Wolseley Industrial acquires Duhig Stainless, Inc.

It has been reported that Guild International, the company specializing in coil joining equipment for the steel pipe, tube, producing, and stamping industries, has new ownership with the purchase of the company by three long-term employees. Joseph "Joe" Thomas, formally VP of Operations, has been named President; William "Bill" Maruschak will continue as Chief Financial Officer; and Mark Wagner, formally Sales Engineer, has been named Vice President of Sales. Mr. Thomas and Mr. Maruschak have each been with the company for over 30 years, while Mr. Wagner joined the company in 2009. Guild International is a privately-held company that has been owned by Michael Wheeler, son of Donald Wheeler, the original founder of the company. Mike Wheeler will continue on as Chairman of the Board. Guild International was established in 1958, making 2018 its 60th year in business.

"As a longtime employee, I’ve always known that Guild International was a solid, stable company that built great machines,” said Mr. Thomas. “When the opportunity was presented to purchase the company from Mike, with Bill and Mark as my partners, I knew this would be a chance of a lifetime. Now Bill, Mark, and myself have the opportunity to take Guild into the future, built on a solid reputation of 60 years serving many industries.”

Raccortubi Group acquires Raccortubi Group

Raccortubi Group maintains a broad range of products and services, including industrial, marine, and offshore platforms.

Raccortubi upgrades its certification to the latest ISO 9001:2015 standard

After a rigorous process of certificate renewal and transition audits completed by Lloyd’s Register, Raccortubi has successfully updated its ISO 9001:2008 to the latest ISO 9001:2015 standard. The new ISO 9001:2015 standard pays special attention to risk management and encourages all involved to adopt an overall perspective of risk-based thinking. An extremely thorough evaluation of the entire organization was carried out to ensure that Raccortubi was well equipped with all the tools and requirements to meet its stakeholders’ requests. Raccortubi Group manufactures, stocks, and supplies piping materials destined for critical applications such as chemical and petrochemical plants, oil installations, power plants, shipyards, urea plants, and offshore platforms.

East Coast Stainless Steel Distributors

Metalinox Cogne invests in new cutting machine

The distributor of stainless steel in São Paulo, Brazil, Metalinox Cogne, has recently invested in a brand new cutting machine to help increase production. This innovative piece of equipment is the SCMD 460 A, which was manufactured by Franho-Brazil.

The saw is a carbide cutting machine and is specifically intended to be used for stainless steel alloys. By investing in this state-of-the-art machine, speed and productivity for cutting bars will be increased approximately three to four times when compared to a conventional band saw. The machine is equipped with automatic Pro-tional band saw. The machine is specifically intended to be used for stainless steel alloys. By investing in this state-of-the-art machine, speed and productivity for cutting bars will be increased approximately three to four times when compared to a conventional band saw. The machine is equipped with automatic Pro-tional band saw. The machine is specifically intended to be used for stainless steel alloys. By investing in this state-of-the-art machine, speed and productivity for cutting bars will be increased approximately three to four times when compared to a conventional band saw. The machine is equipped with automatic Pro-tional band saw. The machine is specifically intended to be used for stainless steel alloys. By investing in this state-of-the-art machine, speed and productivity for cutting bars will be increased approximately three to four times when compared to a conventional band saw. The machine is equipped with automatic Pro-tional band saw.
As a master distributor of stainless steel tubular products, Dover Tubular Alloys, Inc. sells exclusively to metal service centers, distributors, and other metal wholesalers. It proudly houses one of the largest inventories of seamless mechanical tubing (hollow bar) and general servicing tubing available throughout the United States. It also maintains an extensive inventory of seamless stainless steel pipe in a variety of grades. Dover Tubular’s products are used throughout a multitude of end-use markets including: oil & gas, power generation, chemical, aerospace, defense, and medical.

With locations in Dover, New Jersey and Houston, Texas, the company maintains a diverse selection of 2,000+ tubing products procured from the world’s leading Domestic, DFARS (Defense Federal Acquisition Regulation Supplement), AML, and Import mills. Both Dover Tubular facilities also have state-of-the-art cutting capabilities enabling the company to offer its customers quick-release cut-to-length pieces of tube and pipe. Just as impressively, almost all orders ship within 24 hours, which helps the company demonstrate and fulfill its commitment to providing superior customer service.

Stainless Steel World Americas had the pleasure of speaking with Mr. Justin Rattner, Dover Tubular Alloys’ General Manager, about how over the company’s 35 years of operations, it has always focused on customer service and creating value for its clients through its unique product offerings and services.

By Candace Allison

A company reinventing itself

Rattner began our interview by explaining that Dover Tubular Alloys is a third generation family-owned company that specializes in stainless steel tube and pipe. The company is a master distributor in the truest sense of the words selling exclusively to metal service centers, distributors, and other wholesalers. “We basically act as secondary inventory for both the large multi-branch distributors and small single location operations alike.”

He indicated that historically, the company has served a niche role in market by providing spot inventory of stainless hollow bar and tubing. “In the past, we have essentially been a buyout house for the inside sales teams of metal service centers and distributors that needed stock length tubing or cut to length hollow bar.” However, he explains that the company which is celebra-

its 50th anniversary has really begun to change. “Right now we’re in the process of reinventing ourselves and redefining our role within the market,” Rattner stated. However, despite all the recent changes, one thing has remained the same: Dover Tubular’s mission begins with having the right product at the right price and delivering the highest level of customer service.

High-quality products

Seamless mechanical tubing/hollow bar

Dover Tubular’s primary product line is seamless mechanical tubing or hollow bar. Hollow bar is often used as a cost-savings alternative to round bar for applications that require an Inner Diameter (ID). The company inventories hollow bar in a wide array of Outer Diameters (OD’s) and Wall Thicknesses in grades 304/L and 316/L. Dover Tubular’s stocking program goes above and beyond the conventional A, B, and C inventory items and offers OD’s as large as 46” with walls as thick as 2.00”. The company maintains one of the most diverse inventories of hollow bar within the country and offers quick-turn and production cutting on all sizes.

Seamless & welded general service tubing

Another very popular product line is the company’s offering of welded and seamless general service tubing often referred to as instrumentation, heat exchanger, condenser, or boiler tubing. Dover Tubular inventories a myriad of sizes, which are available in domestic, import, AML (Approved Manufacturers’ List), and DFARS compliant variations. Certain instrumentation and heat exchanger tubing sizes are even available in hard-to-find grades such as Duplex 2205 and 310H. There are only two or three other distributors in the United States offering these grades of tubing. Most other master distributors can’t compete with Dover in terms of size range and variety of products. By stocking these more difficult-to-find alloys and offering ‘in between’ wall sizes, Dover Tubular is able to provide clients with more value by being a ‘one-stop shop’ for all of their tubing needs.

