 80% VOC content
Hazardous Air Pollutants (HAPS) Free	Pro: None / Limited use of HAPS regulated substances	Con: The use of xylene, toluene, MEK and ethyl benzene still documented
Flammability	Pro: Low risk	Con: High risk
Conversion Costs	Pro: Water is the thinner – inexpensive	Con: Organic thinners and additives are required
Colour Development	Pro: Excellent colour development and effect pigment variation	Con: Older technology oil-base enamels show lower colour tolerances
Product Shelf Life	Con: Typically, about 6 months under strict storage conditions.Temperature control of warehouse (10–15°C)	Pro: 1-year shelf life with limited storage requirements. Temperature control of warehouse (5–40°C)
Equipment Setup	Con: Must be stainless steel and well maintained	Pro: Mild steel used. Setup functionality less stringent
Equipment Cleaning	Pro: Water as flushing thinner	Con: Must use organic solvents
Note: Water used in WB coatings is de-ionized or reverse osmosis water. The control of conductivity, bacterial count and pH is critical in the management of these systems.		

Table 1: The pros and cons of waterborne (WB) vs solventborne (SB) systems.

See *Table 1* for the pros and cons of water-borne (WB) vs solventborne (SB) systems.

Globally, the shift is moving towards the waterborne systems. Statistics released by Allnex[4], a leading supplier of specialty chemicals and resins, shows the following trends:

Primer Surfacer	2004	2010
WB	15%	23%
SB	62%	48%
Powder	23%	29%
Basecoat	2004	2010
WB	43%	66%
SB	57%	34%

For the purpose of this article I shall focus on the increasing trend towards the use of waterborne primer surfacers and basecoat systems together with solventborne clearcoats. Currently, this is the most commonly used automotive OEM coating system in South Africa and is applied by electrostatic spray application (ESTA) *(Figure 3a and 3b).*

Primer surfacer

At 25 – 30µm DFT the primer surfacer must achieve the following minimum requirements as part of the overall coating system:

- Excellent appearance – high gloss, good levelling properties, no surface defects
- Colour development – for certain basecoat colours, the colour-keyed primer plays a significant role in the full colour development
- Excellent mechanical properties – offers resistance to stone chips and elasticity (even at –20°C)
- Excellent intercoat adhesion to the underlying EC and the subsequent basecoat

The chemistry of primer surfacers relies on the careful blending of specific resins to create a waterborne emulsion of modified epoxy, PU-modified polyester and melamine resins. Specific pigment and additive packages are then incorporated to deliver the finished product under stringent manufacturing environments.

Basecoat systems

The primary role of the basecoat is colour development. Henry Ford's adage of "You can have any colour as long as it's black"

Figure 3a.

Figure 3b.

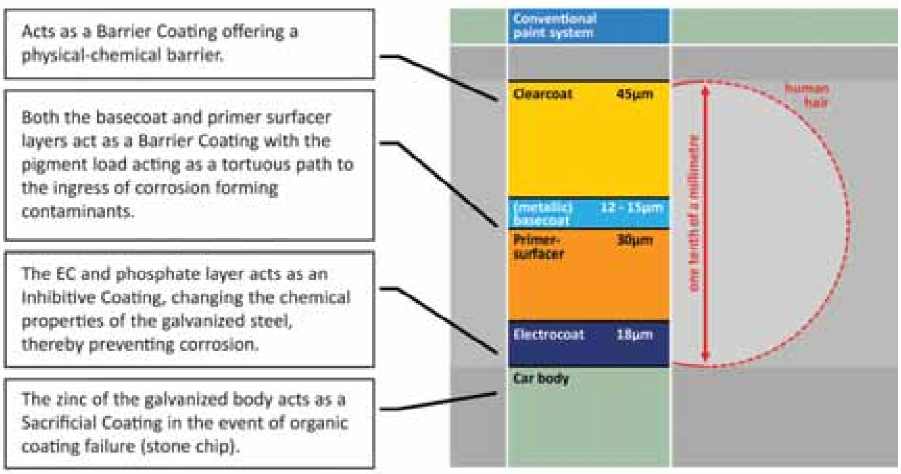
has long been surpassed. Today's automotive colour palette is extensive with significant marketing focus being spent on colour trends and styling. The use of interference mica pigmentation to provide a perceived change in colour from different viewing angles, aluminium flakes to give a very high sparkle and brilliance effect and high quality synthetic colour-fast pigments, affords the customer an almost unlimited selection of colour and effect. Colour matching and control (5-angle matching and ΔE94 protocols) is a detailed QA/QC exercise that the automotive OEM and product suppliers undertake on a constant basis.

Application of these waterborne basecoats requires detailed production processes. The robotic spray systems undergo extensive line-trial development and unit profiling (a teach program where an individual robot head is tracked over the unit to establish all body shape parameters) before production units are run.

The use of polyurethane and acrylic dispersion resins are relied upon to achieve what is the most sophisticated paint layer of the vehicle.

2010		2015	
Technology	In Use At...	Technology	In Use At...
SB 1K – Melamine crosslinked	Fiat, Peugeot, Renault	SB 1K	Decreasing consumption – Being replaced by the SB 2K
SB 1K – Epoxy based	Toyota		
SB 2K – Polyisocyanate crosslinked	VW, Audi, Mercedes, BMW	SB 2K – Polyisocyanate crosslinked	VW, Audi, Mercedes, BMW, Toyota
WB 1K – Melamine crosslinked	Opel / Mercedes (certain lines only)	WB 1K – Melamine crosslinked	Opel / Mercedes (certain lines only)
Powder	BMW (Dingolfing – Germany only)	Powder	BMW (Dingolfing – Germany only)

Technical changes from 2010 to 2015.



Performance of overall coating system.

Clearcoat systems

Up until 2010 the clearcoat layer was the one with the broadest technology diversification. In recent years there has been a consolidation of this thinking. The table below summarises the technology shift.

Being the final layer of paint applied to the unit, the clearcoat layer will ultimately be the first layer of defense against corrosion forming elements. The technology therefore employed in the formulation, manufacture and application of clearcoats must ensure the following characteristics are met:

- Premium appearance – high gloss, excellent levelling and NO surface defects
- Excellent adhesion properties
- Excellent outdoor durability – no yellowing and high UV resistance
- Excellent humidity and chemical resistance
- Excellent mechanical properties and scratch resistance
- Easy repair (sanding and polishing) properties

As a "by-the-way"... The pencil hardness destructive test finds limited application within the heavy duty industrial coatings sector. However, this test is a standard development test in the automotive coatings sector and is specified on most clearcoat technology packages.

ESTA spray application – *a quick note on this form of coatings application*

As mentioned at the start of this article, mechanization and the use of robotics is extensively used in the manufacturing process of automobiles. The area where this form of robotics is the most impressive is within the paint-shop.

The use of electrostatic spray application (ESTA) has developed significantly in recent years and this form of technology plays a significant role in achieving the corrosion protection offered by modern vehicle manufacturers.

A delicate balance between the volume of paint delivered (both ml/min and ml/m^2), the electrostatic charge and the spray pattern ("W" or "Z" overlap) is achieved to ensure the properties of the appropriate coatings system is met. Application robot arms operate within a full 7-axis dexterity *(Figures 4a and 4b)*. A rotating bell cup (spinning at up to 50 000 rpm) forms micro-droplets of paint which are then propelled to the unit under the forces of both electrostatic charge and an inert shaping air stream. The charge applied to the coatings will vary depending on the technology and outcome desired but will be in the region of 60 – 100kV at low amperages (typically 100µA). The "lay-down" of the appropriate coating technology is hereby achieved so that the colour, gloss, smoothness of film and many other variables are met.

Summary

With a total coating thickness of around 100µm DFT (*Figure 5*), about the same thickness of a human hair, modern automotive coatings offer a protective and visually appealing layer to the cars we drive.

In previous years one would travel inland to purchase a good second-hand vehicle. This need not be the case today. If the bodywork is well maintained, checked and cleaned regularly, a rust-free vehicle can be found almost anywhere.

The technologies employed not only assist the OEM manufacturer in achieving a quality product within cost and environmental limitations, but also afford the purchaser a vehicle to enjoy.

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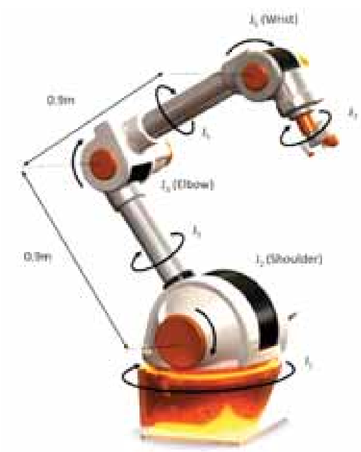

Figure 4a: 7-Axis Robot schematic.

Figure 5b: ABB IRB 5400 Application Robot.

An introduction to stainless steels

Stainless steel represents one of the more recent groups of engineering materials. Although discovered at the beginning of the 20th century, it was not until after the World War II, when modern stainless steels were developed and became commonly used.
The single most important property of stainless steel is its corrosion resistance. Corrosion resistance, in combination with good mechanical properties and manufacturing characteristics, has helped establish stainless steel as an extremely versatile material which, in many cases, offers the only economically viable alternative for the designer.

What makes stainless steel stainless?

Stainless steel is an alloy of iron (Fe) and chromium (Cr), with a controlled amount of carbon (C). Stainless steels are a family of steels containing a minimum of 11% chromium, whose primary property is that of corrosion resistance. If 11% or more chromium is added, a protective, passive film will form *(see Figure 1.1)*. The higher the chromium content in the steel, the stronger the passive film that will develop.

Other elements such as molybdenum (Mo) and nitrogen (N) further strengthen the passive film and improve corrosion resistance. If the passive film is removed or damaged, it will spontaneously re-form in the presence of air or water.

Why then is nickel often added?

Nickel, when added in sufficient quantities, makes stainless steels "austenitic" and this accounts for the excellent properties, namely weldability, formability and toughness, of the austenitic grades of stainless steel. Nickel has limited influence on corrosion resistance.

Stainless steel classification and grades

Since their discovery and initial development, the number of stainless steel grades has increased rapidly, with hundreds of different chemical compositions standardised around the world.

Stainless steels have traditionally been divided into categories based on their micro-structures. This gives a rough classification in terms of both composition and properties. The relationship between the major stainless steel classifications is described below and is summarised in *Table 1*.

Martensitic: Are plain chromium alloys with relatively high carbon levels. They are included in the American Iron and Steel Institute (AISI) 400 series. These steels have a moderate corrosion resistance, as well as high strength and hardness developed by heat treatment. They have poor weldability and are magnetic.

Ferritic: Are plain chromium alloys with low carbon levels and are also included in the AISI 400 series. These steels have moderate to excellent corrosion resistance depending on chromium content. They cannot be strengthened or hardened and have poor weldability, except in thin gauges. They are magnetic. 3CR12, a utility ferritic stainless steel, developed in South Africa, has improved weldability compared to conventional ferritic stainless steels, being weldable up to 30mm thicknesses.

Austenitic: Are included in both the AISI 300 and AISI 200 series and contain nickel with low to very low carbon contents. These materials have excellent corrosion and high temperature oxidation resistance. Strength and hardness can be increased by cold work. They have excellent cryogenic properties. In the annealed condition, they are non-magnetic. In steels in the 200 series, the nickel is partially replaced by manganese. These variants have properties similar to the 300 series, but have higher strength and lower corrosion resistance.

