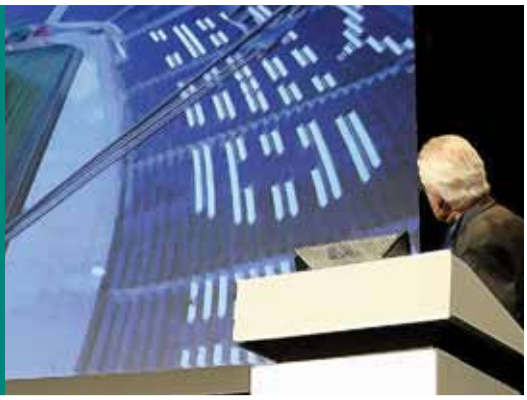
HOT DIP Galvanizing TODAY 65
Hot Dip Galvanizers Association Southern Africa 2017 Volume 14 Issue 1



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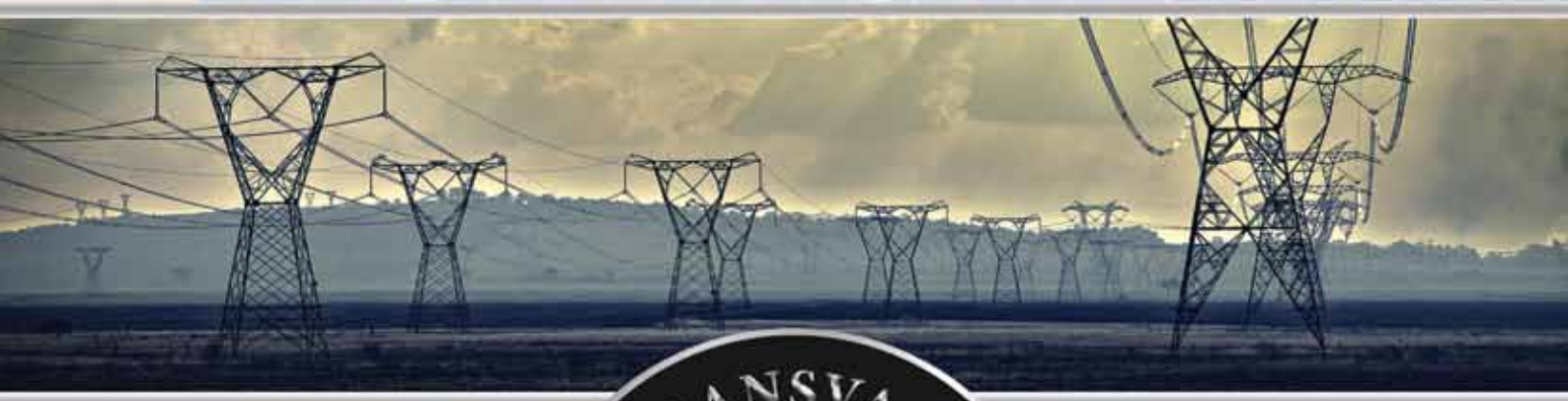

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Bedfordview Office Park, Building 2, Ground Floor, 3 Riley Road, Germiston
P.O. Box 2212 Edenvale 1610 Tel: 011 456 7960 Fax: 011 450 0728 Email: hdgasa@icon.co.za Website: www.hdgasa.org.za

Executive Director: Robin Clarke Cell: 082 909 5119 Email: robin@hdgasa.org.za
Publication Liaison: Anthony Botha Cell: 076 440 2793 Email: anthony@hdgasa.org.za

Advertising and Sales: Anne van Vliet Tel: 011 462 5073 Cell: 082 775 0711 Email: anne@communiquepr.co.za
Richard van Vliet Cell: 076 299 3471 Email: rvanvliet076@gmail.com
Design and Layout: Sandra Addinall Tel: 011 868 3408 Email: cbtdesign@adcot.co.za
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Executive Director's Comment

Welcome to the latest edition of Hot Dip Galvanizing Today.

There are various mechanisms through which the Hot Dip Galvanizers of Southern Africa markets and promotes the use of hot dip galvanizing as a preferred technology for corrosion control of steel and iron components.

One of the most important activities centers around "spreading the word" through education. The Association is able to tailor courses to suit the needs and requirements of any interested party. Such courses or presentations may range from one-day seminars to our universally recognized "level two" course. This course has, with minimal tailoring for local consumption, been adopted for training in both Brazil and Spain. The level two course is aimed at qualifying inspectors to perform inspections relative to appropriate SANS/ISO standards for batch, continuous, spin, wire and fastener galvanizing. The Level 2 course carries accreditation for the awarding of three CPD points.

All courses have a broadly similar structure, this being:

- The fundamentals of corrosion
- How zinc protects
- Standards and methods for predicting service life of Hot dip galvanized components
- Standards and methods for the inspection of Hot dip galvanized components

The Association website carries comprehensive details relating to these courses, as well as target dates and venues for 2017.

The Association has watched with interest one of the heaviest cost drivers in the galvanizing industry worldwide, namely the price movement of Zinc.

The price of zinc escalated by approximately 30% in the period June 2015 to July 2016. The following 6 months to year end 2016 saw a further 11% increase. Drawing from research of the Lead and Zinc study group as well as the USA research consultancy CRU, this price phenomenon has arisen primarily as a result of decreasing zinc concentrate levels due to mines being closed or mothballed. Whilst a global "inventory overhang" exists there is decreasing gap between stock of refined zinc and production of the concentrate. This trend is predicted to continue until, in the medium- term, mining activity is increased to restore concentrate levels to match market demand for zinc consumption.

Robin Clarke

INTERGALVA
17-22 June 2018 Berlin

Intergalva 2018 Update

Preparations are already well advanced for the 25th International Galvanizing Conference – Intergalva 2018 – to be held at the Estrel Hotel, Berlin, 17 to 22 June 2018. This 'must-attend' event for the worldwide galvanizing industry includes conference sessions that cover technical, commercial and environmental topics and is accompanied by an extensive exhibition of equipment, services and materials for the industry.

The Intergalva series began as long ago as 1950 and was last held in Liverpool in 2015 *(see issue Volume 12 Issue 2 2015)*. The 2018 event is organised by European General Galvanizers Association (EGGA) and hosted by Industrieverband Feuerverzinken. The 3-day conference programme with simultaneous translation planned in German, Italian, Spanish, French, Polish, Chinese and Japanese languages. Participants will include owners, operators and managers of galvanizing plants; users of galvanized products; corrosion specialists; suppliers of equipment and services to the galvanizing industry and suppliers of zinc and zinc alloys.

Berlin is Germany's top tourist destination – with three UNESCO World Heritage sites and 180 museums. It also has a reputation for a 'great for a night out' with over 11 200 restaurants, 2 300 bars and 200 different performance stages in the city.

A 'Call for Papers' has recently been launched with proposals sought in these topics:

- **Market and product development** – including coating durability; new applications in bridges, concrete reinforcement and other sectors; coating technology.
- **Process technology** – including plant design; kettle management/

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life; flux and degreasing technology; post-treatments; bath alloys.

- **Environment and safety** – including improvements in environmental performance; operational safety; material efficiency.
- **Regulatory status** – including regulatory issues affecting markets/applications; future evolution of environmental controls on processes.
- **Sustainable development** – galvanizing's contribution to meeting the goals of sustainable building and maintaining the value of infrastructure assets.
- **Galvanizing in architecture** – applications in building and construction.

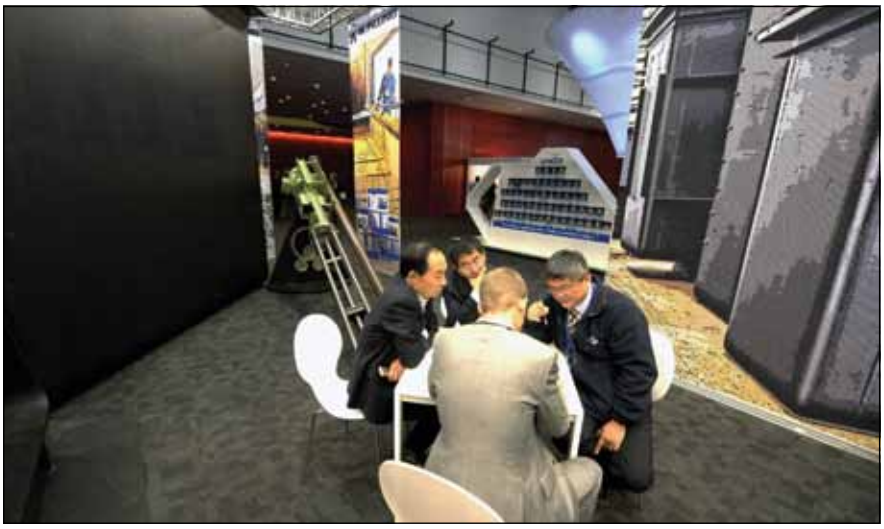
The deadline for submissions is 1 July 2017 and accepted papers will now be notified by 1 November 2017.