Seamless pipe

It isn’t just tubing solutions that offer clients value. Dover Tubular also has a large selection of pipe ranging from the standard grades of 304/L and 316/L to the more rare 304/H and Duplex 2205. Rattner also detailed that since pipe is such a commodity, Dover Tubular differentiates itself by specializing in the heavier schedules such as 120, 160, and XXH and by offering quick-turn cut-to-length pieces of all pipe sizes. Currently seamless pipes are available up to 16” NPS and later this year 18” NPS will also be an option. But for Dover Tubular having the right product mix is just the beginning as the company is also adding value through its services.

Moving beyond just inventory

“Over the last few years, our role in the market has really begun to transform. As we’ve repositioned our business to become more competitive and begun to offer procurement solutions beyond just standard inventory, we’ve seen a dramatic increase in activity from corporate inventory buyers and more success supporting our customers in project work,” explained Rattner. “As I mentioned earlier, previously the market perceived us as just a trick pony – a buyout house that could only quote in stock products. But now we’re offering so much more than that like production cutting, mill direct sourcing, and customer supply programs,” Rattner indicated.

Rattner provided an example of a customer who earlier this year approached Dover Tubular to see if they could provide a better solution for providing cut-to-length finished polished parts. At the time, the customer was purchasing material overseas, having it sent out for cutting and polishing stateside, and then packaging it and holding a full years’ worth of inventory on their warehouse floor.

“We were able to come in and help our customer by cutting down the complexity and the cost of this process dramatically. We arranged to have the material produced, polished, cut, inspected, and packaged overseas. It was then delivered directly to our warehouse where we absorbed the inventory risk and released the product monthly to our customer. Not only was the overall process much simpler, it saved our customer over 35% in the process all while helping them also free up cash that would have otherwise been tied up in inventory.”

This is a good example of some of the new ways Dover Tubular is creating value for its customers that would not have been attempted in the past. “We’re moving beyond just quoting in stock inventory by offering procurement solutions and mill-direct sourcing that our customers require to land projects and create more value for their own customers,” indicated Rattner.

Recent additions & investments

Instead of just listening to their customers’ wants and needs they’ve been translating it into action. “We’re taking calculated risks and aggressively adding new sizes and product grades in response to the feedback from our customers. And – I think our customers
We’re taking calculated risks and aggressively adding new sizes and product grades in response to the feedback from our customers. And – I think our customers are really starting to notice the difference...”

– Justin Rattner

are really starting to notice the difference and they feel that we are moving in the right direction to better fulfill their needs.” Dover estimates that they’ve introduced over 125 new products last year alone. “... and the big news around here is that we’re about to venture outside of stainless for the first time in our company’s history. Later this year we’ll begin selling Aluminum Tubing in 6061-T6, which Rattner indicated was launched based on a combination of data analytics and input from his top customers.

Another important factor to the company’s success as a master distributor is its emphasis on continual improvement through capital investments. For example, in the fourth quarter of 2016, the company began using STRATIX, a state-of-the-art ERP (Enterprise Resource Planning) platform created by Invera. This technology has enabled Dover Tubular to shift some of its resources away from day-to-day tasks by automating certain business processes and helping the company become more competitive on the purchasing and sales side through better sales analysis tools and improved forecasting modules.

On the equipment side, a new saw was recently purchased that can cut up to 18” outer diameter (OD), which later this year will greatly expand cutting capabilities in both facilities. Both of these significant investments have assisted Dover Tubular in becoming a more competitive supplier.

Unparalleled customer service

Dover Tubular is also able to support its customers by providing a level of service unparalleled within the industry. They are a ‘lightning fast’ supplier that has the ability to provide products within hours instead of days. Clients located in the Gulf Coast region really appreciate this, as often they will place orders that require pick up within hours or even minutes. Dover Tubular is able to accommodate these time sensitive requests because its basic business model was built from the ground up to be as efficient as possible. “We have a really great team here,” Rattner indicated. “We are able to quote fast, cut fast, package fast, and get you from A to B efficiently and accurately because we work together as a team all the way from procurement to final delivery.”

When asked what sets Dover Tubular apart from its competitors, Rattner was quick to respond. “It comes down to three words in my mind: inventory, expertise, and efficiency. It all starts with having the right inventory in stock, using our expertise to offer the right products and solutions, and then being efficient and nimble enough to deliver on the promises we make to our customers. We do things the old-fashioned way here and we do whatever we can to make our customers shine in the process. In my opinion, any master distributor can be the lowest number on a buyer’s spreadsheet, but when things go wrong do you have the faith that your supplier will stand behind you? When a due date is missed do they work with you to help resolve the issue? When you have a claim do they stand behind you and resolve it quickly? Some do but not everybody. For us like I said, we do business the old fashion way – we care about our customers and we prioritize the long-term business relationship with them over this transaction, this quarter, or even this year, and that allows us to make decisions that may not be in our best short-term interest but are in the best interest of the long-term relationship with that customer.”

He continued to state how essential it is to understand and listen to what the customers’ needs are. It isn’t just about quick quotes and supplying stock, it is about collaborating with your customers and going above and beyond to assist them with their needs.

Looking ahead to 2018 and beyond, Dover Tubular will be putting even more new products on its shelves and offering them with their needs. “As we’ve repriced our business to become more competitive and begun to offer procurement solutions beyond just standard inventory, we’ve seen a dramatic increase in activity from corporate inventory buyers and more success supporting our customers in project work.”

– Justin Rattner

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– Justin Rattner

Producing range:

Seamless mechanical tubing / hollow bar

OD: 1/16” to 12” Walls: 0.010” to 0.125”

Cutting: All Sizes

Seamless & welded general service tubing

OD: 1/8” to 12” Grades: 304/L, 316/L, 310S/H, Duplex 2205

Cutting: All Sizes

Seamless pipe

NPS: 1/4” to 10” Schedules: 40/80 to XXH

Grades: 304/L, 316/L, 310S/H, Duplex 2205

Cutting: All Sizes

Aluminum seamless drawn tube

OD: 1/4” to 4” Grades: 0.028” to 0.250”

Cutting: All Sizes

Dover Tubular Alloys at a glance

Company name: Dover Tubular Alloys, Inc.
Locations:
New Jersey–Headquarters: 50,000-square-feet
200 West Clinton Street, Dover, NJ 07801
Texas: 30,000-square-feet
6500 Bingle Road, Houston, TX 77092
Year established: 1983
Products:
Stainless mechanical tubing, hollow bar, instrumentation tube, condenser tube, heat-exchanger tube, boiler tube, aluminum tubing.
Industries:
 Petrochemical, railroad, automotive, structural, military, shipbuilding, etc.
Industries:
Oil & gas, chemical & petrochemical, paper & pulp, water & wastewater, desalination, power generation, etc.
Website: www.dovertubular.com
End-user Interview