Duplex: Contain less nickel than the austenitic grades and have very low carbon contents. They have a duplex (mixed) micro-structure of ferrite and austenite. These steels have excellent corrosion resistance, particularly to pitting, crevice corrosion and stress corrosion cracking. They also have high strength and excellent weldability. They are magnetic.

Corrosion resistance

Corrosion resistance of stainless steels increases with increasing levels of chromium and additions of molybdenum and nitrogen. The relative corrosion performance of selected stainless steels under atmospheric conditions is illustrated in *Figure 1.2*.

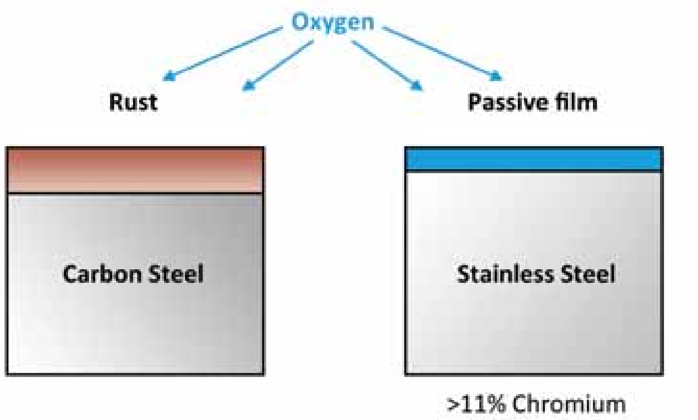

Figure 1.1: The passive film on stainless steels.

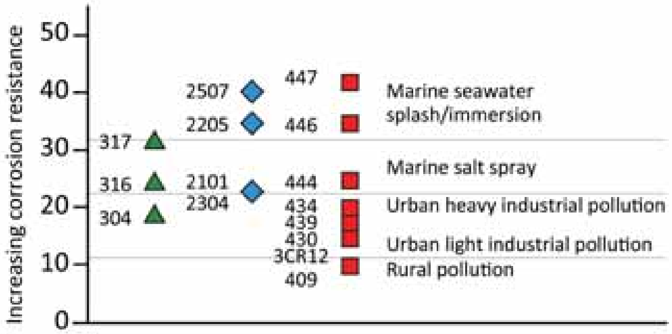

Figure 1.2: Relative corrosion performance of selected stainless steels.

To pickle or passivate, that is the question...

...whether tis nobler to suffer corrosion if you don't (apologies to Hamlet)

During recent presentations to the Corrosion Institute of Southern Africa and while investigating the premature corrosion of 304 stainless steel welded pipe at a meat processing plant, I became aware that few technical people working with stainless steel understood the difference between pickling and passivation of stainless steel. While the choice of the right grade of stainless steel offering the right corrosion resistance for the application and environment under consideration is important, it is also important to specify the correct stainless steel surface condition for extended corrosion resistance. This applies particularly to welded stainless steel. Most South African engineering concerns are familiar with 304 and 316 austenitic stainless steel but how many know about 304L and 316L and the need to pickle or passivate welded or fabricated stainless steel before use.

So what is pickling?

Pickling is by far the more severe process and involves using a mixture of 8 – 20 % by volume Nitric Acid (HNO_3) and 0.5 – 5.0% by volume Hydrofluoric Acid (HF). The pickling reagent can be applied either as a spray onto piping and components, as a pickling paste or where the component is dipped in a pickling bath.

Figure 1 shows a 304L stainless steel pipe with dark heat tint which should have been pickled and has now shown pitting due to the heat tint oxide weakening the chromium oxide passive layer.

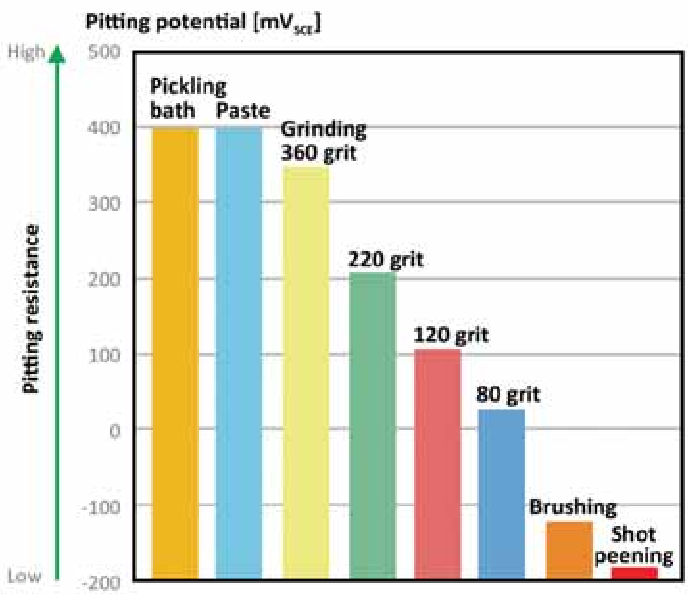

Figure 2: The graph shows how pickling gives the best pitting resistance when compared to grit grinding and other surface cleaning techniques (graph courtesy Outukumpu).

Pickling creates the most corrosion resistant surface of all stainless steel surface cleaning methods save for electropolishing which offers the best surface treatment. Pickling uses very strong acids which remove the damaged oxide film and the chromium depleted underlying metal layer to reveal a fresh chromium enhanced layer to the atmospheric oxygen. The pickling process produces a clean, grey, slightly coarsened matte finish that passivates spontaneously.

If during welding there has not been adequate removal of oxygen using an inert gas and dark heat tint is formed on the weld then the weld and surrounds will have to be cleaned and pickled to ensure that the heat tint oxide is completely removed.

Pickling results in a roughened and coarsened surface as the process removes substrate metal down about 25 – 40 microns, where in contrast passivation only removes inclusions and iron impurities and restores the passive oxide layer to stainless steel.

If a stainless steel part, pipe or item has been pickled it does not need to be passivated unless mechanical processes have caused iron particles or dust to contaminate the surface.

So what then is passivation?

Passivation involves the use of a nitric acid solution applied to stainless steel pipes, parts and components in order to remove metal inclusions and metallic contaminants such as iron. The purpose of passivation is to actively build up the protective oxide film on the stainless steel and improve the Cr/Fe ration in the outer layers of the oxide film to enhance corrosion protection.

Talking about nitric acid as a pickling reagent, there are other gentler pickling reagents such as citric acid which also remove metal inclusions and also dissolve out iron contamination.

So passivation is only carried out if the stainless steel surface in question has been contaminated with metallic particles specifically iron and to remove surface inclusions. The only reason a pickled item need be passivated is if it became contaminated with iron particles after the pickling process. The complete passivation process consists of mechanical cleaning, degreasing, inspection and passivation with nitric acid or citric acid and finally rinsing with fresh water with a very low chloride content.

So let's talk pickling versus passivation

Passivation is not designed to remove heat tint, embedded iron particles, heat treating scale or other surface defects produced during fabrication. This is simply because nitric acid does not remove or corrode the surface layers of the stainless steel that contain embedded defects. To remove all these requires pickling with a mixture of very strong acids namely HNO_3 and HF to remove the normal protecting oxide layers and 20 – 40 microns of the substrate metal. Pickling results in a coarser surface after the pickling process however if electropolishing is used to surface treat the stainless steel the substrate surface becomes smoother.

So to wrap it all up

It is essential to pre-plan your stainless steel welding and surface preparation before the equipment, piping or fittings are used operationally. Surfaces can be mechanically prepared using grinding or blasting but be careful not to damage the stainless steel surface and reduce its corrosion resistance. Remember also to degrease a stainless steel surface before pickling or passivation and then to rinse the surface thoroughly after pickling or passivation. Rinse water must have a low chloride content so as to avoid pitting damage to the stainless steel. Initially to remove heat tint use smooth glass beads which also shot peen the surface and introduce a compressive stress into the stainless steel and prevent stress corrosion cracking. However if a weld has dark heat tint then pickling will be necessary. If stainless steel has been exposed to dirt, dust and iron contamination it is advised to carry out a passivation process including mechanical cleaning, degreasing, water break inspection, passivation and thorough rinsing with low chloride rinse water.

Pickle or passivate you are certain to improve the life expectancy of your stainless steel pipe or fitting and have trouble free operation.

Key characteristic	Pickling	Passivation
Chemicals used	Nitric acid + Hydrofluoric acid	Nitric acid or Citric acid
Function	Removes impurities, iron contaminants, removes damaged oxide layer, removes about 20 - 40 microns of metal substrate, removes heat tint	Removes only surface inclusions and iron contaminant particles – restores passive layer
Removal of heat tint from weld areas	Yes	No
Format	Liquid, Paste, Gel	Liquid, Paste, Gel
Enhances the level of chromium in the oxide film	Yes	Yes
Increases surface roughness	Yes	No
Permanent improvement in corrosion resistance	Yes	No

Key characteristics between Pickling and Passivation.

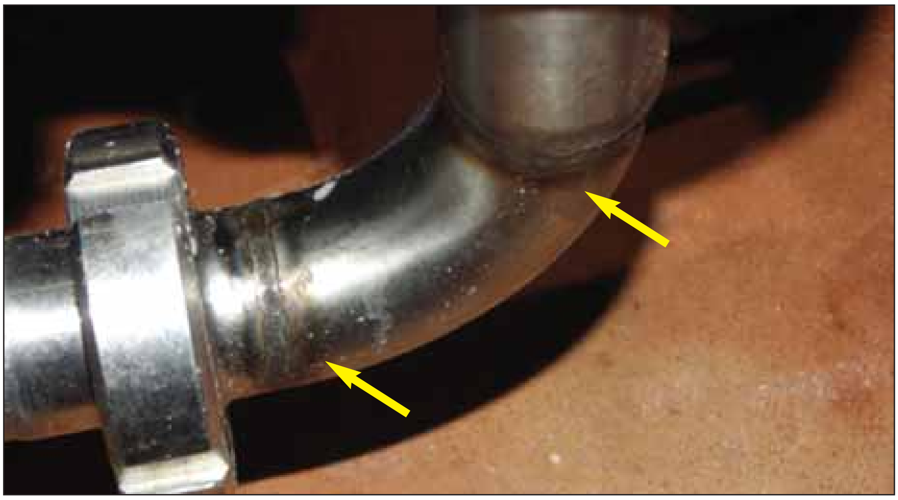

Figure 3: Heat tint on a 304L stainless steel pipe which should have been pickled before being put into operation and which in all likelihood will pit after a short period in operation.

Simon Norton is a expert consultant and advisor on corrosion control, design for corrosion, coating investigation and material failure investigation and provides a professional service throughout Southern Africa and to international associates. He can be contacted on +27 82 8312924 or at chemdetect@iafrica.com

Volatile corrosion inhibitors

Dr. Eino Vuorinen has started a consultancy in the field of vapour phase corrosion inhibitors, also known as volatile corrosion inhibitors (VCIs). VCIs are used in metal packaging to prevent atmospheric corrosion. VCI Services is based in Pretoria.

Dr. Vuorinen was formerly at the National Metrology Institute of South Africa (NMISA) and at the CSIR. He obtained his MSc in Finland, his Licentiate of Technology in Sweden and PhD in Pretoria. He 'retired' in July 2013 but realised that his knowledge is needed in the metal packaging industry.

VCI-services centre can give advice, evaluate and source VCI-products. *Please, consult our website: www.vci-services.co.za.*

Getting to grips with the corrosion of stainless steel

It's true to say that stainless steels are a key facet of modern life and form the basis of so many items that are commonly used in households such as knives and forks and pots and pans. Equally they are also the mainstay of piping and machines used in food factories, chemical plants and process plants. Their performance and properties in each of these applications includes strength, weldability, formability, aesthetic appeal and corrosion resistance.