A feature of Intergalva 2018 will be the opportunity to visit some of Germany's leading and most technologically-advanced galvanizing plants. The programme of visits has already been drafted and will include 14 plants spread across the country. In addition to visits around the Berlin area, delegates will be able to plan their trip to Intergalva 2018 to include 2-day visits on 21/22 June 2018 to the areas of Munich, Cologne or Bremen that will include a chance to do some sightseeing alongside the visits to the plants.

A briefing session for major exhibitors was already held at the Estrel Hotel on 8 February 2017 – to demonstrate the exhibition facilities and the opportunities for large-scale displays of plant and equipment. The floor plan and exhibition sales will be available from mid-2017. With the FIFA 2018 World Cup taking place during the event, large TV screens and refreshments will likely feature in the exhibition booths and the exhibition will be open through the evening to create a 'fan zone' atmosphere!

Intergalva 2018 will also continue the short workshops that were new for the 2015 event. Consultations will start very soon, through an online survey and LinkedIn discussion, to identify the workshop topics. During 2017, the entry process for the Global Galvanizing Awards 2018 will start. These awards will be held in conjunction with Intergalva 2018 – to recognise the innovative use of galvanized steel by architects, engineers and steel constructors *(see https://www.intergalva.com/awards/)*. HDGASA members will be able to register as delegates to Intergalva 2018 at a reduced delegate fee when registration opens in December 2017. A discount code will be provided by the association and should be used during the online registration process. Another benefit of membership!

German galvanizing plant.



Exhibition stands for galvanizing equipment.

Exhibition booths for process and product exhibitors.

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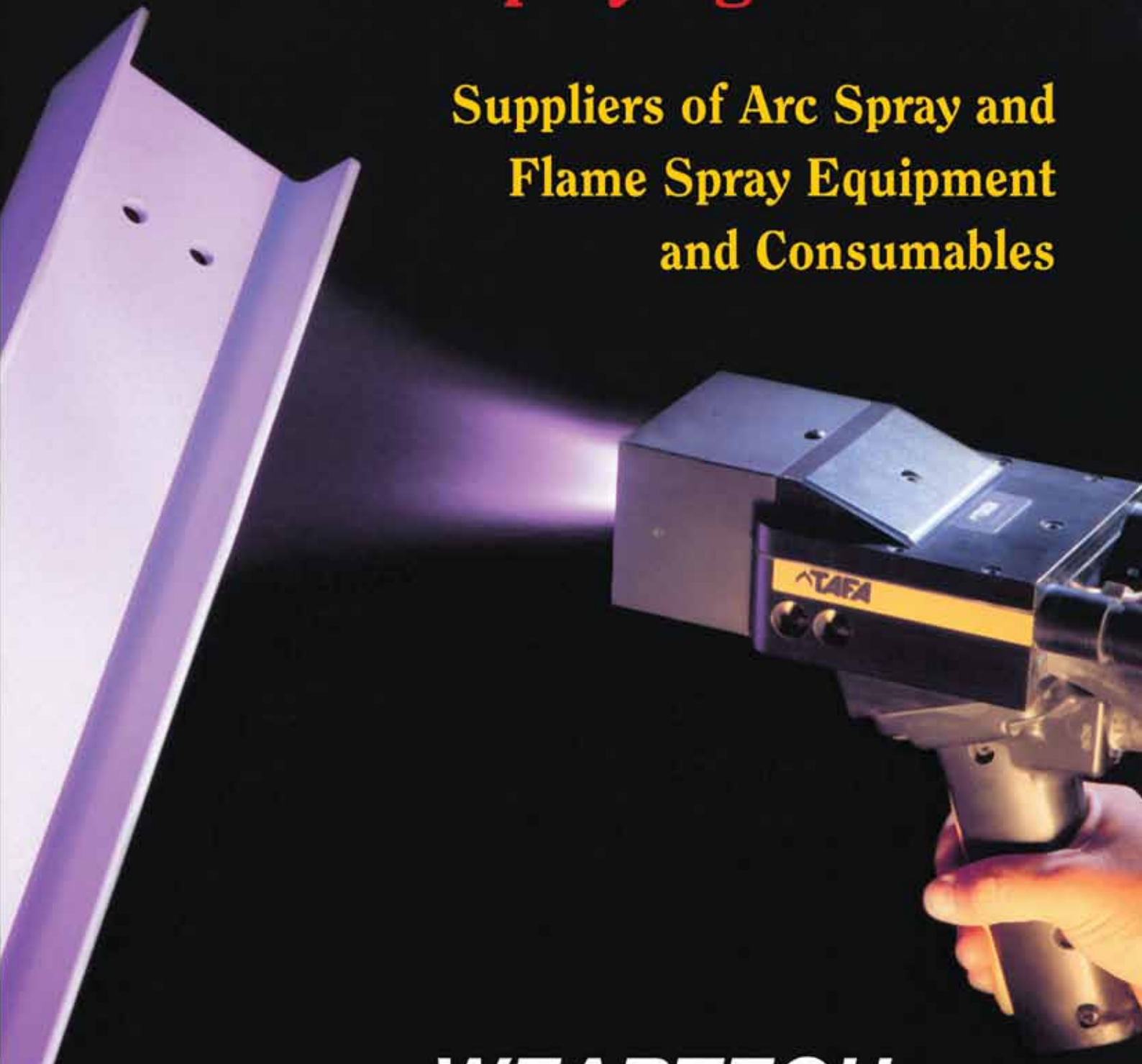

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Phoenix Galvanizing celebrated 20 years in business in 2016

Phoenix Galvanizing – KZN's largest hot dip galvanizer celebrated its 20th anniversary in September of 2016. Phoenix Galvanizing ranks among the galvanizing industry's significant players. The company had rather humble beginnings. Phoenix Galvanizing was launched in 1996 by entrepreneurial brothers, Roy and Anni Ramkisson. They were in the steel fabrication business at the time, specialising in domestic and industrial steel security products when they identified a niche in the market for a company that could provide local, quality hot dip galvanising. Armed just with their passion, drive and determination to build a business that could make a difference and stand out from the rest, they proceeded to commission and build the largest hot dip galvanising plant in KwaZulu-Natal. Phoenix Galvanizing became a reality when the first dip took place on September 6, 1996. Significantly, the first item ever to be hot dip galvanized was a Hindu Aum sign.

In addition to its size and capacity, Phoenix Galvanizing was also ground breaking in that it was the first fully non-white owned and operated hot dip galvanising business in South Africa. "The opportunity to venture into new territory was largely due to the dawn of the new democracy in 1994, with the late Madiba taking office as the first black President of South Africa," explains Anni Ramkisson. He and his brother, Roy, remain at the helm as part of the company's team of directors, who together have grown Phoenix Galvanizing into a household name that still boasts the status of being the largest hot dip galvaniser in the province.

Aerial view of Phoenix Galvanizing.

Directors (from left to right): Ron Ramkisson(Fin. Dir); Roy Ramkisson (CEO); Yashira Ramkisson (Dir: Ops & QS); Ashish Ramkisson (Dir: Ops & Maint); Anni Ramkisson (MD); Amish Ramkisson (Dir: Sales & Mkt).

Phoenix Galvanizing boasts a molten zinc tank, or kettle, 14 metres in length, 2.5m deep and 1.4m wide. It has a total zinc capacity of 330 tons of molten zinc, which is maintained at a temperature of 450 degrees Celsius. The zinc kettle was designed to accommodate some of the largest single pieces of steel fabrication.

The costs of fabrication as well as the onsite construction costs are reduced when longer and wider sections are manufactured as a single piece and subsequently hot dip galvanized as one large article of fabrication.

Phoenix Galvanizing's large tank enables not only significant operational efficiencies and productivity advantages, it also affords its customers significant cost savings overall.

Phoenix Galvanizing strives for the highest level of professionalism and service by using its facilities, innovation, business characteristics and strategies to provide the customer with a competitive advantage not available anywhere else in KZN.

Phoenix Galvanizing has a passion for the customer service and streamlined business processes which drive their uncompromising service in KZN. Their highly efficient and productive 24-hour operation enables delivery at industry-leading turnaround times. The combined experience and expertise of the team provides for consultative input on special projects from the design stage which have included uShaka Marine World's award-winning Phantom Ship, Moses Mabhida Stadium and the King Shaka International Airport as well as numerous Transnet projects.