Leak prevention in a 100-year-old refinery
An interview with Larry Wilkerson, Supervisor of Air Fugitives at the Golden Eagle Refinery

Larry’s career in the refining industry began in 1979 when he worked as an Operator at Texaco Refining and Marketing. Learning the intricacies of the job and gaining more knowledge about the industry as a whole sparked a deeper inquisitiveness in Larry, and so he enrolled in educational classes that focused on the ins and outs of petroleum and environmental technology. While Larry openly admits that these classes were initially a way for him to merely begin in California as a Supervisor in the operations department. After a few years, I had an offer from Tesoro to come to the Bay Area that was new and foreign to me. “I didn’t really know what I was getting into, but I took what I knew, both operational and environmental, and applied it to the job,” he explains. “I then had an offer from Tesoro to come to the Bay Area in California as a Supervisor in the operations department. After a few years, I had an offer to take over their fugitive emissions program and bring it to the level of a Tier 1 program. That’s how I ended up where I am today.”

Larry is currently the Supervisor of Air Fugitives at the Golden Eagle Refinery in Contra Costa County, California. He is primarily responsible for coordinating the LDAR program, assisting in the routine inspections for compliance and managing the QQQ and HES MACT programs as part of the Environmental Department. Larry also manages an in-house LDAR program at the refinery. Though this is uncommon, it works well at this facility. His daily duties tend to involve monitoring the database, assessing the status of inspection and repairs and attending meetings. Larry’s day is fast-paced and doesn’t focus solely on LDAR (Leak Detection and Repair), as many would assume. He mentions that his routine changes from day-to-day; regulatory reporting, interaction with operations and maintenance is just a small portion of his day. “Being in the Bay Area means that we’re subject to some of the most stringent regulations in the country, and the rules are continuously changing. We’re currently implementing the latest rule changes by the local APCD (Air Pollution Control District) – all the refineries in the Bay Area are collaborating as part of a joint effort,” says Larry. While this can be a challenge, Larry is lucky in his current role as he is constantly meeting and working with new people. He says, “Often times in a refinery you get stuck working with the same people and you almost never venture out of that realm. In this role, I work with a lot of the same people but I also work with new people every day. Whether it’s in the refining sector or in the regulatory area of the business, there’s always somebody new to meet and something new that comes up. That’s what I enjoy.”

Issues in an aging plant
The plant that Larry works at is over 100 years old, and because of that there are numerous problems that occur due to aging equipment. As the machines and the components have been built at different stages throughout the lifetime of the plant, there tends to be issues when it comes to isolating the fault. Larry explains that many years ago plants weren’t worried about isolating the problem as VOC (volatile organic compound) leaks were not a concern. However, nowadays if there is a leak in the system it can be nearly impossible to repair the equipment to meet today’s standards.
without having to shut everything down. In older plants, process units were not designed with isolation valves for each individual section of the unit. “That can be really challenging,” he says. “You may have to do a complete shutdown and take everything out of service. We can delay the repair (DOR) if it meets the requirements of the APCD rules, but we only use that option if there is no other alternative.”

Despite the older status of the plant, Larry doesn’t encounter many problems with obsolescence. The plant is systematically updating the equipment to more energy efficient, environmentally friendly standards as time goes on. For example, at Andeavor’s Martinez plant, a large gas fired steam turbine which was like a jet engine was recently upgraded to an electric motor to drive a compressor, resulting in significantly lower NOx emissions. This is one of the many ways in which the refinery is upgrading to become an efficient and regulatory compliant facility.

**Methods of leak prevention**

When it comes to working in a refinery, particularly as part of the Environmental Department, the prevention of leaks is a key aspect of the daily operations. To prevent leaks from occurring, the material of choice for much of the equipment, including pumps, hoses, coupling, and valves, is stainless steel. This equipment is essential in nearly every application throughout the plant, from pumping the water to controlling the flow of material, and everything has to be leak-free. “Whether it is a temperature related or process related application, you have to have something that’s corrosion-resistant—even in a water service application,” says Larry. While the plant has nearly every type of metal alloy one could imagine, including copper and steel, Larry says that stainless steel is one of the more critical materials in use. However, although material selection is an important factor in leak prevention, issues can still occur.

“When I first took over this department we had a lot of issues with our hoses and couplings at the gasoline loading rack,” says Larry. “They were always leaking. However, I was familiar with this regulation, which was fairly new at the time, from having worked at the Shell terminal in Central Valley. So, we upgraded to better equipment to meet these regulations and put a repair program in place. I went to the terminal and trained the operators on how to recognize signs of leakage and repair methods. That’s a particularly successful program we have in place today.”

In addition to the repair program, Larry elaborates that the plant takes further measures to prevent leaks from occurring. He has trained his technicians to do the initial repairs of the valves, which are the most common cause of leaks in Larry’s experience, in particular the valve packing. Because of this training, his team has fixed approximately 80-90% of the plant’s leaks on the first attempt, as regulations in the Bay Area require leaks to be minimized within 24 hours and final repairs completed in 7 days. “Between the repairs, inspections, better quality packing and doing the right work at the right time, our leak rate is below one percent and has been for several years, which is incredible,” says Larry. “SAGE Environmental did our last audit and they were very impressed.”

**Low-leak technology**

As more and more regulations are introduced into the industrial sector, particularly by The Environmental Protection Agency (EPA), new developments in technology are essential in ensuring refineries are able to comply with these new rules. One innovation that Larry mentions as having a real benefit is certified low-leak technology which is being added to a lot of consent decrees. While the Golden Eagle Refinery is exempted from this due to their low leak rate, they use this technology nonetheless. This, as Larry explains, is essential for the upkeep of the plant. Additionally, Larry helped set up tracking methodologies for other plants throughout the corporation. He says, “It’s making a huge difference in helping other facilities adhere to the more stringent guidelines of the consent decree. We’ve come a long way in being able to certify valve packing to be 500ppm or less. Here at Andeavor Martinez we’re currently at 100ppm, the lowest standard in the world.”

While chronic leaks used to cause many of the issues in the plant, this is now being prevented due to better reliability practices, high quality products and ensuring the correct component is selected for the correct service. To add to that, Larry mentions that new technology such as Infrared (IR) Cameras are also useful in detecting and keeping the level of VOC leaks down.