However it is to stainless steel corrosion resistance and performance that we will turn our attention. Stainless steels are renowned for their ability to resist corrosion when exposed to atmospheric corrodants such as seawater spray or pollutants such as sulphur dioxide. Stainless steels are also used in the seawater desalination industry as part of the process plant to handle hot brines and highly corrosive process streams and here again they make an outstanding contribution to industrial equipment by offering both strength, weldability and outstanding corrosion resistance.

It was in Sheffield just prior to 1916 that Brearley experimented with 12 – 14% chromium containing steels and discovered that they did not etch in normal etching acids. These were acids used to reveal the underlying microstructure of the steel by selectively attacking the steel and revealing the grain structure. Brearley also noticed that chromium containing steels resisted corrosion better in the hardened than in the annealed condition. He saw the possibilities of this material for use as cutlery and he gave the non-rusting steel the name " stainless steel " and registered patents in the USA and Europe. Work in Germany by the Krupp works to find corrosion resistant material for thermocouple tubes lead to the discovery that high chromium and chrome-nickel additions to steel allowed the material to resist corrosion for months. Thus the first patents for a ferritic and austenitic stainless steel were registered in 1912. However it was only after the Second World War post 1946 that developments in process metallurgy lead to the widespread use of stainless steel. Duplex stainless steels were first developed in the 1930's by Avesta but only came into their own when the weldability of duplex stainless steels was mastered in the 1970's by using nitrogen.

So what exactly are stainless steels and what gives them their corrosion resistance?

By far the key component of stainless steels that gives them their corrosion resistance is chromium which is present in stainless steels at greater than 10.5 % by mass and the more chromium that's added the greater the corrosion resistance. Chromium also increases the resistance of stainless steels to oxidation at higher temperatures and promotes a ferritic structure. Nickel is added to stainless steel to promote an austenite structure and also improves ductility and material toughness.

Table 1: Families of stainless steel.

Note: Fe = Iron; % = percentage by mass; Numbers 304 /316 / 904 are ASTM grades

Table 2: Typical compositions of common stainless steels and their family type.

Types of corrosion affecting stainless steels.

Figure 1: Pitting corrosion of a 304 stainless steel pipe at the weld seam.

Figure 2: Stress corrosion cracking of a stainless steel pipe due to chloride containing fluid splashing on the outside of the pipe.

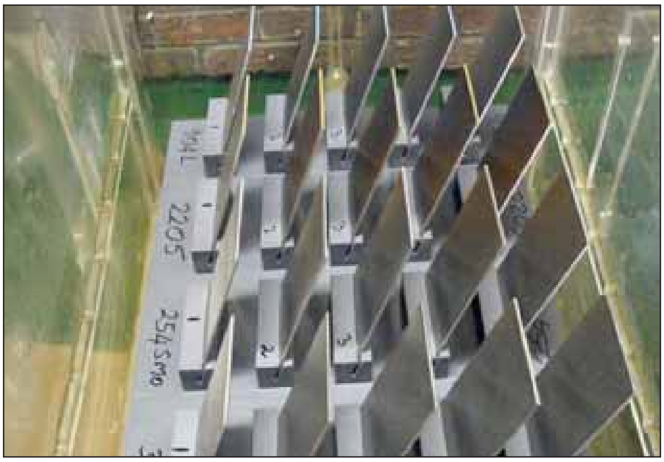

Figure 3: Accelerated corrosion testing of various stainless steels to prove capability in a selected corrosive atmosphere – in this case Calcium chloride and Acetic acid at 75°C.

Molybdenum is added to stainless steels to increase the resistance to both uniform and localised corrosion such as pitting corrosion.

There are a variety of families of stainless steel that lock in the capabilities and corrosion resistance of stainless steels and it's important to know these family types. The table below shows the main stainless steel families:

So far we have seen how certain chemical alloying elements such as chromium, nickel, molybdenum and others can determine not only the performance of the stainless steel but also its resistance to corrosion. More than this the alloying elements can be divided into those that are ferrite stabilisers and those that are austenite stabilisers.

The microstructure of stainless steels is influenced by the packing of the atoms in the crystal structure, the heat treatment that's been applied to the stainless steel and the alloying elements that have been added to the stainless steel.

All the stainless steel families shown above relate to a microstructure at room temperature after the combined effects of alloying, heat treatment and impurities. The microstructure has a decisive effect on the properties and hence the performance of the stainless steel. Thus the corrosion resistance of stainless steels is hugely influenced by microstructure and alloying elements added to the stainless steel.

Let's talk corrosion of stainless steel

Corrosion is the gradual degradation of a metal by means of chemical or electrochemical reactions with the environment that surrounds or contacts the metal. The outcome of corrosion is a loss of physical strength of the material, damage to the structural integrity and the aesthetic appearance of a material. Corrosion often leads to such damage to a metal that the metal is no longer able to seal in gases or liquids.

Stainless steels are more resistant to corrosion than certain mild steels or carbon steels but they are NOT IMMUNE to corrosion. For stainless steels to be resistant to corrosion depends on the composition of the stainless steel and the aggressiveness of the environment. There are two modes of corrosion to consider namely WET CORROSION and HIGH TEMPERATURE CORROSION. Where wet corrosion covers immersion in liquids, moist environments and humid atmospheric environments and high temperature corrosion covers exposure to hot gases at 500 – 1200°C.

Why is stainless steel corrosion resistant?

The key to this resistance is the formation of a thin passive film that forms spontaneously on the surface of stainless steel in oxidising environments i.e. air or aerated water. The stainless steel must contain at least 10.5 % chromium. This passive film is very thin about 1 – 3 nanometres (10^{-9} of a metre) and consists of iron and chromium oxides and hydroxides. The passive film protects the stainless steel surface from the surrounding environment and stops the electrochemical reactions that drive corrosion. The passive film can heal and spontaneously reform to continue to protect the stainless steel.

When stainless steel does corrode it's because the passive film is completely or permanently broken down or permanent local breakdown occurs as in chloride pitting corrosion.

Types of corrosion affecting stainless steels

There are four main types of corrosion that can be associated with stainless steel and the table below shows these forms:

Pitting and crevice corrosion

Pitting and crevice corrosion are very similar in the factors that bring on their occurrence and stainless steels are very susceptible to pitting and crevice corrosion.

Environments that cause pitting and crevice corrosion are those high in halides such as chloride ions including seawater and process fluids. The presence of sulphides will increase the aggressiveness of the halide containing media while sulphates lower the corrosiveness of the medium. Other common factors that can speed up pitting and crevice corrosion are an increased environmental temperature in contact with the stainless steel, low pH solutions and oxidative species resulting from say chlorination of a water. It is to be remembered that pitting and crevice corrosion have an incubation period but once started the corrosion can proceed very fast and thus this form of corrosion must be avoided at all costs.

A convenient and useful way to rank and compare stainless steels is to use the PRE (pitting resistance equivalent) number or measure the Critical Pitting Temperature (CPT) or Critical Crevice Temperature (CCT) for a specific stainless steel. Tables of values exist for these parameters.

Pitting corrosion is very insidious and dangerous and cannot be detected by corrosion weight loss measurements. To avoid pitting and crevice corrosion it is important to select a highly alloyed stainless steel with high chromium, molybdenum and nitrogen content. Alternatively try to lower the chloride content of the environment surrounding the steel, increase the pH, avoid stagnant fluids and tight crevices and produce smooth surfaces with weld oxides removed and the stainless steel pickled.

Uniform corrosion and environmentally induced cracking

While uniform corrosion can occur with stainless steels it is not often the corrosion form that puts stainless steel equipment, pipes and structures at risk. We know that pitting and crevice corrosion are dangerous when it comes to stainless steel and can rapidly propagate into a pipe wall or plate and bring about catastrophic failure. However environmentally induced cracking of stainless steel is very dangerous as well and can propagate very quickly.

2016 CORROSION AWARENESS DAY

The 2016 Corrosion Awareness Day takes place on the 22nd April. We invite all members who have corrosion exhibits to donate these to the CorrISA museum before the 15th April.

The week before Corrosion Awareness Day, High schools in and around Midrand and Tembisa will be visiting the institute to learn a bit about every day Corrosion.

Should you wish to participate in this exciting venture kindly deliver your corrosion exhibits to the CORe before the 15th of April or contact Lynette van Zyl at CorrISA.

Environmentally induced corrosion in stainless steels works by the combined action of mechanical stress in the material and a corrosive environment. Once this form of corrosion is initiated the crack propagation is very fast and can result in failure often of critically important pipe or other components. The mechanical stress in the cracking component need not be an applied stress but the residual stresses due to welding or metal forming.

Chloride, sulphide and hydrogen induced environmental cracking are some of the forms of this form of corrosion.

Stress corrosion cracking (SCC) of stainless steels is a well know form of environmentally induced corrosion and takes place most frequently in chloride containing environments at temperatures higher than > 60°C however SCC can occur at lower temperatures as low as 30°C. Low chloride solutions often thought harmless can also cause SCC when the chloride deposits and concentrates on hot pipes or under pipe insulation.

Hydrogen sulphide environmentally assisted corrosion in stainless steels is of particular importance to the oil and gas industry. It is brought on by a combination of mechanical tensile stress and corrosion in the presence of water and hydrogen sulphide. Many crude oils and natural gases pumped from deep exploration wells and oil wells contain hydrogen sulphide.

Other forms of environmentally induced corrosion that are of importance are hydrogen induced stress corrosion cracking and corrosion fatigue. If a steel structure is under cathodic protection in seawater then hydrogen can get introduced into the material. Often stainless steel are connected to carbon steels under cathodic protection and it's the ferritic phase in the stainless steel that's most susceptible to hydrogen embrittlement than the austenitic phase and thus ferritic, martensitic and duplex stainless steels suffer hydrogen induced stress cracking.

If a stainless steel is subjected to cyclic loads they can fail at loads lower than the ultimate tensile strength and if exposed to a corrosive environment then the failure may occur at lower load levels and in even shorter periods of time. This is corrosion fatigue failure.

Atmospheric corrosion

Atmospheric corrosion is not a unique type of corrosion but a term used to describe the corrosion of metal surfaces when exposed to the atmosphere which could be either an indoor or outdoor atmosphere.

Usually the main culprit causing corrosion of stainless steel in an atmospherically exposed atmosphere is the chloride ion whose source may be sea spray in coastal installations. Sheltered areas may accumulate deposits which speed up corrosion but regular rainfall washes exposed stainless steel and prevents concentration of corrosive pollutants. Coarse surfaces easily retain dirt, particles and corrosive chemicals and thus increase the susceptibility of stainless steels to corrosion.

Intergranular and galvanic corrosion

If stainless steels are allowed to remain in the temperature zone 550 – 850°C then chromium carbides precipitate out at the metals grain boundaries resulting in the metal near the grain boundaries becoming chromium depleted and very susceptible to corrosion. This is known as intergranular corrosion, however modern stainless manufacturing techniques allow the production of stainless steels with low carbon contents below 0.05% and thus intergranular corrosion is a thing of the past.

If stainless steels are welded they can be " sensitised " resulting in corrosion of the weld heat affected zone. Thus it is important for engineering designers to select low carbon grades of stainless steel such as 316 L or use stainless steel stabilised with niobium or titanium. Fabricators need to avoid keeping stainless steel in the region 550 – 850°C and can solution anneal the steel in the range 1000 – 1200°C to dissolve the chromium carbides followed by rapid cooling in air or water.