Phoenix Galvanizing's large, fully-serviced and secure yard space of around 6 000m^2 in laydown space is made available to customers to store their steel products free of charge during the period between fabrication and hot dip galvanizing.

Phoenix Galvanizing also offers full containerisation services that include all the necessary pre-load quality checks, correct loading of the galvanised products into the container and the transport of the container directly to the harbour for export.

Dedicated transport facilities collecting fabricated steel at the point of manufacture by Phoenix Galvanizing offers customers a combined service that can also be used to deliver the finalized galvanised steel to site. The fleet consists of vehicles that vary in size from one-ton bakkies to 24-ton horse and trailers.

Phoenix Galvanizing has a depot in Port Shepstone, where steel is dropped off by customers and delivered back to the client within 48 hours.

Phoenix Galvanizing's transport services are available on a daily basis to the north coast as far as Richards Bay as well as to the Midlands covering Howick and Pietermaritzburg.

Phoenix Galvanizing boasts the only hot dip galvanising centrifuge plant in KZN.

Phoenix Galvanizing dedicated transport service fleet.

Here, small items are galvanised in a smaller zinc tank and spun to remove excess zinc from the articles. The centrifuge plant specialises in threaded sections, including the galvanising of nuts and bolts.

Phoenix Galvanizing takes its market status seriously being an accredited Level 2 B-BBEE company and holds both SANS 9001:2008 (Quality Management Systems) and SANS 121:2011 certification. It has been a member of the Hot Dip Galvanisers Association of Southern Africa since inception and complies with all aspects of the associations standards and codes being a responsible corporate citizen.

Coming from a disadvantaged background, Anni and Roy have always placed great emphasis on sharing their success by giving back to the local community and supporting local charities. Among the many causes

it supports are the Verulam Frail and Day Care Centre, Phoenix Child Welfare and the Mariamman Temple in Mount Edgecombe. Phoenix Galvanizing actively fundraises for by arranging events such as golf days and sponsoring special annual events. The directors are also patrons of Duffs Road Child Welfare, and each year, the company hosts the packing of Diwali hampers for the underprivileged. The directors of Phoenix Galvanizing also spearhead the building of the Phoenix Community Hospice and Day Care Centre. The project is progressing well, with the hospice board members successfully achieving the required PBO number.

For the directors behind Phoenix Galvanizing's 20-year success story, this significant achievement is all about the legacy they have built in a unique field that was historically predominantly white-dominated prior to their arrival. "As the directors, we have always been passionate about this business and are proud of the hands-on approach we have followed together with our staff members to create

Zinc plant kettle.

this success. We are also immensely proud of the fact that we have been able to build a business that provides people with reliable employment and a means by which they can improve their lives," says Anni.

This focus on employee welfare, training and skills development has paid dividends in the form of high staff retention. In fact, about 40 percent of employees have been with the company for more than 10 years, while some have even been on board since its inception.

"We understand that Phoenix Galvanizing's achievements have been as a result of the collective effort of the people who make up the company – and we remain passionate about continuing to do business this way," he concludes, "As a result, Phoenix Galvanizing looks set for even further success well into the future."

2016 HOT DIP GALVANIZING AWARDS

Advanced Galvanizing team: Denzil Clifford (Prod Mgr); Sim Swart (GM) and Johan Louw (MD).

Charlene and Robert Bossert.

The 2016 Hot Dip Galvanizing Awards held at Thaba Eco Hotel in Klipriviersberg Johannesburg in November 2016 was a splendid success and justifiably the highpoint of the galvanizing industry's year. Winners were acknowledged for excellence in their respective categories. The overall winner, as judged by the HDGASA panel, was 'The Boomslang' at Kirstenbosch Botanical Gardens in the Western Cape. Officially named 'The Centenary Canopy Walkway' the project and all the stakeholders were recognized for the exceptional engineering of a superb engineering feat.

The next Hot Dip Galvanizing Awards will be held in 2018 giving all stakeholders and disciplines involved with galvanizing and the use of galvanized steel plenty of time to enter their submissions. The HDGASA would like to thank all parties who made the event possible from our Platinum Sponsor – Columbiana Boiler Company to the Gold Sponsors – Monoweld Galvanizers and Transvaal Galvanizers to our Silver Sponsors – Lianru Galvanizers and METSEP. The HDGASA has expressed a special "Thank You" to Charlene Bossert, who managed the project in support of the HDGASA team and without whom the event would have been an arduous task.

Devland Soweto Education Campus

A collaborative development Community Social Investment (CSI) project managed by Growing Up Africa (GUA), is currently constructing an educational campus in Soweto funded by more than 60 partner companies. The HDGASA was contacted, by Monoweld Galvanizers (MWG), to assist GUA regarding corrosion control of seven brackets that had been cast into the concrete superstructure prior to galvanizing. MWG have galvanized the majority of brackets and columns for this project at their facility in Germiston.

The project broke ground in February 2014 and has been the proving ground for more than 200 national and international third year university students and new graduates in disciplines ranging from Civil and Structural Engineering to Architecture and Industrial Engineering. GUA liaises closely with the universities and mentoring organizations to ensure practical real-time on site experience of each student is achieved to the benefit of all stakeholders. Lectures relating to the project have been presented to more than 800 students and an ongoing program of knowledge exchange with these future decision makers anticipates at least twice as many will be exposed to the numerous aspects of the project.

Robin Clarke Executive Director, HDGASA with Deborah Terhune of Growing Up Africa.

Columns and brackets galvanized by Monoweld Galvanizers.

The HDGASA team met with GUA founder, Deborah Terhune and Dimakatso Rampedi aka 'DK', a third year Civil Engineering student, at site to discuss the options for corrosion control of the non-galvanized brackets. The brackets, having been cast into the concrete super structure, could no longer be hot dip galvanized thereby limiting corrosion control options. The HDGASA preferred recommendation was to apply zinc metal thermal spray, with a minimum mean coating of at least 100µm. This approach would ensure both barrier and galvanic corrosion control, ensuring a long service life, of these important structural elements.

The HDGASA is eager to continue supporting this project and similar activities that engage and develop future professionals in our arena of corrosion control. The HDGASA will present workshops on hot dip galvanizing to the students and support the transfer of practical implementable corrosion control knowledge in this venture and others like it.

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COATINGS & CHEMICALS

Zinc, zinc-aluminium and duplex coated sheeting

Definitions

Coil coated sheeting: *Thin gauge steel sheeting produced in coil form, which is subsequently de-coiled, passed through a continuous metal coating processing line and then re-coiled.*

Duplex coil coated Sheeting: *Coil coated sheeting which is provided with an organic paint coating over an initially applied metal coating.*

While hot dip galvanized profiled roof sheeting has performed very well for many years both in Southern Africa and abroad, other protective coating systems have been developed which may in many applications provide a possible cost effective corrosion control alternative.

The first step in selecting a coating system for a structure, is to understand and assess the degree of corrosion attack likely to be encountered in service. This will be influenced to a large extent by environmental conditions which are broadly described as Coastal Marine (very aggressive corrosion-*CX), Industrial (aggressive corrosion-*C4 or C5) and Rural (benign to moderately corrosive – *C1 to C3).[* Ref ISO 9223].

A further factor to consider is the extent to which corrosion inducing chemicals are produced or stored within a building and/ or the presence of corrosive fumes produced as a result of various manufacturing activities for which the building is used.

The metal coating systems available for the protection of steel sheeting fall into three main categories:

1. Zinc-aluminium alloy coated steel sheeting

When it was recognized that aluminium in zinc increased its corrosion resistance, the steel industry developed a coating alloy consisting of 55% aluminium, 1.5% silicon and the rest zinc. This product was first produced by Bethlehem Steel Company and marketed under the name Galvalume and subsequently Zincalume.

Competitive product is now produced by other manufacturers under names such as Alugalva, Aluzinc, Algafort and Zalutite. The coating is applied on non-oxidising continuous anneal hot dip coating lines to a wide range of strength levels.

a) Corrosion resistance

Relying on long term atmospheric exposure tests (accelerated laboratory tests are unreliable), it has been established that thickness for thickness, the Galvalume type coating provides a corrosion resistant coating between two to four times that of pure zinc but with less cathodic protection and with the inherent problem of aluminium in contact with alkalis such as cement. Aluminium and zinc are described as amphoteric metals in that they react aggressively at both low and high pH levels. This is in contrast to steel where the corrosion rate decreases as the pH increases. Aluminium is tolerant down to pH levels of 3.6 while above pH 8.6 it corrodes. The equivalent range for zinc is from about pH 5.5 up to pH 12.5.

The 55% Al –Zn alloy provides good performance under paint, good ductility and reasonable edge protection although hot dip galvanized sheet has been shown to have still better edge protection, particularly on sheets more than about 1.5mm thick. Likewise, the galvanized zinc coating has better ductility properties.