Larry’s optimism is evident, as is his outlook on the future of the industry. He believes that the industry as a whole is going to continue to grow, and stresses that the amount of time that has been devoted to environmental progress is staggering. “I have seen so many changes since I began working in this industry. Emissions were sent off into the atmosphere and solid materials were washed down the sewer. That’s unheard of now,” he says. “Between the safety and environmental changes that have happened over the last 40 years— I’m just amazed. It’s good to have alternative energies going forward and to be environmentally-conscious. But we need oil and gas. We’re not going to survive without it.”
Welding of low nickel chrome-manganese austenitic and ferritic stainless steel is an emerging area of research. Due to nickel price volatility, there has been increased interest in no-nickel or low-nickel economical grades of stainless steel. Chrome-manganese austenitic (“standard 200-series”) and ferritic stainless steel (“standard 300-series”) grades with well-defined technical properties have proved acceptable materials for specific applications for many years.

This increase in the use and production of these low nickel grades is not currently matched by a proper level of user knowledge. So there is a risk that they may be used in unsuitable applications. It is very important to cultivate the method of fabrication like welding. This article looks at the behavior of low nickel chrome-manganese and ferritic austenitic stainless steel in terms of microstructure and sensitization effects.

**Introduction**

In the late 1980s, a nickel crisis caused the Indian government to reduce nickel imports. This led to development and production of the chrome manganese and ferritic stainless steel grades in that country. Increased knowledge of these grades gradually became to be acquired and many suitable applications for the grades emerged. As a result there has been increased interest in economical low-nickel grades of stainless steel having properties similar to AISI-300 series stainless steel. The AISI-200 series and AISI-400 series grades of stainless steel are well-known examples of low-Ni stainless steel.

Low nickel chrome-manganese grades were first developed in the early 1950s. As a way of conserving available nickel, which led to the increased use of chrome-manganese grades during the 1950s in America and new grades with higher properties have continued to be developed. Rises in the material’s popularity have been linked to higher increased nickel prices and advances in steel production technology. This leads to higher use of AISI 200 series, alloyed with manganese (Mn) and the other alloying elements like nitrogen (N) and copper (Cu). Manganese acts as a substitute of nickel, in order to stabilize austenite phase (α). These low-nickel stainless steels are economical than 300-series and are popularly known as chrome-manganese stainless steel (FMSS). Its current contribution in total stainless steel production is more than 10% [14]. In the future 200 series alloys will have greater demand and will act as replacement over 300 series for variety of industrial applications [3]. Low nickel Cr-Mn SSs are used in various applications like home accessories, home appliances, light poles, construction, outdoor installations, etc. where high corrosion resistance is not required [3,4]. In some applications welding of the materials is important. Ferritic stainless steel are BCC crystal structure with iron-chromium alloys containing 12 to 25% of chromium with a carbon content below 0.10% along with other alloying elements, notably molybdenum having similar properties to those of mild steel but show better corrosion resistance than nickel steel grades. These low-nickel stainless steels are economical than 300-series and are popularly known as chrome-manganese stainless steel (FMSS). Its current contribution in total stainless steel production is more than 10% [14]. In the future 200 series alloys will have greater demand and will act as replacement over 300 series for variety of industrial applications [3]. Low nickel Cr-Mn SSs are used in various applications like home accessories, home appliances, light poles, construction, outdoor installations, etc. where high corrosion resistance is not required [3,4]. In some applications welding of the materials is important. Ferritic stainless steel are BCC crystal structure with iron-chromium alloys containing 12 to 25% of chromium with a carbon content below 0.10% along with other alloying elements, notably molybdenum having similar properties to those of mild steel but show better corrosion resistance than nickel steel grades. These low-nickel stainless steels are economical than 300-series and are popularly known as chrome-manganese stainless steel (FMSS). Its current contribution in total stainless steel production is more than 10% [14]. In the future 200 series alloys will have greater demand and will act as replacement over 300 series for variety of industrial applications [3].

*By Urade VP and Ambade SP, Department of Mechanical Engineering, Yeshwantrao Chavan College of Engineering*

**Welding current**

Y.D. Han studied the influence of welding parameters in shielded metal arc welding (SMAW) process and studied that welding current (I) is the most influential parameter because it affects the current density and hence the rate of filler and base metal melting. This welding current influences on mechanical and microstructural properties by altering its weld pool and heat affected zone (HAZ) width. Penetration and reinforcement increase with the increase in welding current. If the current is too high the weld bead shape and welding process parameters began in the mid-1900s. Nearly 90% of welding in world is carried out by an arc welding process; therefore it is imperative to discuss the effects of welding parameters on the weldability of the materials during the arc welding.

Welding parameters should be selected properly for a given task to provide a better weld quality, which is identified by its microstructural and correct weld bead shape, and relied on the amount of spatter. Investigation into the relationship between the weld bead shape and welding process parameters began in the mid-1900s. Nearly 90% of welding in world is carried out by an arc welding process; therefore it is imperative to discuss the effects of welding parameters on the weldability of the materials during the arc welding.

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starts decreasing by using polarity DCEP. But when DCEN polarity is used weld bead shape increases with the increase in current for entire range [15]. Heat affected zone also increases with the increase in welding current if same flux is used. Too low current may lead to inadequate penetration and incomplete fusion may result. Too low current also leads to overlapping, inadequate penetration, and unstable arc.

Welding speed

Welding speed is the linear rate at which an arc is moved along the weld joint. With any combination of welding current and welding voltage, the effect of changing the welding speed conforms to a general pattern. If the welding speed is increased, heat input per unit length of weld is decreased and less filler metal is required per unit length of the weld, resulting in less weld reinforcement. Thus, the weld bead becomes smaller. Welding speed is the most affecting parameter for weld penetration other than current. This is true except for excessively slow speeds when the molten weld pool is beneath the welding electrode. Then the penetrating force of the arc is cushioned by the molten pool. Excessive speed can cause uneven bead shape, porosity, undercutting, cracking, arc blow, and higher slag inclusion in the weld metal. Aksoy observed that higher welding speed results in less heat affected zone and finer grains [16]. Within limit, its, welding speed can be adjusted to control weld size and penetration. Relatively slow welding speed provides time for gases to escape from the molten metal as a result reduction in porosity. An excessive slow welding speed produces time for gases to escape from the molten metal as a result reduction in porosity. An excessive slow welding speed produces time for gases to escape from the molten metal as a result reduction in porosity. A slow welding speed will carry more current than a small electrode, and produce a higher deposition rate at higher amperage. For the same values of current, arc voltage, and welding speed, an increase in electrode diameter results in a slight increase in the weld bead shape [17].