If two dissimilar metals are joined together in a corrosive environment then galvanic corrosion could take place. Usually stainless steels do not corrode in galvanic couples but the less noble metal connected to the stainless steel may corrode. The galvanic series of metals can act as a guide to deciding if joining of two dissimilar metals could result in corrosion. The wider the difference on the galvanic series between two metals the more likely they are to corrode. Stainless steels are normally passive and more noble than other metals on the galvanic series however should a stainless steel become active then it can shift position on the galvanic series.

And they lived happily ever after

So while stainless steels have the reputation of being corrosion proof, they do however offer excellent corrosion resistance if used correctly in the right application for the grade of stainless steel chosen. Surface finish and surface treatment of stainless steels also makes a significant different to how stainless steels perform in a corrosive environment.

The key is to understand the application of the stainless steel, know what fabrication techniques are going to be used to form the stainless steel into its functional form and what maintenance will be available to care for the stainless steel.

If necessary carry out accelerated corrosion testing to determine the resistance of various stainless steels in the application that is under consideration.

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Treatment of rusted surfaces

R A Francis, R A Francis Consulting Services, Ashburton, Australia

It is generally accepted that, for maximum protection, paints must be applied to surfaces which are entirely free from rust and other contamination. This is especially true of modern high performance coatings such as epoxies, inorganic zinc silicates, etc where abrasive blasting to a high standard is usually mandatory. There are, however, situations where it is not possible to completely remove all rust from the surface for design, economic, safety or other reasons. There has therefore been much research into treatments for rusted surfaces to avoid the need for such critical surface preparation. A large number of products have appeared on the market for such purposes although it is generally agreed that the protection achieved is nowhere near that attained if a rust-free surface is used. However, there is certainly a market for such products, especially in the consumer, or DIY market.

Five categories

1. Some of the products simply bind the rust particles together to the steel surface, forming a barrier between the metal surface and the environment. There is no reaction between the rust or the metal substrate and the coating. Examples of this are penetrating primers such as PENETROL (OWATROL in other countries), ISOTROL and fish oils. Most of these are penetrating drying coatings (linseed oils or alkyds) and they may be overcoated for appearance or additional protection.

Strait Shipping Strait Feronia (Jotamastic).

Roof refurbishment in Auckland (Jotamastic).

2. A second type, such as CORROLESS primers, contain a pigment which is claimed to convert rust into a more stable chemical compound (magnetite). These compounds also contain a conventional paint resin. They are usually overcoated with a top coat.

3. A third type are aqueous solutions of phosphoric or tannic acid or other tannin product, often in conjunction with wetting agents, surfactants, catalysts, etc. They are usually, but not always, water-based. Treatments are usually followed by a conventional primer and top coat. Some brand names which have appeared or are currently on the market include FERTAN RUST CONVERTER, GALMET IRONIZE and KILLRUST RUST-EETER.

4. A fourth kind is similar to type 3 in that it is based on the tannin products but also incorporates a latex emulsion compatible with the acidic tannin product. As well as providing the same form of protection as type 3 above, the presence of a binder means that a polymeric film is also formed so that these products act as a rust pretreatment and a primer. Examples of this type are CORROSEAL, NEUTRA RUST 661 and FERONITE RUSTY METAL PRIMER.

5. Industry will usually use high solids epoxy coatings, generally called surface tolerant epoxies or epoxy mastics, such as AMERLOCK, JOTAMASTIC 87, Dulux DUREBILD STE and the International INTERPLUS and INTERSEAL range. These are epoxy coatings which have very good wetting and penetrating properties but can also be built up to quite high thicknesses, 300 microns or more. The epoxy resin provides excellent adhesion so they bind the rust particles together and bond it to the substrate. Furthermore, the thick film provides excellent barrier protection.

There are two problems with coatings applied to rusted surfaces. Firstly, the rust particles are not strongly bonded to one another, nor the substrate, so that any coating applied to loose, flaky rust will have poor adherence to the substrate. When moisture penetrates through the coating, the coating will lift and disbond from the surface. All products recommend removal of as much flaky, non-adherent rust as possible to minimise this problem, but those with the best penetrating ability and strongest adherence will perform the best. The second problem is the salts such as chlorides, sulphates, etc., that are contained in the rust. The rust itself, hydrated iron oxides, is generally fairly innocuous chemically,


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Tasport's Korimul Tug refurbishment over spot blasted surface with UHWJ.

and tends to grow due to the presence of new ferrous ions forming as a result of these salts reacting with moisture and oxygen. The salts aggregate at the bottom of the rust pits, so are generally not removed when the loose rust is removed. They remain under the coating and draw moisture through by osmosis, leading to blistering and coating failure.

The significant variations in rust, both in its adhesion and salt content, make it very difficult to scientifically evaluate the various rust treatments. It is impossible to compare results of one researcher to another because these two factors cannot be standardised. These will influence rates of breakdown far more than the small differences between the products. A poor quality product applied to a surface with almost all rust removed and no salts will show better performance than a better quality product applied to a surface with rust containing significant salts. A further problem arises because accelerated testing using salt spray is usually carried out. A salt spray solution on the surface of a coating

Corrosion & Prevention 2016

13 – 16 November, SkyCity Convention Centre, Auckland, New Zealand

In 2016, the Australasian Corrosion Association (ACA) will being saying "Haere mai" to delegates attending Corrosion & Prevention 2016 when New Zealand hosts the four-day gathering of world experts on corrosion mitigation. The degradation of infrastructure and assets costs industry and governments billions of dollars each year so minimising the impact of corrosion is vital.

The conference – to be staged in Auckland's Sky City Convention Centre between 13 – 16 November 2016 – will bring together leading researchers and industry practitioners who combat corrosion on a daily basis. The conference will feature a program of keynote speakers and technical presentations and is expected to attract more than 450 delegates. An extensive exhibition of key industry suppliers will also run in conjunction with the conference.

C&P2016 will again be a premium networking event as well as a source for the latest information concerning corrosion prevention, control and repair. As a delegate at a previous conference stated: "I always find them of considerable benefit because the various technical streams and discussion forums allow interaction and debate on topical issues."

Diverse technical streams will showcase the latest developments in the field, ranging from fundamental corrosion science to hands-on application. Topics covered will include advances in sensing & monitoring; asset management; cathodic protection; concrete corrosion and repair; corrosion mechanisms, modelling and prediction; materials selection and design, and protective coatings

This conference will be of value to people working in a wide range of industries, including construction, oil & gas, mining, cultural and historical materials preservation, power generation, maritime, asset management, food processing, and defence.

For further conference details including submitting technical abstracts, please refer to the web site: http://www.acaconference.com.au or email: conference@corrosion.com.au

The ACA is a not-for-profit, membership Association which provides training, seminars, conferences, publications and other activities to disseminate information about corrosion and its prevention or control. The industry association was formed in 1955 and represents companies, organisations and individuals involved in the fight against corrosion and promotes cooperation between academic, industrial, commercial and governmental organisations.

placed over rust containing salts actually provides a lower osmotic pressure, therefore a slower rate of breakdown, than fresh water. Coatings over rusty surfaces should never be evaluated by salt spray or similar accelerated testing. Such tests may, in fact give results that are inversely proportional to life in actual exposure.

When all the above variables are considered it can be seen that it is very difficult to assess such products and the claims from manufacturers. As a result, while significant research has been carried out into their mechanism of protection, little work has been published on actual protection achieved by such products. DesLauriers (Materials Performance, Nov 1987, p35) did compare some tannin-based products and found poor performance. Generally speaking, those products based on soluble materials such as phosphoric and tannic acid (Types 2, 3 and 4 above) appear to provide least protection, probably because they are adding to the soluble content of the coating, leading to osmotic blistering. The inert materials (Type 1) probably provide superior protection to these, but the limited film build means that oxygen and moisture will penetrate fairly quickly, leading to eventual breakdown. The most successful treatments are the epoxy mastic type materials (Type 5) which have superior penetrating ability, adhesion and good film build to minimise moisture and oxygen penetration. These are the usual treatments recommended in AS/NZS 2312.1 for poorly prepared surfaces.

According to AS/NZS 2312.1:2014, 75 microns of epoxy mastic (syst EPM2) should provide 2 to 5 years to first maintenance in a moderate ISO C3 environments, while 200 microns of the same product (system EPM3) would provide 10 to 15 years in same environment and 2 to 5 years in a severe ISO C5 environment. The Standard also has a number of epoxy mastic primer systems, with a decorative topcoat for maintenance where blasting cannot be carried out. As mentioned above, the amount and salt content of the rust are significant factors in determining the life of such coatings and these figures must be considered as only a very rough guide. Any other rust treatment would be expected to provide significantly lower lives than these figures.

May 2015

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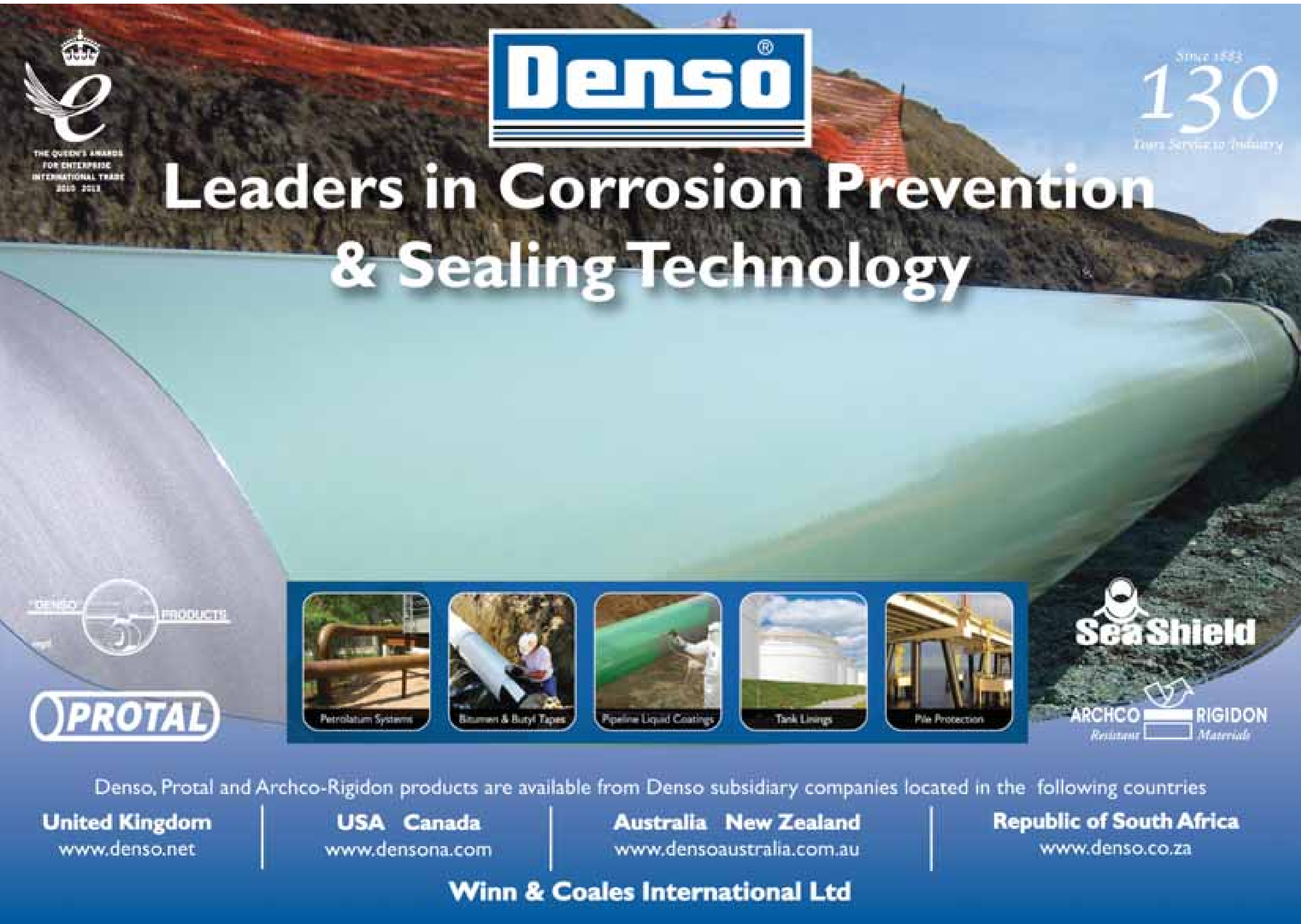
We wish to thank Brendan Pejkovic, Technical Services Manager of The Australian Corrosion Association Inc. for this article.