Figures 2, 3 and 4 provide the results of long term atmospheric exposure tests on hot dip galvanizing, Galvalume (55% aluminium) and hot dip aluminium coated sheets. The latter aluminium

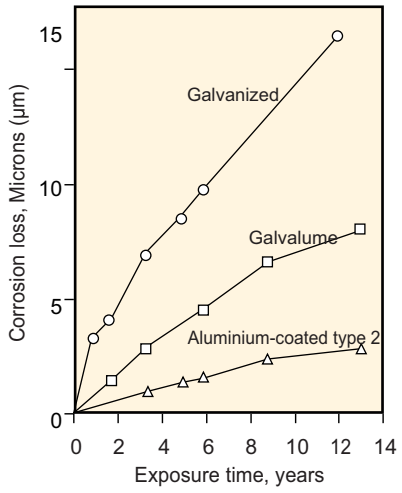


Figure 2: Corrosion performance of galvanized, aluminium coated and Galvalume sheet in a severe marine atmosphere.

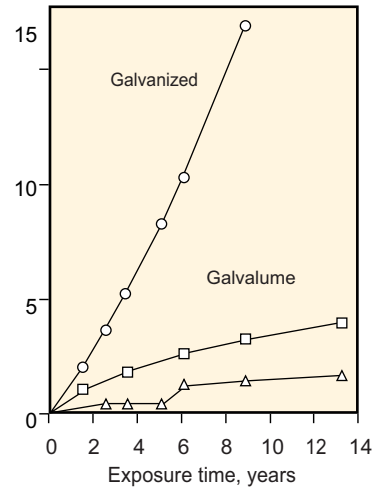


Figure 3: Corrosion performance of galvanized, aluminium coated and Galvalume sheet in an industrial atmosphere.

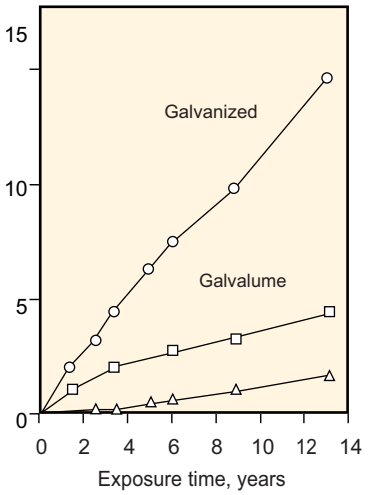
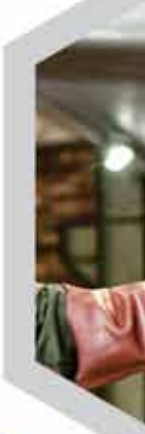


Figure 4: Corrosion performance of galvanized, aluminium coated and Galvalume sheet in a rural atmosphere.



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coating is more expensive and it is not available commercially in RSA.

The excellent performance of Galvalume in the industrial atmosphere (SO_2 pollution) is clear indication of the ability of aluminium to withstand corrosion attack down to relatively low pH levels.

When extrapolating these exposure test results with a view to reliably predicting a maintenance free service life, it is important to take into consideration the original as applied coating thickness prior to exposure. Specifications for coated steel sheet define the required coating by mass expressed as the sum of the coating on both sides of the sheet in g/m^2. This can lead to confusion, particularly if a less dense aluminium containing coating is being evaluated against a normal zinc coating. As a reliable indication, the mean coating thickness per side of the 55% aluminium coated sheet is 14µm compared with 19µm per side of Z275 galvanized material (137.5 g / m^2 = 19µm).

b) Zincalume Resin Coated Steel®

Unlike other types of steel roof sheeting, this can be easily prepared and coated during or immediately after installation. Corrosion "duplex theory" states that the combined life of a zinc containing coating plus a matched organic coating applied early in the life cycle of the sheeting, will be considerably longer than the sum of the lives of the two products when used separately.

Therefore the best protection and hence, life of this type of roof sheeting will be assured by applying a suitable coating early in the life of the roof. The type of organic coating selected will vary depending on the corrosive substances present in the atmosphere (e.g. marine or chloride attack and industrial SO_2 acid attack).

c) Galfan

Galfan is a 5% aluminium, ±95% Zinc coating with a small amount of mischmetal. In this particular application, mischmetal (a special mix of various "rare earth metals") is required to promote effective bonding between the steel substrate and the metal coating. It has become a standard product in many countries for the wire industry and it is being processed in ever increasing quantities by the steel coil coating industry. Galfan is also successfully used to coat steel tubing.

This coating is more ductile than the 55% aluminium alloy which is one of the reasons why it has been developed for protecting wire. Cathodic protection provided by Galfan is more or less the same as that for galvanizing, while general resistance to corrosion is said to be up to twice that obtained from pure zinc. Galfan performs extremely well in coastal marine atmospheres but understandably the 55% aluminium alloy is superior in industrial environments.

Tests undertaken in Belgium indicate that the performance of Galfan in buried conditions is considerably better than that obtained from the 55% aluminium coating. The Galfan coating is generally thicker due to the presence of Zn/Fe alloys in the coating structure.

2) Continuously hot dip galvanized sheeting

The coating applied by this process consists almost entirely of pure zinc with a trace of aluminium (about 0.02%) added to the zinc melt. The coating is ductile and provides excellent cathodic protection at uncoated edges and surfaces where coating damage has occurred.

Hot dip galvanized roof sheeting is available in a range of coating classifications, the most available of which are three zinc coating grades:

- Z275 (137.5 g/m^2 per side) mean coating thickness = 19µm

Durability of hot dip galvanized sheeting exposed to general atmospheric conditions

There is no doubt that in order to optimise the service life of the sheeting on a building in any environment, a factory painted galvanized steel sheeting system is preferred. Alternatively, the zinc coating on the sheeting could be over coated with a suitable paint system preferably shortly after the building is erected. The latter alternative requires a comprehensive coating and application specification and the services of a skilled applicator to successfully apply the paint.

Duplex coating technology suggests that the combined life of the zinc coating and the paint coating can be multiplied by a factor of between 1.5 and 2.7, depending on the conditions at hand.

However, an elaborate duplex coating system is only necessary if the service life required by the sheeting is indeterminable and the additional costs are considered negligible.

If on the other hand, the required service life is determinable such that the overall life of the sheeting is required to be say 15 to 20 years in a C1 to C3 environment, making use of a Z275 class of coating, would be appropriate. Z275 has a nominal coating thickness of about 20µm.

Similarly, if a 35 to 40 year service life in a C1 to C3 environment is required, a Z600 class of coating would be appropriate. Z600 has a nominal coating thickness of 43µm.

Making use of inappropriately coated roof fixing screws or a possible future variance in the local micro-climatic conditions over the prescribed life of the sheeted project, can negatively influence the corrosion rate and hence shorten the overall service life of the sheeting.

- Z450 (225 g/m² per side) mean coating thickness = 32µm
- Z600 (300 g/m² per side) mean coating thickness = 43µm

These are distinguished by the mass of zinc present per square metre of sheet surface.

Since the life of a zinc coating is more or less proportional to its thickness in a given environment, it follows that the Z600 zinc coating will provide more than twice the maintenance free life available from the Z275 coating. The long term atmospheric exposure tests depicted in *figures 2, 3 and 4* demonstrate clearly that the 14µm thick 55% aluminium containing coating is attacked at a considerably lower rate than the pure zinc coating, but the substantially thicker zinc film of about 43µm on Z600 galvanized sheeting more than compensates for this.

The most commonly used galvanized roof sheet coating is Z275 which provides extended corrosion control in moderately corrosive environments. When this coating is used in corrosive coastal marine or heavily polluted industrial applications, duplex protection by means of an organic paint coating is recommended. Painting should take place sooner rather than later in order to avoid an accumulation of zinc corrosion products on the zinc surface which may be difficult to remove prior to painting. For optimum corrosion free life as well as for aesthetically pleasing architectural purposes, duplex coating is also recommended in environments where moderately corrosive conditions pertain.

3) Duplex coil coated sheeting

Factory applied (usually silicon/ polyester/urethane) coloured coatings can extend the life and improve the appearance of profiled sheeting considerably.

This type of product has been manufactured in South Africa for many years. Improved versions are currently being offered in technical publications and periodicals.

Coil coated sheeting is an excellent choice for vertical cladding of a building and other high visibility areas. If correctly installed, it will provide excellent durability both inland and in coastal marine environments, other than in the aggressively corrosive zone which, depending on land contours and prevailing wind direction, is more or less within one kilometre of the surf line.

Where significant weathering of the topcoat has occurred, the coil coated sheeting should be recoated by a coating specialist well experienced with this type of material. 8 to 12 years after installation is the usual recommended recoating interval.