Electrode size

Electrode size affects the depth of penetration and weld bead shape at fixed current. Electrode size mainly influences the deposition rate. At any given current, a small diameter electrode will have a higher deposition rate and higher current density than a larger electrode. However, a large diameter electrode will carry more current than a small electrode, and produce a higher deposition rate at higher amperage. For the same values of current, arc voltage, and welding speed, an increase in electrode diameter results in a slight increase in the weld bead shape [15].

Don’t miss part 2!

Part two of this article will be published in the April issue of Stainless Steel World Americas.

References

Since 1950, the melting production of stainless steel has increased almost fifty-fold, outperforming practically all other major metals and alloys. In the first of a series of reports for Stainless Steel World Americas, industry insider Peter Cranfield has dug through historical production data—and his own memory banks—to explain this phenomenal and sustained growth.

By Peter Cranfield, Consultant, World Bureau of Metal Statistics

Long term historical growth

To this very day the actual origins of stainless steel remain a matter of some dispute. Curious readers might like to peruse a most interesting article available on the British Stainless Steel Association website for more information. However, for our purposes let us just assume it was around 1910-12, give or take a year or two.

What we can confidently state however is that by 1950 global stainless melted production was around 1 million tons (Mt). Main producers were in Europe, USA, and Japan. It is interesting to compare the performance of stainless with other high volume metals shown in Table 1. The striking conclusion is the phenomenal success of stainless from 1950 to the present day. In 2016 stainless melting production reached 46.0 Mt. So it had increased 46 times in seven decades.

How did stainless perform so well?

One of the advantages of stainless is that it possesses that unique combination of properties. Not only heat and corrosion resistance, but also strength, ductility, hygiene factors, choices of surface finish, and aesthetic appeal among many other qualities. The stainless steel development associations and industry associations for nickel, chrome, and moly have done a lot over many decades to promote the use of stainless in place of competing materials. The merits of life cycle costing are now accepted and applied in many applications both in private industry and the public sector.

Over the years there has been a move to longevity and product quality. In some applications crude steel and zinc coated galvanised steel have been replaced by stainless. Stainless rebar continues to make inroads. As a personal aside, I remember many years ago when I was working in the nickel industry for Inco how a colleague bought a stainless steel spade for gardening. This was unheard of. It was a year or two before I could afford such luxury. Now nearly all the garden tools in my shed are stainless. I also recall at around this time visiting a leading high quality kitchen appliance company to research their materials use. They had switched to stainless for washing machine drums but reported that their dishwashers worked perfectly well and were quieter with plastic door liners. Fortunately their customers preferred stainless so they switched back.

Table 1: Long term growth in global metals production.

<table>
<thead>
<tr>
<th>Year</th>
<th>Crude steel</th>
<th>Stainless steel</th>
<th>Primary aluminium</th>
<th>Refined copper</th>
<th>Slab zinc</th>
</tr>
</thead>
<tbody>
<tr>
<td>1950</td>
<td>189.0</td>
<td>1.0</td>
<td>3.2</td>
<td>2.1</td>
<td></td>
</tr>
<tr>
<td>1960</td>
<td>347.0</td>
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<td>15.3</td>
<td>6.1</td>
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<td>19.2</td>
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<td>2010</td>
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<td>97.0</td>
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<td>2016</td>
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<td>46.0</td>
<td>31.0</td>
<td>13.9</td>
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Table: Analysis of stainless steel melting production from 1970 to 2016.
Aluminium has performed well and competes with stainless in some sectors e.g. architecture, building, and construction (ABC), and transportation. On my return to the UK from The Hague some twenty years ago, we bought a house with a typical farmhouse type Aga range. So we needed to buy cookware to fit the runners in the ovens. The local Aga dealer explained that he stocked both aluminium and stainless, which were the same dimensions and a similar price, but in his view the aluminium was superior. I don’t remember his suspect logic and can only assume it was to do with weight. Of course I extolled the far superior merits of stainless and explained the error of his ways. Needless to say I did not get a decent discount. On the plus side I still cook with the same aluminium cookware today, as good as new. I think it is fair to say that not much of the aluminium growth has been at the expense of stainless but results from applications such as beverage cans and foil for food packaging where glass and tinplate have lost out. The latter affecting crude steel.

Copper is widely used in electrical applications and for water storage, heating and tubing as well as brass (copper/zinc) fittings. Here, too, there has been some substitution by stainless.

Major zinc uses are galvanized steel, brass, and die castings. There are some losses to stainless and in the case of die castings to plastics.

The golden quarter century 1950-1974

This period was the start of the rapid growth in stainless and other metals (see Table 2). Following the depression of the 1930s and the devastation of the Second World War, there was a period of immense reconstruction. In Europe the Marshall Plan stimulated investment and economic recovery. This period came to an end stimulated by a quadrupling of the oil price in late 1973 and lower macroeconomic growth rates, but there were also signs that the intensity of use was slowing. When most households had a stainless kitchen sink, washing machine drum, or cooking hollow-ware these were not replaced for many years. Of course there was still scope for growth outside the (then) large economic powerhouses of USA, Europe, and Japan.

Mid-1970s to mid-1980s slowdown

There was a second energy crisis in 1979, which precipitated a severe recession in 1980/81. In economic terms this inflationary period, triggered by the sharp rise in oil prices, caused a hike in interest rates and restrictive economic policies in Europe and the USA, which were the main stainless consuming regions.

Although it is not apparent from Table 2, stainless production peaked at 6.6 Mt in 1974 and again at 6.9 Mt in 1980, annual growth of less than one percent pa. Underlying growth was higher but there was the usual boom/bust high inventory building, which turned a bad market situation into a crisis.

And, whilst the “old economies” were struggling, newcomers in the stainless steel arena were keen to grasp sales opportunities.

### Table 2: Growth in stainless melting production by region.

<table>
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<tr>
<th></th>
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<td>0.6</td>
<td>11.3</td>
<td>24.9</td>
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</tr>
<tr>
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<td>2.5</td>
<td>4.3</td>
<td>8.4</td>
<td>9.8</td>
<td>11.0</td>
<td>24%</td>
</tr>
<tr>
<td>Total</td>
<td>5.0</td>
<td>6.9</td>
<td>12.9</td>
<td>19.3</td>
<td>31.0</td>
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</table>