Corrosion prevention for buried pipelines

By Shivananda Prabhu, November 24, 2015

Carefully designed coatings, combined with cathodic protection and pipeline operating parameter controls, can help reduce pipeline corrosion.

Introduction

The longest pipelines are buried pipelines. They transport different petro products such as crude oil and natural gas, wastewater, potable water and other liquids, significantly influencing the economies of the developed countries as well as the developing countries. Corrosion of internal and external surfaces of pipelines is a leading cause of failure of buried pipelines. Apart from huge financial losses due to damaged assets, corrosion causes catastrophic failures, accidents and loss of precious lives. In case of potable water systems, corrosion can lead to disruption, wastage and supply of water of inferior quality.

Failure of an external pipe coating system prior to backfilling.

Soil condition

Due to contact with soil, the buried pipes face an environment which can change due to climatic and other factors in an abrupt manner. Methods adopted to lay the pipeline may at times damage the coatings provided on external surfaces. Even the slightest damage to coating can cause the onset of localized corrosion.

Low electrical resistivity of the soil helps it to act as an electrolyte in the following cases:

- When a section of pipeline is directly laid on undisturbed local soil and other sections on uncompacted earth containing excess oxygen and dissimilar soils.
- Long pipeline laid inside totally dissimilar soils.
- Sulfates, chlorides and other acidic contents are present in soil.
- Soils with clay content and moisture.

Soils with high sand content are less corrosive as they have higher electrical resistance. Shifting of soils can add to the severity of corrosive pipe damage. Corrosive chlorides in soil result from tidal flows or ocean currents carrying salt water droplets up to several miles away from sea shore. Soil with fuel generated combustion products contain sulfur compounds and nitrogen, which result in reduced resistivity and higher corrosion potential.

Even alkaline elements such as sodium, magnesium and calcium lead to higher corrosion potential, whereas granular types of soils reduce the corrosion potential.

Moisture content of the soil depends upon the climate as well as the ground water level. Shifting ground water levels can result in higher corrosion. Even the temperature of the moist air affects corrosive reaction. At lower temperatures below freezing point, soil resistivity is high and corrosion potential is low. Generally soil properties such as electrical resistivity, organic content, sulfates, chlorides and pH value determine the soil corrosion potential.

Disturbed soils (filled soils) contain higher amounts of oxygen. Oxygen at cathodic region supports vigorous corrosion. Undisturbed soil has lower oxygen content. Soil aeration influences the availability of the moisture and oxygen necessary for the electrochemical reactions leading to corrosion of metallic pipe surfaces.

Types of corrosion found in buried pipelines

- Uniform corrosion occurs at uniform rate over most of the surfaces throughout the pipe lengths.
- Pitting is a case of extreme localization of corrosion reaction due to a hostile local environment.
- Erosion and cavitation corrosion mainly occurs on the inside surface, due to contaminants as well as collapsing of vapor bubbles on the pipe wall, due to pressure changes in the liquids and turbulent flow conditions, which can be reduced by redesigning flow parameters.
- Inter-granular corrosion occurs around the metallic grain boundaries in metallic pipelines.
- Stress corrosion cracking of pipelines is caused by a hostile environment and residual stresses, load stresses and climatic conditions.

Corrosion of water and sewage pipes

Modern water pipes are generally made of ductile iron, but older pipelines could be grey cast iron. These pipes are used for potable water systems, sewage, raw water, and some chemical applications.

Grey CI pipes fail due to graphitization corrosion. Residual graphitic flakes get interspersed with ferrous oxides, weakening the mechanical strength and making the material susceptible for failure due to hydraulic impulses or other mechanical load stresses. Apart from graphitization they also fail due to localized pitting corrosion, depending upon the soil conductivity for electric current flow during electrochemical reactions.

Galvanic corrosion results from the use of dissimilar metals according to the galvanic series such as ductile iron and copper, the latter of which becomes cathodic to iron.

Microbiological corrosion

Buried metallic pipes are also prone to microbiological corrosion. Both aerobic type as well as anaerobic type of microbes (bacteria) can enable and accelerate the corrosion rate enormously. Certain types of sulfate reducing bacteria are responsible for enabling corrosion damage in presence of sulfur compounds. Anaerobic microorganisms have ability to release oxygen from compounds such as carbonates and sulfates for corrosion reactions, which will take place even if dissolved oxygen is not readily available. Microbial influenced corrosion is found to be accelerated by more than ten times, as compared to pipes with sterile contents.

Different soils, across the pipe length and depth, can aggravate corrosion, for example when part of a pipeline is laid in a sandy soil and part in a clay type of soil, anodic and cathodic cells can be formed on the same pipeline. However when the pipe lengths are joined through rubber gaskets, the electric circuit gets broken and pipe lengths may remain isolated from each other.

Corrosion protection of buried pipes

External coatings for buried pipelines require the following properties:

- Negligible permeability
- Good electrical and electrochemical resistance
- High adhesion to pipe surface
- Flexibility
- Good impact strength
- Scratch resistance and abrasion resistance, to protect against damage during handling, testing, transport, laying and other site activities
- Not prone to cathodic disbondment
- Resistance to changes in soil, thermal stresses and resistant to cracking

Different types of barrier coatings are adopted for protection of buried pipelines. The types of coatings are:

- Loose polyethylene jacketing
- Epoxy coating
- Bituminous coal tar based coatings
- Polyurethane coatings

Loose polyethylene jacketing

For water pipes laid in corrosive sites like landfills, polyethylene encasements are commonly used. The advantages include ease of installation, low maintenance cost, low failure rates.

However the polyethylene encasement may get damaged during installation. It softens at 80 degree Celsius and melts at temperatures close to 100 to 110 degree Celsius.

Bituminous coating

Sprayed bituminous coat over sprayed zinc coating is used in Europe as well as USA for buried pipes. Zinc provides sacrificial protection. For ductile iron pipes of water systems, zinc spray-bitumastic coating is also used in combination with polyurethane or polyethylene jacketing. However, the combination is subject to failure due to scratch damage during installation.

Regulations requiring low Volatile Organic Compounds (VOC)

Due to EU regulations requiring zero VOCs, new polyurethane formulation with hundred percent solid polyurethane is being offered by coating manufacturers. Polyurethane can be used for both internal as well as external surfaces. The coating can be completed during pipe manufacturing stage itself. Zero VOC polyethylene and epoxy coatings are also being offered. Some water based anti-corrosion coatings are also available. However, in developing country markets, solvent based products still dominate as strict regulatory requirements are yet to be enforced in several developing countries.

Advantages of polyurethane

Well-designed solid polyurethane reduces load current of CP. A combination of polyurethane and CP is adopted in the Middle East, Asia and Europe. For corrosion protection of pipe fittings as well as valves, epoxy coatings are also used.

Zero VOC polyurethane coatings used for buried pipelines is an example of new coatings developed due to regulatory requirements. These coatings are used for water and wastewater piping systems, oil and gas piping and industrial applications.

Cured polyurethane is used for lining potable water pipes as well as raw water pipes, as it is inert, remains resistant to water and non-conducive to growth of Microorganisms and bacteria. They are suitable for sewage pipes as well as sewage treatment systems.

Compared to traditional cement mortar lining of internal surfaces of potable water pipes, polyurethane lining has the following advantages:

- Polyurethane is fast curing and ensures economy of high production rates and efficiency.
- Has higher adhesion to ferrous and steel surfaces. Cement mortar needs to be lined and retained in place through compression.
- Polyurethane has high impact resistance.
- Corrosion resistance of polyurethane is over 10 times higher (based on salt spray test).
- Polyurethane has higher impact resistance.
- When polyurethane is used, a thinner lining thickness is required with lower deadweight, and hence pipe design can be more efficient, reliable and economical as the wastage factor will be reduced, and pipeline capacity is higher for same size of pipe.
- Lower head loss and pumping losses due to smoother internal surface of pipes.
- Longer economic life as deterioration due to erosion cavitation is low.
- In case of industrial or waste water pipes, cement mortar may get attacked by chemicals such as chlorides, whereas polyurethane has high chemical resistance to ensuring a longer economic life.

Internal corrosion of potable water piping can profoundly impact water quality due to increase in concentration of lead, zinc, cadmium, iron and copper, apart from pipe leaks resulting in ingress of other harmful substances due to a suction effect when the system is not pressurized.

Corrosion of gas and oil pipes

Internal corrosion on gas pipelines occur when the pipe surface reacts with a combination of contaminants i.e. moisture, oxygen, carbon dioxide, chlorides and sulfur compounds present in gas. Operational parameters such as gas temperature, flow rate and particle velocity are also critical for corrosion prevention. Corrosion is also caused and sustained due to microorganisms when nutrients are present on the internal pipe surface.

This corrosion can be minimized by following operating guidelines for temperature and velocity parameters and contaminant control. Epoxy lining as well as polyurethane lining are used for prevention of internal gas pipe and oil pipe corrosion.

Coating selection for oil and gas pipes

Polyurethane has stronger electrical properties as well as outstanding mechanical toughness together with superior corrosion resistance. Formulation of polyurethane can be customized to suit the specific application and the corrosive environment it is subjected to. Spray application technique with fast curing advantage, as it does not need heating before or after application. High abrasion resistance as well as impact strength can be built in specially formulated polyurethane.

Compared to polyethylene, polyurethane has better bonding reliability, whereas epoxy coating suffers due to brittleness.

About the author...

Shivananda Prabhu is a graduate engineer from University of Mysore, Karnataka, India and PGDBM (Equivalent to MBA) from XLRI, a top ten management institute. He worked for Tata Steel, Jamshedpur in the area of maintenance as a manager and specialist in tribology, lubrication, wear prevention, corrosion prevention, maintenance management and condition monitoring, contributing to loss prevention and value engineering as well as knowledge management initiatives.

Shivananda later worked as Technical Trainer, Safety Trainer, Lead Auditor of ISO 9001, ISO 14001, Management Trainer and Training and HR specialist.

For about four years he worked in the academic area, in PG institutions as a professor and later as Director of IPS (Management Institute) in Pune. For three years he worked as an editor and writer for research papers, newspapers, trade journals and websites. Over all he has more than 25 years experience.