Each protective coating system has its strengths and weaknesses.

Edited from initial publishing in Hot Dip Galvanizing Today Volume 4 Issue 1 2007. Acknowledgement to Frank Porter's Zinc Handbook for the corrosion performance graphs.

History of zinc, its production and usage (Part 2)

Dr. Marinanne Schönnenbeck and Frank Neumann (subedited and reprinted from a published report by Rheinzink)

Modern production processes

In Nature zinc is found in the form of compounds involving oxygen or Sulphur. The most important zinc mineral is zinc blende (ZnS). It often occurs together with galena, iron pyrite, copper pyrite and other minerals.

The weathering of zinc blende gives rise to carbonatic and siliceous zinc minerals, known as oxidic zinc ore or calamine. In addition, zinc deposits generally contain other valuable metals on a scale that is of economic interest, with lead occurring most frequently. Other important metals are copper, silver, iron, manganese and cadmium, as well as low levels of other metals. Some 90% of zinc ore is mined by underground working. Normally the ore is processed into concentrates near the deposit site in several stages via flotation and then used as the base material for subsequent smelting.

The following processes are available for the production of zinc from these concentrates:

- zinc electrolysis,
- the Imperial smelting process and New Jersey zinc distillation (for refining crude zinc).

There are also plants for resmelting and liquation, i.e. for thermic separation, of zinc scrap.

High-grade zinc is produced during zinc electrolysis using a hydrometallurgical process, which involves the following steps:

- **Roasting:** the roasted blende is oxidised from the concentrates, producing SO_2-containing off-gas, which undergoes further processing into H_2SO_4 in a separate system,
- **Leaching:** the roasted material (roasted blende) is dissolved in sulphuric acid,
- **Purification of leach:** here accompanying elements such as copper and cadmium are separated from the leach, resulting in the so-called neutral leach,
- **Electrolysis:** the zinc is deposited electrolytically from the neutral leach on the cathode,
- **Resmelting:** in a final step the cathodes are resmelted into blocks of zinc.

Zinc electrolysis results in a high utilization level of the concentrates. Increasing use is also being made of secondary raw materials rich in zinc in this hydrometallurgical process.

As a pyrometallurgical technique or Imperial Smelting process provides for the direct processing of concentrates and secondary raw materials. The main energy source is coke. In addition to the primary products of zinc and lead the process also produces slag, which can be used in the construction sector. This process accounts for some 15% of the world's zinc production.

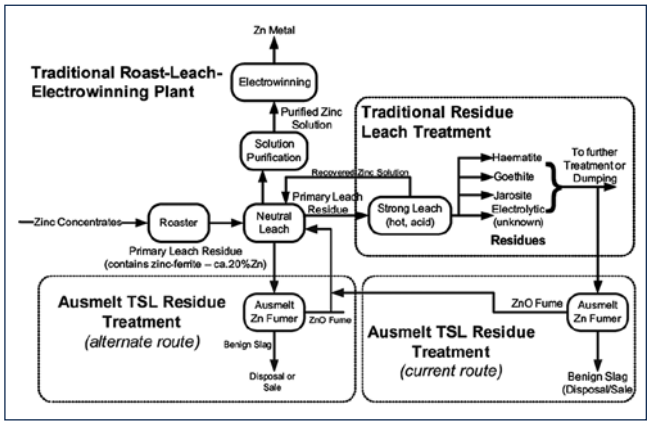

Figure 8: With zinc electrolysis zinc is deposited from the neutral leach on the cathode. (according to Hullmann (Publ.): Natürlich oxidierende Metalloberflächen).

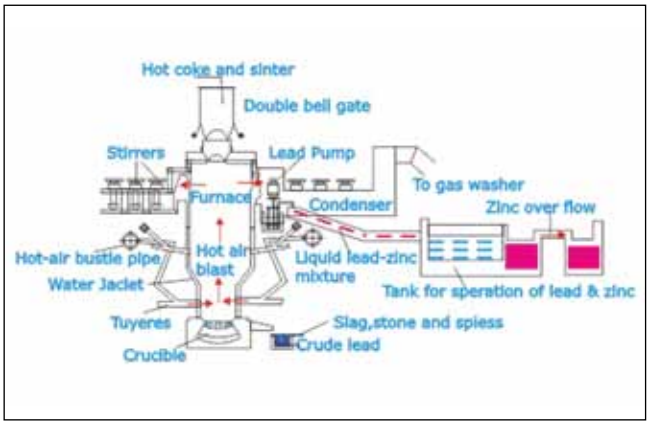

Figure 9: Diagram showing the extraction of zinc and lead using the Imperial Smelting process in a shaft furnace (graphic Initiative Zink).

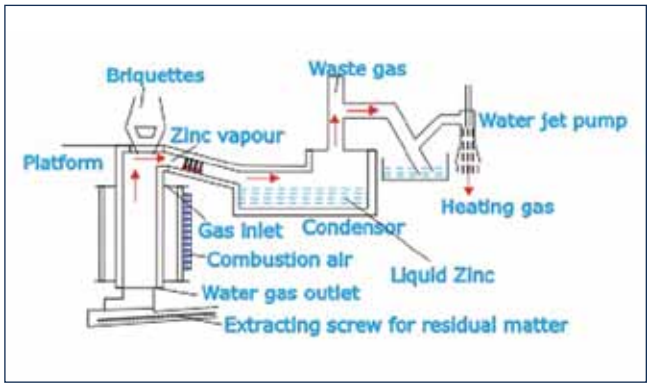

Figure 10: Process flow diagram for New Jersey zinc distillation (according to Hullmann (Publ.): Natürlich oxidierende Metalloberflächen).

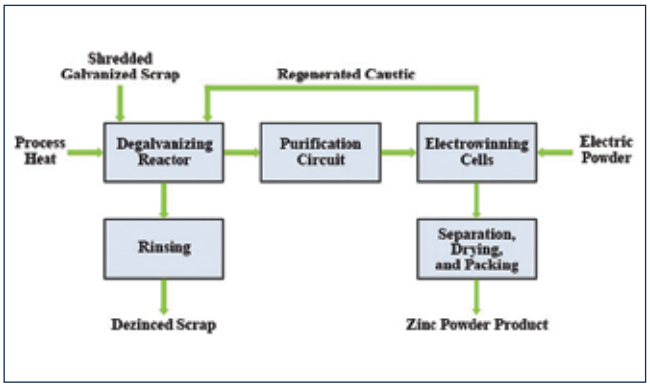

Figure 11: Processing of zinc scrap via smelting and liquation (according to Hullmann (Publ.): Natürlich oxidierende Metalloberflächen).

The individual steps of the IS process are as follows:

- **Briquetting**: secondary raw materials and "waelz" oxide are hot-briquetted,
- **Roasting:** concentrates are desulphurised (roasted) via sinter roasting and agglomerated with recycling materials,
- **Reduction and condensation:** hot briquets and sinter are reduced with coke in the IS furnace. Zinc is discharged with the blast furnace gas and condensed as crude zinc. Lead is discharged at the lower end of the furnace.

To extract high-grade zinc this is followed by two-stage distillation according to the New Jersey process, involving removal of the remaining accompanying metals.

Zinc distillation according to the New Jersey process for the production of thermic high-grade zinc involves distilling crude zinc from primary and secondary raw materials in a single or two-stage process. Here the entire quantity of the crude zinc can be distilled or only part of it to recover both high-grade zinc and cadmium-free commercial zinc or a cadmium alloy depending on the requirements.

During New Jersey zinc distillation all intermediates undergo further processing so that no waste materials are left over.

Processing zinc scrap involves resmelting and liquation after the necessary sorting of the scrap material. The individual process steps are:

- **Sorting:** zinc scrap, aluminium and iron parts are separated from each other,
- **Smelting:** unmixed scrap is resmelted, clean scrap melted and liquated, mixed scrap melted down in a furnace
- **Liquation:** the constituents of the molten metal are separated according to their different melting points; this process also produces hard zinc, an iron-zinc alloy.
- **Casting:** the zinc alloys and zinc are then cast.

The Waelz tube process is used when processing feedstock with a low zinc content typically as occurs during recycling. Here the feedstock is first formed into moist balls (pelletized) and then heated in a rotary furnace (Waelz tube). The zinc contained in the material vaporizes, is oxidized and can be recovered as "waelz" oxide after cooling in a filter.

One important source of feedstock with low zinc levels is the filter dust containing zinc produced when recycling galvanized steel parts. Recycling the zinc found in such dust using the above process has represented the state-of-the-art technology for many years.