About the author

Peter Cranfield has a BSc (Econ) from London University and an MBA from Warwick. He started his career at Inco serving as market research manager and also producing the annual publication World Stainless Steel Statistics (in 1986 taken over by WBMS). Later he joined Shell-owned Billiton in The Hague for 15 years working with a number of metals and industrial minerals as well as strategic planning. Peter then moved back to London with BHP Billiton working in business planning and analysis in nickel, cobalt, and stainless. He has regularly delivered presentations on nickel and stainless at conferences around the globe. Since retiring he has consulted for BHPB, the Nickel Institute, and now the UK-based World Bureau of Metal Statistics (WBMS – see www.world-bureau.com for more details).
Mike earned a Bachelor of Science in Mathematics at Texas Tech University and subsequently got a job as an Application Engineer at Dresser-Rand where he worked on steam turbines and centrifugal compressors. Eager to progress further, Mike returned to school part-time, while simultaneously working full-time at Dresser-Rand, and got his Bachelor of Science in Mechanical Engineering. “It was a busy time. I then ended up back down in Houston where I got a job at Burns & McDonnell and I’ve been here for almost five years,” says Mike. Currently, Mike is a Senior Mechanical Engineer and works specifically with rotating equipment. He mentions that he can work with anything from blowers and fans to pumps and compressors, but lately he has been concentrating a lot more on compressors and troubleshooting issues with this specific equipment. On a typical day he is responsible for developing and reviewing end user and client specifications. “Instead of big projects, we tend to work on a lot of smaller, more frequent projects. The trick to being a Rotating Equipment Engineer is being able to adapt to a variety of standards; each client is unique and has their own requirements,” he explains. Mike’s role also involves package development, drawing reviews, and developing requests for quotations, whether for pumps, compressors, fans or turbines. He mentions that at times the data sheets between a pump and a motor can be quite large; sometimes over 100 pages. This, as he explains, can be very time-consuming. However, Mike wouldn’t have it any other way. “I used to like being in the field, but as I get older I’m content with doing my in-house drawing reviews and I enjoy the regularity of the day. Being able to go home at the end of the day and not be dispatched to Nova Scotia, for example, is reassuring,” says Mike. While the desk job has some disadvantages, he is happy to occasionally visit the site of the project, and not have to live out of a suitcase.

Mike elaborates that he is also involved with pump selection and uses a lot of the OEM sizing programs, which help with guiding the process group with sizing or with sourcing the correct pump type. “Generally, when I send a data sheet out to an OEM or pump manufacturer I allow them to have their say and decide whether it should be a BB or an OH2, for example,” he says. “I tend to leave the onus for holding pressure or leaking, but the most common issue that I deal with on a day-to-day basis is vibration. We have a lot of soft footing issues on motors, and right now I’m dealing with a larger base plate that has some residence issues.”

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Over the years Mike has had experience working with a variety of pumps and pumping equipment. At present, he is working with big BB style injection pumps, including BB3 and BB5 high pressure casing, and larger pumps for boiler feedwater. In addition to being a Senior Mechanical Engineer, he is also the RK (Responsible Engineer) for his current project, which involves Tier 3 conversion on a Tier 3 refinery; an EPA (Environmental Protection Agency) requirement that a lot of refineries are performing at the moment. “That has been a lot of our activity lately; working on alkylation units and debottlenecking projects and there’s a lot of pumps on each service, such as boiler feedwater, injection, ethane injection and debutanizers. I could be working with 20 different pumps at any given time,” explains Mike. “You have to be able to juggle in this industry and to be able to wear several different hats. You might be working with the same pump with two different end users, but they may look completely different because of the way their instrumentation is set up. It really boils down to end-user specifications.”

Working with a variety of pumps can also mean a variety of issues, as Mike knows only too well. He explains that he does see a lot of quality issues with casting, and that a major challenge as an EPC company is the ability to get a consistent quality with a finished pump from OEMs. He also adds that quality documentation is a hugely important factor for end-users, as it provides full traceability and it lessens the possibility of pump or seal failures. Vibration is a key issue when working with pumps. Mike’s experience appears to be no different. He says: “I don’t tend to see many problems with holding pressure or leaking, but the most common issue that I deal with on a day-to-day basis is vibration. We have a lot of soft footing issues on motors, and right now I’m dealing with a larger base plate that has some residence issues.”

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Importance of mentoring

One aspect of Mike’s job that we were really eager to discuss is his role as a mentor to younger engineers. As a company, Burns & McDonnell makes it a priority to hire young engineers, but also to pair those younger engineers with more experienced personnel. Mike has been with the same group dedicated specifically to rotating equipment for over 90 years...
Deterioration of Stainless Steel Corrosion Resistance due to Welding

Part Two of Two

The objective of this article is to provide an overview of the main welding defects that frequently exist in piping and equipment and how to detect these defects without destroying the welds using nondestructive testing (NDT) methods. Then, the sensitization of stainless steel weld, characterization, processing, and structure properties of Heat Affected Zone (HAZ) as well as weld metal will be discussed in detail.

Furthermore, this article will illustrate the treatment of the weld decay by recovery of passivation film after welding which will be followed by prevention of intergranular corrosion or weld decay of stainless steel using surface mechanical attrition treatment. All of these will be described with help of characterization techniques XRD, SEM, TEM, and EPMA.

By Fandem QA* Aramco Qatif, Eastern Region, Saudi Arabia

Recap from Part 1

Welding is an important technique of joining metals homogenously in industries due to its effectiveness with low overall cost. However, presence of welding imperfections is a challenge, which may form due to poor workmanship such as cracks, porosity, lack of fusion, incomplete penetration, and weld decay in stainless steel because of material properties issues. Furthermore, stainless steel material is one of the best choices in industries because of its high resistance to corrosion, however the issue with stainless steel material is the sensitization or weld decay after welding fabrication particularly in HAZ.

NDT techniques are used in order to check the soundness of the weld for the equipment without damaging or destroying it. Many of the manufacturers or fabricators are using NDT methods. There are several types of these such as Penetrant Testing, Radiographic Testing (RT), Ultrasonic Testing (UT), Magnetic Testing (MT), and of course Visual Testing (VT). There are also advanced NDT techniques used for welding critical services such as Time of Flight Diffraction Ultrasonic (TOFD). Some of these methods will be discussed briefly in this article. Penetrant Testing is simple and a low cost technique used to detect open to surface defects such as cracks by using three different spraysers i.e. penetrant, developer, and cleaner sprayers. The applying procedure of this method is by cleaning the surface and applying the penetrant which is in a red color, and then after five minutes the area is cleaned off with use of the cleaner followed by applying the developer which is white in color to bleed out the penetrant and make a color contrast.

Penetrant testing is also simple and a low cost technique. The testing is simple and the solution to recover the protection film is by performing passivation process. Penetration is the removal of impurities or iron from the surface and can be achieved by electropolishing, electrochemical cleaning, or chemical passivation. Electrochemical cleaning approach will be discussed in the report on 316L weld material. The surface was first polished with 1000 grit abrasive paper in Al2O3 (0.5 um) solution Figure 8.