A three layer polyethylene with an inner epoxy coating is also used for corrosion protection of external surface of pipelines. Other options such as PVC coatings as well as coal tar bitumen based coatings lose their mechanical strength as they become brittle and bonding with pipe surface too is lost due to this factor.

Telluric currents

Telluric currents are the natural electric currents existing in the earth's crust. They are mainly induced geomagnetically i.e. they are produced by the changes in the outer layers of the earth magnetic field. As pipelines are constructed as electrical conductors, stretching hundreds and thousands of miles across the earth surface, they experience electric currents induced by outside sources. These sources could be mostly manmade as in case of stray currents, or natural as in case of telluric currents. Recent research has helped to understand the effect of telluric currents in the variations seen in values of pipe-to-soil potential (PSP). Recent usage of higher strength-high resistance coatings for corrosion protection has resulted in huge PSP fluctuations. Use of high strength steels in buried pipes, which are more susceptible to hydrogen on the other hand, demands stringent requirements of lower limits on PSP variations. Telluric currents influence design of cathodic protection as well.

Stray current corrosion

Stray current is a major cause of corrosion of buried pipes as a metallic pipe is a better conductor of current than the soil. The site, at which the current leaves the pipe to go back to earth or a nearby structure, will be the site of this corrosion.

Sources of stray current can be:

- New or pre-existing CP system protecting another adjacent pipe
- DC from transit systems in close proximity
- Power transmission systems with medium high or extra high voltages
- Sites where industrial or domestic appliances are connected to water pipes
- The earthing connection when welding water pipes
- Induced voltage from adjacent high voltage power equipment

Cathodic protection

Cathodic protection (CP) is a technique used to control the Corrosion"corrosion of a metal surface by making it the cathode of an electrochemical cell. A simple method of protection connects the metal to be protected to a more easily corroded metal to act as the anode. The sacrificial metal then corrodes instead of the protected metal. For structures such as long transport pipelines, where passive galvanic cathodic protection is not adequate, an external DC electrical power source is used to provide sufficient current.

The lower the soil resistance the higher the current flow will be resulting in accelerated corrosion. Salt polluted ground and clay soils cause greater corrosion in comparison to gravel and sandy soils. If the gravel is completely dry, then the need for cathodic protection and coatings may not arise. In steel pipes, corrosion cells could result due to manganese, iron and other contents. Even a replacement of a piece of pipe can result in an anode formation with respect to the existing pipe.

All buried metals will create their own electrolyte solution potential. Thus a potential difference (voltage) is created and maintained between the ground-soil and pipe metal. This potential difference can be detected by connecting the negative wire of a DC voltmeter to the metal, and the positive wire to a standard electrode of copper sulfate connected electrically with the soil.

When two different metals are connected electrically and simultaneously buried in soil, they spontaneously develop a galvanic cell. The metal that is higher in the galvanic series will be anodic to the other metal lower in the series. The electrochemical reaction corrodes the anode, while metal rendered cathodic will be protected from corrosion. Due to cost and stability considerations magnesium alloys are used as sacrificial anodes with respect to pipes and structures made of iron and steel. The sacrificial anode is buried in the ground and connected electrically to the pipeline through low resistance copper wire. Multiple sacrificial anodes are are used to protect long pipelines.

Impressed current cathodic protection

Cathodic protection with rectifier and impressed current can replace a complicated multiple anode system, where the regular monitoring of corrosion is mandatory. Converted direct current, flows from ground bed to piping structure and returns to ground.

The system consists of a convertor/ rectifier- transformer to convert the supply voltage to the high current and a low voltage DC power, needed for cathodic protection. An electric cable is connected to the buried pipeline structure from the negative side of the convertor/rectifier instrument to provide a return path of electricity. A variable voltage input is provided to enable fine adjustment of impressed current.

Impressed current CP has the following advantages over a multiple anode system:

- It can generate a higher impressed current when a deteriorating coating is likely to accelerate corrosion.
- It can take care of any changes in soil resistivity.
- It can be adopted for coated as well as bare pipelines.
- Pipeline structures of different sizes can be protected.

Conclusion

Buried pipelines are best protected by judiciously combining coatings with cathodic protection. As far as it is practical bury pipelines in dry crushed rock with sand. An addition of inert gases or removal of corrosive gases and oxygen can enhance the economic life of the pipeline. In the case of oil and gas as well as water piping systems, water temperatures and contaminants as well as flow parameters need to be investigated.

Acknowledgement: www.corrosionpedia.com.

Coating Thickness | Material Analysis | Microhardness | Material Testing

Measuring Protective Coatings in Accordance with SSPC-PA2

Coating thickness measurement is of growing importance in the paint and corrosion protection industry, as is conformance to regulations and standards like SSPC-PA2, a specification that describes procedures to measure the thickness of a dry film (DFT).

As the useful life expectancies for structures such as bridges, ships, pipelines and water tanks have increased, detailed inspections during or after the paint application process have become the norm. SSPC-PA2 provides a uniform way for industrial painting contractors, facility owners and third party inspectors to evaluate these coating projects.

According to SSPC-PA2, a **gauge** measurement is a single instrument reading, **spot** measurements are typically the mean of three gauge measurements within a 4 cm (1.5 inch) diameter circle, and **area results** may comprise the mean of five spot measurements. The frequency of measurements is determined by the size of the structure: If less than 300 square feet (~28 m²), a measurement is taken every 100 square feet (~10 m²). If the structure is between 300 and 1000 square feet (~28 and 100 m²), one arbitrarily selects three random test areas of 100 square feet (~10 m²) and measures.

Fig. 1: The FISCHER Hand Held Coating Thickness Product Group complies fully with SSPC-PA2, including the ability to transfer measured data to industry and customer specific report templates.

Fig. 2: Coating Thickness measurement with DUALSCOPE® FMP100

All FISCHER handheld gauges comply with SSPC-PA2. Even the entry level MP0 Series quickly calculates spot mean values. Standard units such as the MP0R have the built in specification to automatically sequence spot mean values while simultaneously monitoring the minimum and maximum readings. In addition, the user is alerted if spot measurements are less than 80% or more than 120% of the specified thickness. In the case of the DUALSCOPE® FMP100, a complete inspection plan with images can be created to guide the user to the location of each measurement.

Selecting the appropriate probe for the application greatly enhances adherence to tolerances, and FISCHER offers various models of gauges, either with integrated probes or gauges able to accommodate multiple separate probes designed for specific measurement challenges.

Your local contact person for FISCHER products will gladly assist you in selecting a suitable handheld coating thickness instrument from the MP0/MP0R or FMP Series for measuring in accordance with SSPC-PA2. FISCHER is a contributor to the Society of Protective Coatings (SSPC) and a member of the SSPC-PA2 committee.

Please contact us. We will gladly help you solve your measurement tasks.

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WE DO IT THE FIRST TIME

From the Kettle

Because corrosion control of steel by hot dip galvanizing plays such an extremely important role for specifiers and end-users in their specification choice, it was proposed that we highlight and demystify a number of surface conditions over a series of editions that bear very little influence of the coatings durability seen both during the initial inspection and also after years of being exposed to a particular environment.

While most steelwork can be successfully hot dip galvanized and adequately provide the appropriate corrosion control, visually good quality hot dip galvanized coatings on fabricated articles are more likely to be achieved if the following criteria has been implemented:

- communication has been opened with the galvanizer at hand and at the time of contract or alternatively,
- the galvanizer has been requested to discuss the requirements with other parties on the initial project team;
- the steel has the correct chemical composition;
- the design complies with SANS 14713 part 2;
- all welds comply with an acceptable preparation grade from table 1, ISO 8501;
- SANS 121 (ISO 1461) particularly the contents of Annex A have been communicated to the galvanizer;
- good fabrication techniques have been adhered to;
- a Certificate of Conformance in terms of SANS 121 has been requested (if necessary) before hot dip galvanizing commences.

The surface conditions to be highlighted in the series going forward have been divided into two parts:

1) Those that can largely be avoided during the steel specification, design and fabrication stage, including the effects of loading, transport and unloading of the components on site with the assessment being done in terms of SANS121:2012 (ISO1461:2009) Standard as well as when Architectural Hot Dip Galvanizing or Duplex Coating Systems are required.
2) What the galvanizer is in control of and can in most instances, avoid.

While the primary purpose of specifying hot dip galvanizing is for corrosion control and this will always be achieved providing the steel is clean through the process prior to dipping into molten zinc (SANS 121 acceptance). Aesthetics while important to some (Duplex and architectural acceptance), must be discussed with the selected galvanizer and if not discussed, is generally of secondary importance.

LEGEND

#1 – As the life of a zinc coating is proportional to its thickness, a thicker coating will proportionally outlast a thinner one, however, a thicker coating can be more prone to mechanical damage, when handled inappropriately.

#2 – All passivation products including sodium di-chromate will be excluded by the galvanizer when he has received written instructions that the hot dip galvanized steel is to be painted.

#3 – While double dipping is occasionally seen to be necessary due to a limited bath size, the galvanizer must inform the customer that this practice can increase the propensity for distortion, before he commences with the work.

#4 – While the galvanizer can lower the zinc temperature and shorten the immersion time to limit coating pickup, however, due to increased costs to himself, he is not obliged to do this and if necessary will recover the cost from the purchaser. Insufficient vent, fill and drain holes will lengthen immersion times.

Hdg – Hot dip galvanizing ; **A** – Accept; **R** – Reject; **N** – Negotiate

C – Clean; **REP** – Repair; **SS** – Significant surface.

OBITUARY

WILLIAM BERESFORD WILLIAMS

The Corrosion Institute regrets to advise that Barry Williams, a long standing member of the Institute, passed away recently after a long battle with emphysema and cancer.

Barry was a previous council member of the Natal Branch of the Institute and has been well known in the cathodic protection industry in South Africa since the 1970's.

The Institute would like to extend its condolences to family and friends.

William Beresford Williams – Barry to his friends.

I met Barry in 1978 when I started working for Michael A Brett and Partners fresh out of 'Varsity. Barry introduced me to the art of Cathodic Protection, which was to become my life. At that stage I did not even know what a sacrificial anode was. Our friendship was cemented through a common love of modelmaking and the great outdoors as experienced on pipeline survey work.

Barry was a millwright by trade, and one of my best memories of him was when we had a dispute with a client over the effects of hot dip galvanising on a mine shaft structure. The steelwork would not fit in the surface jig, and the client was blaming distortion due to galvanising. Barry made a miniature model with cams that introduced the construction tolerances as per the drawings. This proved that components built according to the drawings could not be assembled within specified tolerances.

On the pipeline side, Barry was a stickler for doing it right - no matter what. He could be relied on to complete a project, be it survey, construction or investigation. He was never too proud to ask for advice or help, and always available to provide help when needed.

I consider myself to be privileged to have had Barry as a mentor, friend and colleague. I will miss the evenings of Eisbein & a bottle of red wine after a site visit. The photograph shows Barry at his best - making a plan on site when survey conditions are challenging and the standard methods don't work. Barry was the epitome of the South African eulogy - " 'n Boer maak 'n plan", even though he couldn't speak a word of Afrikaans.

Neil Webb

CATEGORY 1 - FILL, DRAINAGE & VENTING: SURFACE CONDITION - F1

DESCRIPTION:
Quality of design, fabrication (taking the process into account). Slag and porous free welding leads to good quality hot dip galvanizing.

EFFECT / REMEDY:
Specifying and purchasing the recommended, steel types including appropriate design including venting, filling or draining holes, fabrication instructions and quality welding, will generally result in good quality hot dip galvanizing. See #1

Acceptable to SANS 121:
A

Acceptable for duplex and architectural finish:
A

See Architectural Check List available from HDGASA #4.