Production of sheets and strips

One major advance in the production of zinc strips in predefined thicknesses was the introduction of the continuous wide-strip casting and rolling process at RHEINZINK. Here an alloy of zinc, copper and titanium was smelted in a coreless induction furnace at a temperature

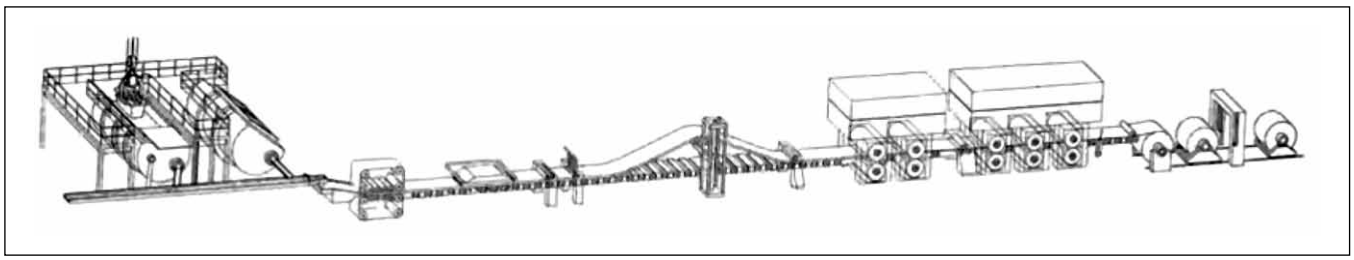

Figure 12: In the casting rolling-process zinc strips are produced from liquid metal in the form of a coil using a continuous process.

Figure 13: In the casting machine the finished alloy is provided with the input cross-section necessary for the rolling process with simultaneous cooling.

Figure 14: At the end of the rolling train the finished strip is wound into large coils and stored temporarily for cooling.

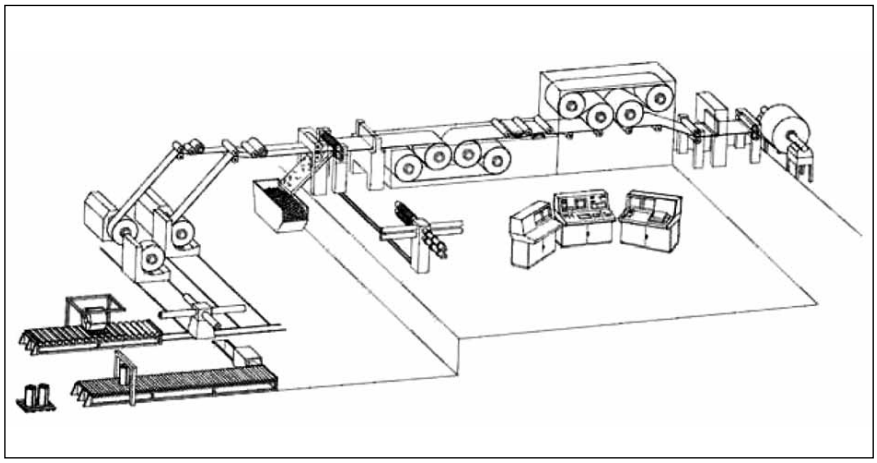

Figure 15: A stretching, bending and straightening system is used to eliminate stresses in the strip, which is then divided longitudinally and crosswise depending on further processing.

of approximately 760°C. This produces master alloy blocks that are then melted in a core-type induction furnace and mixed with high-grade zinc.

The resulting alloy is next passed to the casting machine in liquid form. Here it is cooled below melting point by a closed water circulation system to produce solid billet. The billet passes through a cooling section and loop towers to compensate for any minor differences in speed of the process which runs at a constant rate. The thickness of the material is reduced in steps. The careful coordination of pressure and cooling is used to influence the metallurgical properties of the material such as ductility, tensile strength and long-time rupture strength.

After rolling the finished strip is wound into large coils. The rolling process subjects thin sheets to stresses which are undesirable during subsequent usage. To eliminate such stresses the material is stretched, bent several times and straightened in another process. It can then be divided longitudinally and crosswise and processed into sheets for roofs, facades or roof drainage products.

Deposits and reserves

The deposits of zinc ore in existence are only known for as far as they have been investigated for mining in the present and near future with other deposits explored regularly thus changing the limits of availability, also depending on the technology used and the achievable supply pricing.

The zinc content of the reserves of ore definitely and probably considered to exist at the turn of this millennium was approx. 200 million tons. It is estimated that half of this has been identified in Australia, China, the USA and Canada. With total reserves of zinc identified in terms of the metal content of the deposits are estimated at approximately 1.9 billion tons in total globally. The exploration of other resources in association with appropriate market price adjustments will ensure zinc is available on a long-term basis. In addition, some 30% of the zinc used in the world today is recovered through recycling. This percentage has already been exceeded in Germany and is set to rise globally over the coming decades.

Applications and recycling today

Zinc is mainly used for the following applications:

- in the form of sheets and other semi-finished products, in particular in the building industry,
- in alloys, mostly combined with copper as brass and with aluminium to make die-cast parts – around one third of total zinc production,
- to protect steel parts from corrosion – around half of total zinc production,
- in the chemical industry as zinc oxide and zinc dust.

Zinc sheets are used in construction, not only to protect steel parts from corrosion, but also for roofs, facades and roof drainage. At the end of their service life they can be melted down again and reused as secondary zinc in alloys, for galvanisation or in the chemical industry.

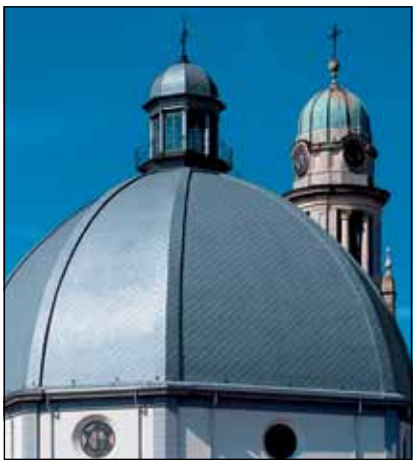

Figure 16: Zinc roofs are a good solution for historical buildings even with challenging geometries.

Figure 17: Facade design featuring zinc with a durable, naturally patina ting surface.

Figure 18: Zinc scrap is a valuable base material for new zinc.

Die-cast parts made of zinc are used for example in domestic appliances and vehicles are shredded up with these products at the end of their useful life. The zinc is then separated from the other materials and reprocessed.

Scrap brass contains a high level of copper and is mainly recycled directly in the brass and copper industry. Depending on the process used, the zinc either remains in the remelted alloy or is separated as zinc oxide via flue dust and forms part of new products made of zinc. Scrap from galvanized steel parts is recycled in steel production. The zinc vaporizes and is then recovered as filter dust. It can then be reused for the production of zinc.

The level of recycling is often described by comparing the quantity of recycled material against the new material produced over the same period of time. This definition is however misleading. If we compare the old waste occurring today against total production at the time this material was produced, it will then become clear that zinc is used with minimally consumption. In Germany the different volumes and usage periods occurring, for the individual applications, is at an average of 30 years. The recycling rate thus defined for the zinc used by the German building industry is virtually 100% recyclable.

The complete recycling cycle for zinc shows the complexity of the processes involved, but also the value of the different types of new and old scrap. The recycling of zinc rich metals is important reducing the unnecessary quantity of useful materials left to revert back to its primary existence in landfills.

Zinc and life

Zinc is an essential trace element for living organisms. The amount of zinc needed by humans depends on age, sex, possible pregnancy and nutritional conditions. The intake of zinc is regulated by an endogenic mechanism according to the requirement for and level of zinc in the diet. The intake of zinc from diet thus varies between 10 – 80%. The availability for living organisms may be affected by changes in the gastrointestinal tract, other substances involved and the types of food consumed. Zinc levels for an adult are around 1.5g to 3g for a person of 70kg mass. The elementary biological significance of zinc is underlined by the fact that it is present in every organ and all bodily fluids.

Zinc and its many forms and uses will remain an integral part of man's world, this mineral and its role as a key element to life and the living is significant to all life on this planet.

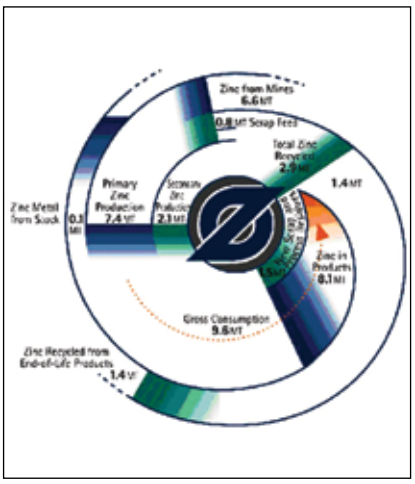

Figure 19: Recycling cycle for zinc (according to IZA).