Then it has been cleaned chemically with 2% citric acid solution and 5% ammonia at 80°C. After that, the passivation was performed at temperature of 60°C with 6% HNO3 solution that has CuSO4 5H2O at 2%. The analysis of the surface was performed before and after polishing as well as after passivation process. Figure 9 shows the SEM surfaces of base metal A and weld metal B, presence of cracks, grain boundaries, and impurities are clear in both. On the other hand, the polished surfaces were characterized by smooth and uniform structure and the cracks as well as impurities were removed as shown in Figure 10.

Stainless steel material is one of the best choices in industries because of its high resistance to corrosion, however the issue with stainless steel material is the sensitization or weld decay after welding fabrication particularly in the Heat Affected Zone.
dropped after passivation, which enhances formation of the passivation film.

Prevention of SS corrosion using surface mechanical attrition treatment

The weld decay or the corrosion of stainless steel material after getting exposed to high temperature such as stainless steel material after getting by Surface Mechanical Attrition treatment using surface mechanical attrition treatment can be utilized for the prevention technique with use of Cr% atomic mass. Furthermore, the iron is reduced with recovery of Cr% atomic mass. Passivation treatment is used to clean the impurities or iron from the surface and hence the iron is reduced with formation of chromium oxide. Thus, to enhance the recovery of the protection film, passivation treatment was refinement, the samples were annealed at 1070°C for one hour and then quenched in water. The inducement of grain boundaries was annealed, the samples were put under vacuum at room temperature for 30 minutes with a vibrating frequency 20 kHz. Optical micrograph of electroetching in 10% oxalic acid solution samples is shown in Figure 13. Grooved grain of the untreated sample are very clear, while the treated sample are very clear, while the untreated sample after electroetching.

Stainless steel 304 material has been used in this experiment with use of GTAW welding process. The samples were annealed at 1070°C for one hour and then quenched in water. The inducement of grain refinement, the samples were put under vacuum at room temperature for 30 minutes with a vibrating frequency 20 kHz. Optical micrograph of electroetching in 10% oxalic acid solution samples is shown in Figure 13. Grooved grain of the untreated sample are very clear, while the SMATed ones are not. The single twins and their intersections can be seen with about 900 um thick below the surface. Moreover, TEM with magnification of 100 nm taken for the SMATed top surfaces as shown in Figure 14, which characterized by ultrafine equiaxed grains with random crystallographic orientation and as can be seen the average grain size is about 10 nm. Moreover, SEM micrographs were also taken for the samples before and after SMAT as shown in Figure 15 and it is clearly observed the deep groove along the boundary area due to weld decay or the sensitization as Figure 15a and 15b. On the other hand, after treatment the deep grooves in the boundaries become shallow and there is no sign for intergranular corrosion or sensitization because of formation high density twins as well as grain refinement. Thus, the SMAT improve the stainless steel material to overcome the sensitization after welding by about 50 times than the untreated one.

Conclusions

It has been observed that the stainless steel material is corroded (weld decay) after welding due to sensitization or Cr depletion in the grain boundaries in form of chromium oxide. Thus, to enhance the recovery of the protection film, passivation treatment is used to clean the impurities or iron from the surface and hence the iron is reduced with recovery of Cr% atomic mass. Furthermore, the prevention technique with use of Surface Mechanical Attrition Treatment (SMAT) can be utilized before welding to enhance the sensitization for about 50 times. Also, it has been explained for the importance of the characterization techniques in failure investigation over the NDT methods with the example of stainless steel welding.

References


Figure 10: (SEM) the surface after polishing.

Figure 11: (a) (SEM) surface of base metal after passivation, (b) surface of weld after passivation.

Figure 12: (EDXSI) Quantitative linear analysis before passivation.

Figure 13: (a) Optical photos of untreated HAZ, (b) SMATed HAZ after electroetching.

Figure 14: Dark field TEM of the top surface SMATed HAZ.

Figure 15: (a and b) SEM photos for untreated surface while, (c and d) for SMATed surfaces.
Stainless steel manufacturers are often handicapped by the fact that they typically sell products to an Original Equipment Manufacturer (OEM) and not to the end-user. This limits access to critical information, which helps determine the Total Cost of Ownership (TCO). The equipment manufacturer has generally been more interested in first cost than TCO.

By Robert Mcilvaine, President, The Mcilvaine Company

Potential for more knowledge

The result has been a smaller market for stainless steel than would have been created had the end-user been better informed. The stainless steel industry has partially overcome this handicap with extensive research and publication of papers dealing with specific end-use applications. Nevertheless, there is a much bigger potential if total knowledge about applications. Nevertheless, there is a much bigger potential if total knowledge about applications.

In fact, there is a sea change underway which promises to provide this knowledge and increase the potential use of stainless steel. This sea change is a direct result of the Industrial Internet of Wisdom (IoWoW), which will empower the Industrial Internet of things (IIoT). Valves in combined cycle gas turbine plants subject to flow accelerated corrosion or scrubbers in coal fired boilers subject to crevice corrosion caused by failure to bleed enough chlorides from the recirculating systems will all be remotely monitored, subjected to data analytics and will generate actionable data relative to solutions.

Sharing information

Corporate experts increasingly will be making stainless steel decisions for all their plants. BASF, ArcelorMittal, and Duke Energy are all examples of stainless users who are embracing IIoW. The potential for stainless suppliers will be further improved by the adoption of IIoW to empower IIoT. Data analytics and subject matter experts need to be interconnected in an organized manner to not only solve problems with existing solutions but to create new ones. This interconnection of knowledge and people is the essence of IIoW.

Decision systems will need to be created for every unique process in every industry. Those stainless steel suppliers who are developing better products and who have the Subject Matter Ultra-Experts (SMUEs) contributing to the systems will become Subject Matter Ultra-Experts (SMUEs). Those stainless steel suppliers who are developing better products and who have the SMUEs will maximize the potential from the sea change.

Applying IIoW

The application of IIoW is presently focused on what is called the combust, flow, and treat (CFT) market. This includes all the vessels, piping, and components involved in utilizing stainless. These systems provide the four knowledge needs: Alerts, Answers, Analysis, and Advancement. Those Subject Matter Experts (SMEs) using and contributing to the systems will become Subject Matter Ultra-Experts (SMUEs). Those stainless steel suppliers who are developing better products and who have the SMUEs will maximize the potential from the sea change.

“Data analytics and subject matter experts need to be interconnected in an organized manner to not only solve problems with existing solutions but to create new ones. This interconnection of knowledge and people is the essence of IIoW.”