Good quality welding, fair sized coping holes.

Base plates fixed to column base with maximum sized hole for fill and drainage purposes.

Instead of continuous welding (that may add unnecessary residual stress to the metal, resulting in possible distortion) plan for at least a 2mm gap with intermittent welding for coating quality.

Gap of at least 2mm between members for good drainage.

Gusset plates fixed into ends of members for maximum drainage.

Appropriately sized and positioned fill and drainage holes.

CATEGORY 7 – FABRICATION QUALITY: SURFACE CONDITION – F2

DESCRIPTION:
Poor design, fabrication quality and inappropriate welding can lead to unacceptable hot dip galvanizing.

CAUSE:
Sub-standard fabrication, inappropriate welding and vent / fill and drainage hole positioning, can substantially reduce the quality of the hot dip galvanized coating.

EFFECT / REMEDY:
Minimise conspicuous joining and use of inappropriate welding. Remove all weld slag or use MIG or CO_2 welding and correctly position appropriately sized vent / fill / drain holes in order to avoid potential air and liquid traps. #4

Not acceptable to SANS 121:
Depending on customer's needs. Requires extensive coating repair, which may be in excess of SANS 121 coating repair limitations.

Not acceptable for duplex and architectural finish:
Galvanizer to advise the customer of the required fabrication quality and its effect on the finished hot dip galvanized coating.

Bad fabrication quality and poor quality welding will result in bad quality hot dip galvanizing.

Surface imperfections in the black steel surface will be highlighted after hot dip galvanizing.

Inappropriately positioned fill or vent holes will lead to an internal air pocket and bare spot or unnecessary drag out of zinc, which will solidify. The former if large enough, can result in premature corrosion from the inside.

The surface where the removal of welded on components after hot dip galvanizing is required will need cleaning and if necessary the appropriate coating repair.

Residual weld slag as well as porosity will be noticeable after hot dip galvanizing.

Manager's Message

Who would have thought that the 2nd edition of our Corrosion Exclusively Magazine would happen so soon? Time truly does fly when you are having fun. 2016 is well on its way and I cannot wait to see what it holds for us.

Last year's Awards Dinner was a huge success and saw the launch of ***Corrosion Exclusively*** which has proved to be enormously popular. The second edition promises so much more with some really interesting articles.

We most certainly have some challenges with the changing economy and unpredictable exchange rate ahead of us. Filling seats in some of our courses has proved challenging, however with other courses we have been lucky and the numbers have exceeded expectations. We are also very excited at the prospect of running some new courses in the near future. Our Training schedule can be found inside this edition.

2016 will be a very busy year, we have a number Expos Lined up, and we will be joining forces with some of our Reciprocal members and will be offering some exciting events. Planning for Africorr is well on its way as is the Corrosion Awareness week. Planning for our Annual Fishing Day, Golf Day and Awards Dinner has begun and your continued support with all of our events would be greatly appreciated.

The Corrosion Institute has finally joined the "modern era" and we will be launching our Facebook page soon.

I certainly am very excited about this edition and about 2016 in general and invite all of our readers to let us know what you would like to see in some of our future editions.

Until next time keep well.

Lynette van Zyl, Manager – CorrISA

Comment – Chairman of the Western Cape

After the very successful launch of the magazine last year and the very high standards that have been set by Terry and his publication team, its going to be tough to maintain this standard. However, with the input and contribution of the whole Corrosion Institute members and industry, I am sure that the challenge will be a success and that the interest factor in future publications will continue to be high. The comments and feedback that I have received have been fantastic.

I am confident in saying that one of the highlights of last years' calendar for those involved in the Corrosion industry in the Western Cape was our Annual Gala Dinner. Tammy, who was in charge of the portfolio pulled out all the stops in making it a success which it certainly was in running at a profit as well as attracting well over 100 guests. We also had the exceptionally entertaining comedian Dalin Oliver as well as a photo booth which provided for a lot of fun and hilarity. Thanks again to Tammy and all the sponsors for making the evening such a success and in particular our title sponsor Corrocoat.

Since last year and my last feedback we in the Western Cape have had some particularly fascinating talks and a site visit which can be summarised as follows:

- Budgetary constraints and mandatory safety procedures can have huge implications on successful corrosion control presented by Mike Book, owner of Bulldog Projects
- THE IN'S and OUTS of STAINLESS STEEL CORROSION presented by Simon Norton – Chemical Investigation Services
- Tour of Blue Willow Aluminium Powder Coating Plant, Schalk Pretorious – GM of Blue Willow Aluminium and Shawn Williams from Surtec
- 3D printing presented by Ahmed Ahmed from 3D Maker Bot.

John Houston has continued to be an integral part in keeping a record and education library of all the Western Cape presentations. We really value all the time and effort that is invested in these videos. Thanks John.

Kelvin Grove has continued to be a superb partner as our favoured destination in making sure that the Gala Dinner as well as our monthly presentations run smoothly and professionally.

A special thanks to the rest of the committee who continue to be very proactive to ensure the smooth running of the Western Cape region. The committee includes Tammy Barendilla, Leonie du Rand, Simon Norton, Terry Smith, Flippie van Dyk, Indrin Naidoo and Pieter can Riet.

See you at the next presentation! We encourage anyone who has a potential topic of interest or knows someone who does to get hold of one of us on the committee.

Graham Duk, Chairman – CorrISA Western Cape

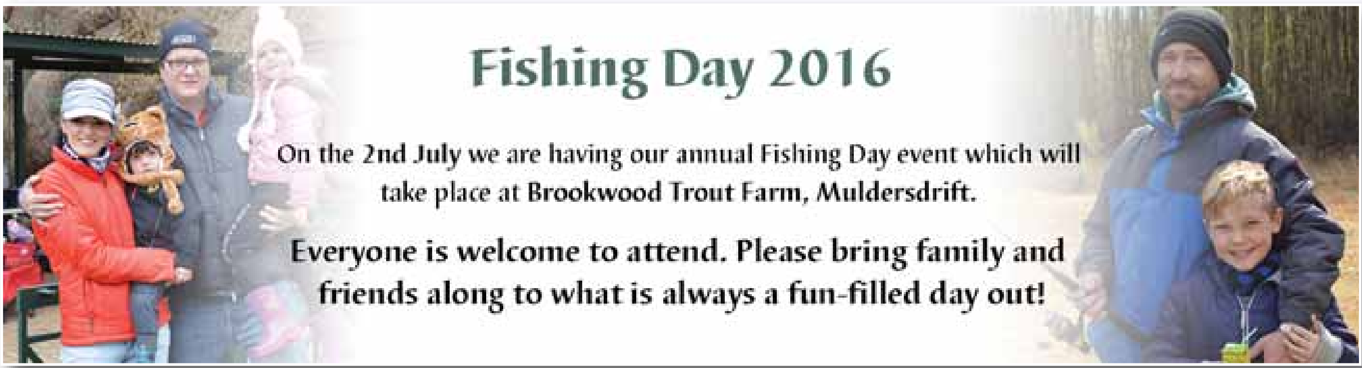
Gauteng 2015 Annual Charity Golf Day

The Corrosion Institute of Southern Africa-Gauteng region, held its annual charity golf day at the Jackal Creek Golf Estate on 30 October 2015. Once again we had an enormous amount of support from the industry and 32 fourballs were entered into the competition which is the maximum number of teams allowed on the course. It was a fantastic day to be out of the office with the weather playing its part and all 128 players thoroughly enjoying themselves.

The winners of the day were team Topfix who played an outstanding game of golf.

Appreciation and thanks go to all that assisted with the build up to and on the day-without your support this event cannot be possible!

The Corrosion Institute Annual Golf Day has become a highlight on the industry's calendar so we encourage you to book early for this year's golf day which is at Jackal Creek Golf Estate on 04 November 2016. For further information and bookings, kindly contact Donovan Edward don@denso.co.za



CorrISA 2015 Annual Awards Dinner

The Corrosion Institute hosted its Annual Awards Dinner on the 16th October 2015. The doors opened and immediately everyone was greeted by the wonderful sound of the Welsh Men's Choir. The ballroom was tastefully decorated in golds, coppers and bronzes which immediately set the tone for the wonderful evening to follow. Our Master of Ceremonies, Ben Garrad was an excellent host who had everyone feeling at ease and welcome.

Our various award winners we so excited to be recognised for their achievements of the past 12 months and I am happy to declare that our Medal recipients were quite literally blown away. What a pleasure it was to honour such esteemed individuals. We proudly launched the first edition of our magazine, Corrosion Exclusively, which was an immediate hit.

All in all it was a wonderful evening shared by so many in our industry and was enjoyed by all. On behalf of the Corrosion Institute of Southern Africa I would like to offer my sincerest thanks to all of our sponsors' guests and honoured guests, thank you for making the Annual Awards Dinner 2015 unforgettable.

2015 WINNERS

Gold	Louis Pretorius
Silver	Robert J A Millenaar
Silver	Dave M Howarth
Bronze	Vanessa Sealy-Fisher
Honoray Member	John S Hay
Honoray Member	John Jamieson McEwan
Fellow Member	Darelle Janse van Rensburg
Fellow Member	Vanessa Sealy-Fisher
Ivan Ogilvie Scholarship	Yonela Mgwebi
Walter Barnett Scholarship	Bernard Ntuli
Corrosion Engineering Course	Tasheen Naicker
Economics of Corrosion (Tie)	Kholo Morudu and Hendrik Van Staden
NACE CIP 1	Staci-Leigh De Rouwe
NACE CIP 2 (Tie)	Ngome H Apande Amy J Thomson
NACE CP 1	Mailane M Mohlala
NACE CP 2	Frances Bradfield
CITWI	Ian Rushton

THE RUSTY COMPUTER

I was not asked to say anything here tonight but seeing as I have walked from the cheap seats at the back I am going to keep you from your dinner for a few minutes more.

I am honoured, proud and humbled by this award, also... I am embarrassed.

Embarrassed because in the past I have been known to criticize this council in general and this evening in particular so I must in some way right a wrong.

I would like therefore to congratulate the incoming Council and the past councils and individuals of this Institute for the amazing achievements that they have reached in Corrosion Education in Southern Africa and the quality of the courses they have created and presented. A round of applause at this point would be appropriate.

In addition to all this they have taken corrosion education beyond the corrosion industry and to into the spheres of commerce in general thereby expanding our coverage.

A month or so ago this was vividly brought back to me by a phone call I received from a newly graduated NACE 1 student looking for a job, who when I enquired, as too what he had done before the NACE Lectures he said that he was in I.T.

I did not have an opening at the time but assured him that he would be the first person we would call if we came across a rusty computer!