"Knowledge is the only instrument of production that is not subject to diminishing returns" John Maurice Clark

COURSES OFFERED

Level I: Introduction to Hot Dip Galvanizing

The HDGASA one day INTRODUCTION TO HOT DIP GALVANIZING course is designed to provide an initial understanding of the concepts relating to hot dip galvanized coatings applied for corrosion control of steel components. The course comprises six modules. In order for the course to be viable we require six or more candidates to attend. Arrangements can also be made for this course to be held at a venue of your choosing for more than six candidates. In addition to the course, a special visit to a hot dip galvanizing plant may be arranged on a separate date, should six or more candidates be interested and able to attend.

Level II: Certified Galvanizing Inspectors

The HDGASA advanced Level II course provides the necessary skills to assess the quality and conformance of Hot Dip Galvanized coatings and Duplex Systems to the applicable specification. Delegates are introduced to other metallic type coating specifications and their application for corrosion control design.

The course provides an in-depth interpretation of the specifications and accepted best practice procedures for determining coating thickness, visual inspection of surface finishes as well as the evaluation of these coatings for corrosion control of steel components. The course includes a visit to a hot dip galvanizing plant where delegates will have an opportunity to assess finished product against the relevant quality standards on a real time first hand basis.

Three Continuous Professional Development (CPD) points are awarded to delegates attending the entire course. Bookings are limited to a maximum of 10 people, with applications treated on a first-come-first-serve basis. In order for the course to be viable we require 6 or more candidates to attend. Arrangements can also be made for the course to be held at a venue of your choice for more than 6 candidates.

ENROL IN A COURSE TODAY!
CALL Lara at 011 456 7960
EMAIL: hdgasa@icon.co.za

HOT DIP GALVANIZERS ASSOCIATION SOUTHERN AFRICA

UJ Students introduced to hot dip galvanizing

A one day course, *Introduction to Hot Dip Galvanizing*, was presented on 28 February 2017. Delegates, predominantly 4th Year University of Johannesburg students from a variety of disciplines that included civil engineering, mechanical engineering, architecture and metallurgy were hosted by **Growing Up Africa** (GUA) at the training facility on the *Devland Soweto Education Campus* site.

Deborah Terhune of GUA coordinated the course which Robin Clarke, Executive Director of the HDGASA, presented. Six modules were covered introducing the delegates to all aspects of hot dip galvanizing. Corrosion in principle and its many forms, including an overview of the environmental factors affecting corrosion, was followed by examination of hot dip galvanizing's unique basket of corrosion control mechanisms. The relevant standards applicable to hot dip galvanizing were covered, particularly focussing on the evaluation of the final product. The hot dip galvanizing process and plant layouts, with an emphasis on typical batch type hot dip galvanizing plants were also introduced to attendees. The course provided a succinct yet clear picture of hot dip galvanizing, its benefits and application as a premium corrosion control measure.

The introductory course to hot dip galvanizing was well received by the attendees who now have a better appreciation for hot dip galvanizing and its low maintenance and long service life benefits in many and varied fields of application. The HDGASA intends to continue engaging with students of this calibre to ensure a practical and accurate knowledge of hot dip galvanizing and its application will endure as the corrosion control system of choice in the future.

Malcolm Wilson

Malcolm retired in 2016 from Voigt & Willecke. The Hot Dip Galvanizers Association wishes Malcolm well in the days to come, as an active Professional Member of the Association in KZN. Malcolm's vast experience and knowledge is still an asset to the industry.

SOUTHEY LEVEL II INSPECTORS COURSE

Southey Contractors accommodated a HDGASA Level II: Certified Galvanizers Inspectors Course at Kusile Power Station in Mpumalanga, from 28th to the 30th of November 2016. The course practical was hosted at Transvaal Galvanizers where the delegates were guided through both the batch and dragline plants.

Back: Egmont Dennyschen; Cain Luhlanga; Marthinus van Rooyen; Byron Gamildien and Marius van Tonder. Front: Griff Fitzsimmons; Ralph Verbiest; Jaco Du Bruyn; Riaan Nienaber and Abram Makuwa.

SILVERTON – GALVADIP DIVISION

A Level I course was held at Silverton in Pretoria on the 18th of January 2017. Seven delegates attended the refresher course arranged by Silverton's Commercial and QA managers. The course reviewed the basics of corrosion control and the parameters relevant to the critical elements in the hot dip galvanizing process. A constructive Q&A session was followed by a two hour exam.

5 LINCOLN RD, BENONI SOUTH, 1502 | PO BOX 15040, FARRARMERE, 1518
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SMT GALVANIZERS

SMT Galvanizers are specialists in the hot dip galvanizing of all types of fasteners including the treating of embrittlement on site. We do offer a wide variety of services to our clients by creating a comprehensive supply chain for all their galvanizing needs. Our expert services are procured by hand railing, flooring, construction, fabrication, civil and general engineering industries for open dipping.

All work is done according to SABS-ISO 1461SANS 121 Specifications. SMT Group is SABS and SATAS accredited and BEE compliant.

SMT Group offers the following services,

- **Hot dip galvanizing** - spinning and dipping;
- **Electroplating** - Barrel work (Yellow and trivalent blue passivating);
- **Electroplating** - Jigging up to 3.5meters;
- **De-embritteling** on site;
- **Fabrication** workshop with certified welding operators;
- **High Tech engineering workshop** - cnc milling, turning and dynamic balancing;
- **Design and building** of machines to customer requirements;
- **Supply** of electrical spares at the best prices.

SABS SATAS SEESA

SMT GALVANIZERS
SPINNING & DIPPING

SMT Galvanizers (Spinning & Dipping) | **jan@smtgroup.co.za**
SMT Electroplaters | **kevin@smtgroup.co.za**
SMT Steel (Engineering) | **bernadette@smtgroup.co.za**

Personality Profile

LARA TEIXEIRA

What is your vision as the HDGASA office manager?

To bring order to all administration tasks. I look forward to bringing in my creative skills and knowledge and taking an active role in the Associations publication, events and members needs. I would like to build and maintain meaningful relationships with our members, suppliers and customers. Lastly to bring credibility to the Association in all that I set out to do.

You have qualifications in film, how does that fit in with the Lara today?

As a young woman I was incredibly free spirited. Whilst I matriculated with outstanding results in Mathematics, I wanted to get out there and experience life for everything that it was. I felt there were only a few short years to be young and reckless. Film and editing was my escape into another world. A part of me always knew that sometime in my thirties I would have a more traditional approach to life. The film and television industry is exciting, but incredibly cut throat and the insane pressure leaves little time for family. It's now more of a hobby and once again numbers dominate my life. Working for HDGASA I may just get to tap into that creative side again.

What would you consider a significant career achievement?

My career has taken many different roads. As an editor I had the privilege of working with some amazing organizations such as WHO and influential individuals. As a franchise owner I was humbled at the struggling world of small business and gratified at turning my stores into something a little fruitful.

On a personal note, tell us a bit about your family and pastimes.

Four years ago I married my varsity sweetheart. I am mom to two beautiful little girls and a scruff mutt rescue hound "Bernie'. I matriculated from Damelin College in 2000. As a family we are spending a lot of time outdoors rediscovering the world through my children's eyes. Weekends are filled with belly giggles, mud pies and dirty faces.

Who has been the biggest influence in your life and why?

My husband Terence, for his amazing support and encouragement in every aspect of my life. For helping me be real and standing strong through the not so rosy parts of life. I would have to say that my dad fills this role too. He has taught me self-control, problem solving and that you are never too old to dream.

What is your philosophy of life, in a nutshell?

Choose! Choose to be happy. Choose to see the beauty in life and people. Choose to be kind. Choose to be understanding. Choose to be present. Being nice takes nothing away from you but can give so much to someone.

What books do you read and what interest do you have in this regard?

I love fiction. My favourite author is Khaled Hosseini, most probably because he writes 'hard' stories set in a life I know very little about. Currently on my bedside table is Dr Seuss and a number of fairy tales- my oldest daughter is definitely a book worm like mom.

What dislikes do you have?

Ignorance. There is so much we can learn from every person we meet yet often our own ignorance and defiance cut us off. While we may not agree with others opinions we could certainly try to understand them.

How would you finish the sentence "At five o'clock on a Friday, I…"

Am negotiating with a toddler about how much more frozen yoghurt she really needs. This is our weekly indulgence over some animated conversation.

Any last thoughts?