- Robert Mcilvaine

New approaches to succeed in the IIoT world

<table>
<thead>
<tr>
<th>Subject</th>
<th>Old approach</th>
<th>New approach</th>
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<td>Market research</td>
<td>Top down periodic general estimates</td>
<td>Bottoms up forecasts with detailed continuously updated analyses</td>
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<tr>
<td>Sales initiation</td>
<td>Uncoordinated sales leads</td>
<td>Identification and pursuit of large prospects</td>
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<td>Sales persuasion</td>
<td>Sales experts</td>
<td>Application experts</td>
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<td>Selection criteria</td>
<td>Price and service</td>
<td>Total cost of ownership (TCO) and service</td>
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<td>Location of specifiers</td>
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<td>Corporate staff with TCO data</td>
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<td>Acceptance of new and better products</td>
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<td>Collaboration with other suppliers</td>
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<td>Decision process</td>
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<td>Decision systems</td>
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<tr>
<td>Subject matter experts (SMEs)</td>
<td>Lots of SMEs but not well utilized</td>
<td>Subject Matter Ultra Experts (SMUEs) contributing to, and improving, decision systems</td>
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<td>Remote monitoring</td>
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<tr>
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<td>Third party Operation</td>
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<td>Major</td>
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<tr>
<td>Component Supplier Role</td>
<td>Initial sale, spare parts, service on demand</td>
<td>Cloud based continuous involvement</td>
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</table>

P.A. Inc. is leading the way with solutions for specialty alloy piping requirements.

Inaccurate documentation? 
Material not protected for shipment?
Late Deliveries?
Backorders?
Specification non-conformance issues?

Figure 1: A comparison and contrast of the old and new approaches of how to succeed in the IIoT World.

By Robert Mcilvaine, President, The Mcilvaine Company
with liquids, gases, and free flowing solids. These components generate a multibil- 
dlion-dollar stainless opportunity in power 
refining, oil & gas, chemicals, metal produc-
tion, food, mining, water, wastewater, de-
salination, and many other industries.

This sea change will influence the busi-
ness strategy and approaches to the market 
for stainless suppliers. The old approaches 
will soon be replaced by new ones.

Major changes to the stainless sup-
plier business strategy and selection, 
use, and training of personnel will be 
necessary to maximize this opportunity. 
However, the rewards will be not only 
increased sales, but also increased mar-
gins for those suppliers with products, 
which create a lower TCO.

Terminology you should know!

Total Cost of Ownership (TCO) – A financial estimate meant 
to assist buyers and owners in determining the direct and 
indirect costs of product or system.

Subject Matter Expert (SME) – A professional person who is 
an authority in a particular area or topic.

Subject Matter Ultra-Expert (SMUE) – A Subject Matter 
Expert who makes use of the IIoW and IIoT to glean as much 
information as possible.

Industrial Internet of Things (IIoT) – A network of physical 
devices, vehicles, industrial equipment, or residential appli-
ances embedded with electronics, software, sensors, actua-
tors, and network connectivity which enables these objects to 
connect and exchange data.

Industrial Internet of Wisdom (IIoW) – A network of intercon-
nc ed data analytics and Subject Matter Experts, which work 
together in an organized manner to solve problems. IIoW em-
powers the Industrial Internet of Things (IIoT).

Reference

(1) IIoT: Remote O&M published by the Mcilvaine Company
Preparations are well underway for the upcoming 2018 Managing Aging Plants/Stainless Steel World Americas Conference and Exhibition, which will be held from November 13th to 14th at the Royal Sonesta Houston Galleria Hotel in Houston, Texas. The aim of this dynamic event is to create a community dedicated to operating aging infrastructure safely & efficiently through the use of materials, inspection methods, and best practices.

Conference
The conference program will be developed by the Chairman, Mr. Kenneth Kirkham, along with the Vice-Chairman, Mr. Cody Kell, and an esteemed Steering Committee. Presentations will focus on relevant topics such as:

- Avoiding failures
- Codes, standards, and regulations
- Corrosion
- Inspection procedures
- Non-destructive testing (NDT)
- Reliability
- Remediation of infrastructure
- Risk-based inspection (RBI)
- Safety
- Sustainability
- The use of duplex, exotic alloys, etc.
- Welding

Participate
The Chairman and Steering Committee are now accepting abstracts for PowerPoint presentations. You can submit your 300-500-word abstract to Candace Allison at c.allison@kci-world.com and be sure to include your full name, title, company, and contact details. For more information about submitting an abstract or becoming involved in the conference please use the Call for Presentations brochure inserted in this issue of the journal.

Exhibition
Running alongside the conference is the exhibition, which will showcase the latest products and solutions for the processing, manufacturing, machinery, repair, and maintenance sectors. There will be ample opportunities to meet and network with professionals specializing in procurement, production, maintenance, operations, and plant management. The exhibition will bring together end-users, buyers and specifiers from a variety of industries including oil & gas, chemical & petrochemical, power generation, etc.

Meet the 2018 Steering Committee

Chairmen: Kenneth Kirkham, Group Head & Principal Leader, EVD The Equities Engineering Group, Inc.
Vice-Chairmen: Cody Kell, Materials Engineering Specialist, SM
Henk Akkermans, Professor, Tilburg University; Director, World Class Maintenance
Jason Bitting, Advisor-Mechanical Tech Service, Allemande Corporation
Eileen Chant, Engineering Manager, Raebolt Engineering
Mel Fomacher, Consulting Engineer, Metallurgical Services Lab, Stent
Brian Fitzgerald, Subject Matter Expert, Stress Engineering Services, Inc.
Jader Partado, International Expert R&D/Physical Metalurgy, Air Liquide R&D
Roy Grishuk, Technical Fellow, Fluor Corporation
Byron Keelin, Operations Director, Materials Technology Institute
Damin Kotekli, Consultant, Damin Kotekli Welding Consultants, Inc.
Michael Long, Executive Director, The Vibration Institute (TVI)
David McFarland, Principal Operations Readiness Maintenance & Integrity Manager, Kellogg-Sullivans, Inc.
Ed Naylor, Principal Operations Readiness Maintenance & Integrity Manager, Shell Global Solutions
Jose Ramirez, Materials & Welding Lead Specialist, High Temperature Materials and Engineering Center, Air Products and Chemicals, Inc.
Kirk Richardson, Marketing Director, Materials Technology Institute
Fred Schowbrough, National Projects Leader, Airgas, on Air Liquide Company
Michael Stevens, Principal Scientist, Ashland LLC
Paul Whitcraft, Executive Director, Materials Technology Institute (MTI)
Scott Whitmore, Materials Engineer Technology Leader, Veolia North America
Michael Yue, CEO, RTConsults
Chuck Young, Business Development Manager, Three Metals
Qiang Zeng, Principal Engineer/Materials Expert, China Merchants Offshore Technology Research Center

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