Dave Harworth

CorrISA 2015 Western Cape Annual Awards Dinner

CorrISA Training Courses and Technical Events

CorrISA TRAINING COURSE SCHEDULE 2016

Course Name	March 2016	April 2016	May 2016	June 2016	July 2016	Aug 2016	Sept 2016	Oct 2016	Nov 2016
CorrEng (5 day Exam)			23rd - 27th JHB	20th - 24th CPT			5th - 9th JHB		21st - 25th DBN
Eco of Corr (2 days)	14th - 15th JHB					1st - 2nd JHB			
C-NJR (1/2 day)	15th DBN		11th CPT		13th JHB		20th DBN	12th CPT	
CITWI BPA Course (4 days)		4th - 7th JHB							
NACE CIP1 (6 Days)		11 - 16th JHB		20th - 25th DBN	4th - 9th JHB	15th - 20th CPT	12th - 17th JHB		14th - 19th JHB
NACE CIP2 (6 days)			16th - 21st JHB					17th - 22nd JHB	
NACE CIP3 Peer review								22nd - 24th JHB	
CP1 (6 days)				6th - 11th JHB					
NACE CP2 (6 days)									7th - 12th JHB
NACE O-CAT							26th - 30th CPT		
NACE CP Interference						15th - 20th JHB			
Corrosion Awareness Week		18th - 22nd							
Africor					25th - 29th JHB				

If you are interested in any of the above pending courses, have a related course that you would like to offer or would like to use our facilities, contact CorrISA. Provided the suggested course or presentation meets our various terms and conditions, CorrISA would be interested in adding it to our offering.

CorrISA reserves the right to cancel or postpone a course, should the need occur. Kindly refer to our website www.corrisa.org.za for current course dates. Numbers may affect the status of the course.

TRAINING COURSES
Gauteng

TECHNICAL EVENINGS
Gauteng

TECHNICAL EVENINGS
Western Cape

A collage of photos randomly taken at recent technical events and courses.

The President's Challenge

'So you want to "do" corrosion?... and you want to know what courses you need to take to "do" corrosion? ' I regularly face these questions from youngsters and also from not so young "youngsters" that have been exposed to some aspect of corrosion that has perked their interest and subsequently would like to follow a rewarding career facing up to the most destructive phenomenon known to modern society.

As it stands in South Africa currently there is no tertiary qualification that is focused purely on corrosion and anyone that would like to pursue a career in anti-corrosion practice typically starts off with a related apprenticeship or technical qualification in another field and then slowly gravitates to attending short courses dealing with aspects of corrosion and its prevention or they get thrown in the deep end by taking up an appointment in an enterprise that either deals with repairing the damage caused by corrosion or applying the technology of preventing or avoiding corrosion, or they take up position with an asset owner that spends much time, effort and other resources countering the progress of corrosion and degradation just to keep their plants operational.

One group of youngsters are those coming from our various universities typically having almost completed (or having already completed) a tertiary qualification in applied chemistry, microbiology, biochemistry, chemical engineering, metallurgy, civil engineering, electrical engineering, to name just a few. In fact I have even met some that have wanted to enter the anti-corrosion industry with geology, marketing and project management qualifications and yes even a few that have started off with accountancy. Although at this stage of their careers they may have some theoretical knowledge there is in many of them a lack of practical exposure i.e. seeing what happens in the real world, and what the current practice is in dealing with corrosion. Unless they get opportunities wherein they can be exposed and mentored to such, the future looks bleak not just for them but also for the whole industry. It is such youngsters that share our enthusiasm about fighting corrosion that will carry the industry forward.

So where do we start? Two years ago several like-minded students from Gauteng based tertiary institutions got together and decided that they would like to know more about this very interesting phenomenon corrosion and organized themselves into a small body and started conversations with CorrISA council members that are employed at the respective tertiary institutions. This subsequently led to them forming CorrISO (Corrosion Institution Students Organization) under the auspices of the Corrosion Institute of Southern Africa. CorrISO membership is held in high esteem by its members and by the main body as well and it is the vision to have CorrISO members build careers in the field of Corrosion and to become fully fledged CorrISA members.

Prior to the formation of the student body, CorrISA council had long expressed the need to attract new members from the younger generation and the formation of CorrISO gave this need much impetus and a much needed platform for interested youngsters to become more involved in corrosion.

Another initiative that was launched a few years ago under the then CorrISA president of Vanessa Sealy-Fisher was the "President's Challenge" which challenged CorrISA members to offer internship/traineeship positions to youngsters that had completed their initial university training and now needed hands on exposure. Subsequent Presidents (Bruce Trembling and currently Edward Livesey) have continued with this challenge and to date several companies amongst them ICP, Total Contamination Control SA, PPT and NUI are known to have taken up the challenge. I am aware of at least 12 candidates that have been placed at these entities in the past and currently there are 9 candidates undergoing training at these same companies. The formation of CorrISO added a new dimension to this program in that the student body leadership is currently working on putting more awareness programs in place. This is to encourage greater membership of CorrISO and currently they have core members at TUT, UJ and at Wits through which they hope to facilitate membership and entry into exposure markets. Furthermore, CorrISA council has decided to focus more on helping CorrISO members enter the employment market and have begun planning a database where available CorrISO members will be listed for companies wanting to either take up the President's Challenge or simply find a person suitable to join their organization. (read more about the President's Challenge on the CorrISA website.)

Greg Combrink
CorrISA Honorary Secretary
hs@corrisa.org.za

Just saying...

Good morning Brenda

Thank you very much for the first copy of the CorrISA Magazine.

May I say Wow! Congratulations on a stunning and most professional magazine!

May your magazine go from strength to strength and grow without limits!

Kind regards

Louis de Wet PhD FWISA
Managing Director : Waterlab (Pty) Ltd

Email sent to Brenda Maree of CorrISA

THE INSTITUTE WOULD LIKE TO ACKNOWLEDGE THE ADVERTISERS AND THANK THEM FOR THEIR SUPPORT

The RUST Spot...

in conversation with Dan Durler

Briefly explain your background

After leaving high school I was pushed into a family hardware business, which I do not regret. I learnt much about paints and all that go with it. After three years of family feuds and politics I left.

In 1958 I joined GC Shave as Sales Representative and was dropped into the deep end starting in the warehouse learning stock control, ordering, dispatch, shipping, railage and whatever else was required, my previous job experience served me well.

After having "passed the test" I was transferred to their large retail decorative store in the centre of Cape Town, this was a top end tradesmen's store and sold everything that was used in the painting and decorating industry. As time passed I attended paint training, wall papering and glass cutting courses. Later I was taught interior decorating by top professionals from the United Kingdom. I was then assigned to decorating showrooms and worked with architects, finally running the division.

I later represented the company in the automotive, industrial and wood finishes industry. The Group now included GC Shave, Albertone Paints, Prolux Protea Chemicals, Dulux and AE&CI. The group then entered the marine and shipping container business and later via Rennies Coasters moved into petroleum storage. I spent twenty years in various divisions of GC Shave and the rest, travelled the country and met great business men as well as gentleman in the trade.

Leaving the group, I worked for Fergusson for twelve years, Plascon ten years and later on Dekro and Jotun for twelve years mainly in the marine and container coatings.

I managed Dekro's marine and technical divisions for 12 years, until my retirement at 65 yrs old.

How and when did you become involved in the Corrosion Institute?

I have devoted more than twenty five years to organizations such as SAPMA, OCCA and the Corrosion Institute of Southern Africa.

In the past most top managers in the industry encouraged their staff to get involved with industry Institutes and Associations. Having had dealings with past Presidents and committee members on my travels and exchanging ideas, I was a keen starter. They offered training and courses that could help one gain more knowledge about the industry. Soon after joining the Corrosion Institute I was co-opted onto the Western Cape committee, after which I was nominated as Chairman where I remained for five years.

The Institute at that stage was extremely strong and everyone in the trade was keen to participate

What was the state of the industry then, what role did you play and what successes were made?

During that time I worked close to Dr Brian Callaghan (CSIR) and Mike Russel (SAPMA) on the training paint courses that were conducted at the Cape Town Technical College.

We developed some of the best contractors and inspectors to service the industry on land and offshore. We put a huge number of candidates through the courses and into the field.

I really enjoyed every moment I spent with these groups. They appreciated what I did for them and would always mention events that occurred that were rewarding to the team. We felt good after our labours!

What advice do you have for the industry going forward?

The industry has changed from those years, the new generation are not keen to offer any of their spare time to the industry, it's a matter of dog eat dog and "what's in it for me?"

To the youth entering our game, build your paint knowledge, listen, ask questions and keep your eyes and ears open for contacts in order to build relations within the work place. Read up on all you can and build your knowledge of different products and applications thereof. Know the opposition's products in order to assist your clients when required to do so. Service your clients regularly and be punctual. Keep training and teaching and bring the youth in, we are in a great industry, keep up the good work.

Due to limited space it is difficult to mention all the people, past and present, that I salute for their contributions, kindness and time offered to me over the years in the industry.

Going back I feel I did everything I could have done to assist where I could and never once refused when asked.

I feel the companies that employ so-called paint people, need to consider doing more training especially in the field. Hands-on to know more about the equipment used in the trade, which is lacking. There are a number of guys out there that are willing to help.

Something about yourself

I am still happily married to Wilna after 50 years, who loves gardening and flowers (particularly roses). We have two children a son who is married with two children and a daughter, single who devotedly works for a corporate.

My spare time when I have some is restoring old motor vehicles for which I have won several awards at shows.

Represented Western Province in cycling; Chairman and selector for many years; Life President of City Cycling Club (Est. 1889) and many other sporting achievements.

At this age enjoy walking, looking at nature and still like a good party!

I will always be grateful to the great mentors that taught me never to forget where I come from.

And finally Dan's life advice – "Never give up for that is just the place and time that the tide will turn!!"

Dan J Durler. Born 14 July 1937

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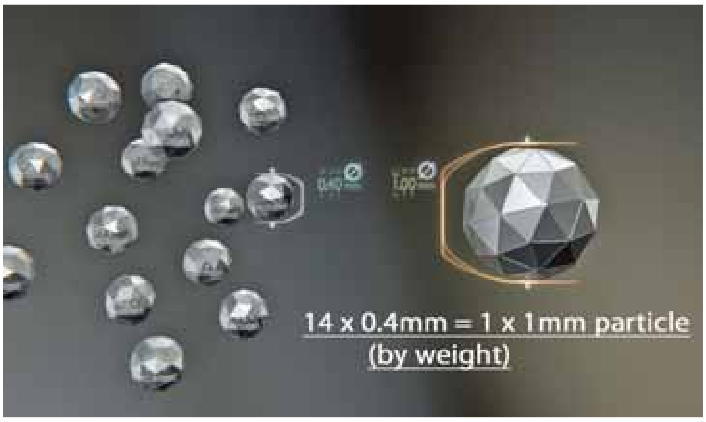

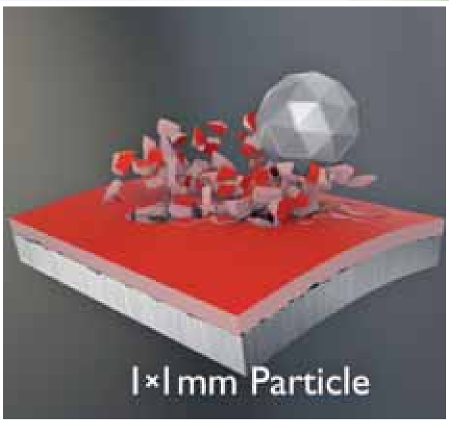

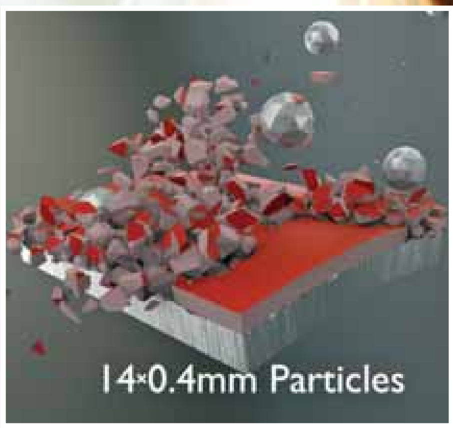

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