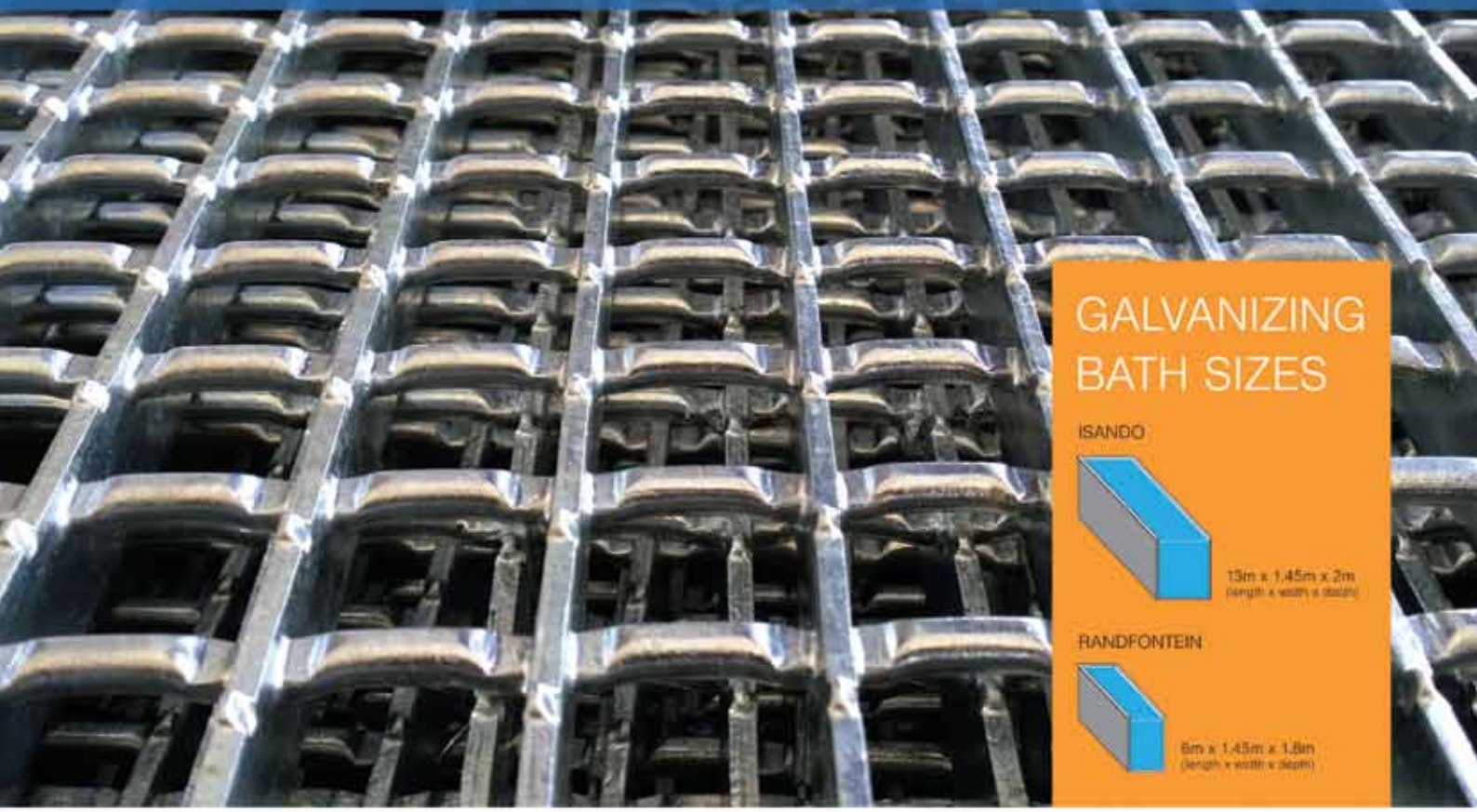
Anyone can find the dirt in someone. Be the one who finds the gold. – Proverbs 11:27

Hot dip Galvanizing Members

GALVANIZER	LOCATION	TEL. NO	SPIN	NO. OF LINES	BATH SIZES (L x W x D) (m)
GAUTENG					
ArcelorMittal South Africa	Vanderbijlpark	016 889 9111		3	Sheet galvanizer
Armco Galvanizers	Isando	011 974 8511		1	13.2 x 1.5 x 2.2
Armco Galvanizers - Randfontein	Randfontein	011 693 5825		1	6.5 x 1.3 x 2.0
Babcock Ntuthuko Powerlines (Pty) Ltd	Nigel	011 739 8200		1	12.0 x 1.4 x 1.8
Galferro Galvanisers	Springs	011 817 3667		4	13.5 x 1.65 x 2.5 6.8 x 0.9 x 1.4 6.5 x 0.9 x 1.5 6.45 x 0.755 x 0.9
Galvadip (Pty) Ltd	Silverton	012 843 8000		1	7.0 x 1.7 x 2.0
Lianru Galvanisers cc	Nigel	011 814 8658		2	7.2 x 1.3 x 1.6 4.5 x 1.3 x 1.6
Monoweld Galvanizers	Germiston	011 876 2900	 Tube	3	14.0 x 1.35 x 2.5 10.0 x 2.0 x 4.0 Dia 42mm to 114mm max tube length 6.7m
Pro-Tech Galvanizers (Pty) Ltd	Nigel	011 814 4292	•	2	3.2 x 1.1 x 1.5 3.0 x 1.1 x 1.2
Robor Tube	Elandsfontein	011 971 1600		1	Tube & Pipe Galvanizer
SMT Galvanizers	Benoni South	011 421 1495	•	2	2.6 x 1.0 x 1.5 2.0 x 1.0 x 1.5
Transvaal Galvanisers In-line and general	Nigel	011 814 1113		4	12.5 x 1.2 x 1.8 9.0 x 1.0 x 1.0 8.0 x 1.2 x 1.5 6.0 x 1.3 x 1.3
WESTERN CAPE					
Advanced Galvanising (Pty) Ltd	Bellville	021 951 6242		1	14.0 x 1.4 x 3.0
Galvatech (Pty) Ltd	Bellville	021 951 1211		1	7.5 x 1.5 x 2.6
Helderberg Galvanizing	Strand	021 845 4500		1	5.5 x 0.8 x 2.4
South Cape Galvanizing (Pty) Ltd (NB: big line is not in operation)	George Industria	044 884 0882		2	3.7 x 0.94 x 2.3 (5.5 x 1.0 x 2.6)
EASTERN CAPE					
Galvanising Techniques cc	Port Elizabeth	041 486 1432		1	12.0 x 1.3 x 2.3
Morhot (Pty) Ltd	East London	043 763 1143		1	7.0 x 2.5 x 1.5
KWAZULU/NATAL					
A&A Galvanisers	Pietermaritzburg	033 387 5783	•	1	3.3 x 0.9 x 1.9
Bay Galvanisers	Richards Bay	035 751 1942		1	5.0 x 1.2 x 2.5
Durban Galvanizing (Pty) Ltd	Briardene	031 563 7032		1	9.5 x 1.3 x 3.0
Phoenix Galvanizing (Pty) Ltd	Phoenix	031 500 1607	•	2	14.0 x 1.4 x 2.5 3.0 x 1.2 x 1.2
Pinetown Galvanizing	Pinetown	031 700 5599		1	9.0 x 1.2 x 3.0
Voigt & Willecke (Pty) Ltd	Durban	031 902 2248		1	14.0 x 1.3 x 2.5
INTERNATIONAL					
MAURITIUS					
Galvanising Co Ltd	Port Louis	+230 234 5118		1	7.0 x 0.75 x 1.68
ZIMBABWE					
Essar Tubes	Graniteside	+263772833477		1	10.0 x 1.1 x 1.0

- *Sheet, wire, pipe and other in-line galvanizing members dedicate their plants to the galvanizing of their own products. The bath sizes are inside dimensions and not maximum component size. Kindly take note of the expansion of the component when dipped into molten zinc or discuss with relevant galvanizer.*

HOT DIP GALVANIZING... THE **BEST PROTECTION!**



CONSISTENTLY DELIVERING SUPERIOR QUALITY GALVANIZED PRODUCTS TO ALL OUR CUSTOMERS

Armco Galvanizers Isando has been operating since 1989. Geared up to accommodate heavy structural steel up and till 13m in length. Isando has an average output of plus minus 2000 tons per month. With an improved lay down area and increased loading capacity by addition of a tower crane we strive to give "A" class service to all our customers big or small.

Armco Galvanizers Randfontein is our second facility based in the Randfontein area. Randfontein has an average output of plus minus 800 tons per month and is geared up to handle light to medium structural steel up and till 6m in length.

The company has it's own SANS 121 2000 ISO 1461 accredited Hot Dip Galvanizing plants. And is listed under the SABS ISO 9001 scheme.

Isando | **Tel.** +27 11 974 8511

Randfontein | **Tel.** +27 11 693 5825

Web. www.armco.co.za

ARMCO SUPERLITE

OBO Bettermann Group