

New Application Awards 2018







Contents

Message of the Secretary-General

New Technology Case Studies

Non-coated Stainless Steel Bipolar Plate for Hydrogen Fuel Cell Vehicle

Stainless Weldable Sandwich with 3D-profiled core

Hydrogen Fueling Receptacle in the Toyota MIRAI Fuel Cell Vehicle

Black Stainless steel for premium appliances
10

Ritz Carlton Hotel in Kyoto

ABACO Anti-bacterial coating

Showerbooths of the Grand Hyatt in Fukuoka

GINZA SIX

Stainless Steel Bottles

New Development Case Studies

Water Supply Tank in Yonago

Stainless steel lined water reservoir

Solar Drier

Development of PossFD for refrigerant piping

Flap-Gate Type Seawall against flood disaster

Biomass Wagons

Stainless steel trays instead of disposable containers in the school dining halls

Collector Electrode

Pedestrian and Bicycle Bridge Concept in Duplex Stainless Steel

Wynyard Walk

Toride Naruto

Corrodur 18 – a new martensitic medium nitrogen stainless steel grade for bearing applications



Message of the Secretary-General



To encourage our members to increase their work on market development, and to provide inspiration for new ideas, we present Awards at our Annual Conference for the Best New Applications for Stainless Steel in two categories: Best New Technology and Best New Development. Participation in these Awards Programmes has unfortunately been disappointingly small, with the same companies submitting entries every year, but the standards are remarkably high. That makes the task of selecting winners very difficult for our panel of eight judges, as is illustrated by the fact that there are two joint winners of the Gold Award and two joint winners of the Bronze

Award for the Best New Development category.

The range of entries has varied widely, giving a good spread of ideas to other members. The purpose of these Awards is not only to reward excellence in individual company achievements but also to increase market development by adding to the pool of creative new ideas. Particularly exciting this year has been the focus on new automotive applications; water conservation ideas and an interesting new concept for architectural design.

All entries are published in this Brochure and members are encouraged to read them carefully – there may be an opportunity which they can use in their own markets.

Despite the relatively low number of entries, this

Awards Programme will continue, because the Awards are valued by the winners, who use them in their own corporate literature, and because the underlying need for market development remains valid. But we hope that this Brochure (and the sight of their competitors collecting their Awards) will encourage other members to participate next year. As the old saying goes “you have to be in it to win it”.

John Rowe
Secretary-General
International Stainless Steel Forum
Brussels



Non-coated Stainless Steel Bipolar Plate for Hydrogen Fuel Cell Vehicle

Name of member: POSCO
Manufacturer: Hyundai Motors, KOREA (Model : NEXO)
Field: Automotive, Green Energy, Industrial Machinery and Equipment, Transport
Environment: Marine, Urban, Rural, Industrial
Grade and surface: Poss470FC, Electro-chemically Modified Surface

Fuel-cell vehicles are attracting attention as the ultimate eco-friendly car as they solve the problem of mileage and charging time, which are the shortcomings of electric cars. Through joint development with Hyundai Motor (2013~2017), POSCO has created a new market for stainless steel in the fuel cell vehicle sector by developing a non-coated super-ferritic stainless steel, Poss470FC, for the bipolar plates of fuel cell stack. Poss470FC has been commercially applied in Hyundai Motor's fuel cell vehicle, NEXO, which comes on the market in March, 2018, with world top performance of mileage per charging, 609Km and charging time of 5 min.

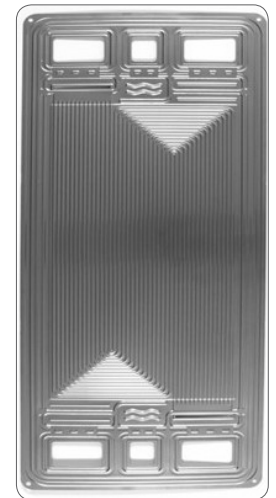
Fuel cell converts the chemical energy of electrochemical reaction of hydrogen and oxygen into electricity. A bipolar plate is a multi-functional component in the fuel cell stack,

which connects and separates unit cells, aids uniform distribution of reaction gases and collects electrical current from each unit cells. Bipolar plates comprises 60~80% of the whole weight and 30~40% of the total production cost of the fuel cell stack.

The material used for bipolar plates should be excellent in corrosion resistance and electrical conductivity. The developed Poss470FC stainless steel has an alloy design that ensures excellent corrosion resistance and world-top electrical conductivity without any additional coating process. As to the superior conductivity, instead of complex and expensive coating process, relatively simplified chemical reforming procedure could remarkably enhance the surface conductivity of Poss470FC that it is equal to or better performance than that of C-coated Ti.

With the advent of this competitive bipolar plate, the cost of stack manufacturing has been reduced, contributing to the potential expansion of fuel cell vehicles. The innovation of uncoated fuel cell separators not only eliminates the threat of scaling down the stainless steel exhaust system due to the reduction of internal combustion engines, but also provides new market opportunities. For example, whereas the consumption of stainless steel on exhaust system in internal combustion engines is 20~25kg per

vehicle, the amount of material requirement for bipolar plates might up to 80kg per vehicle.



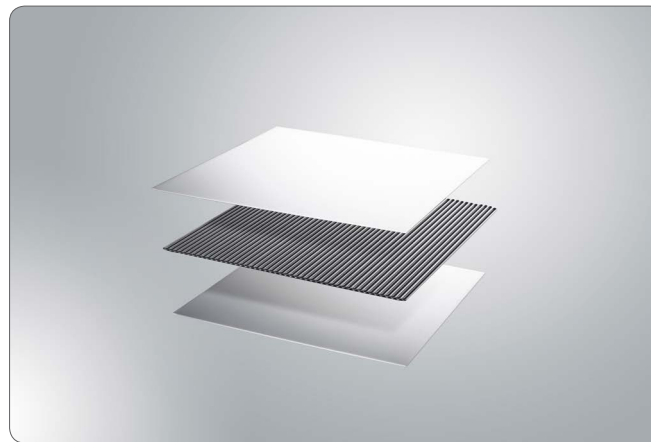


Stainless Weldable Sandwich with 3D-profiled core

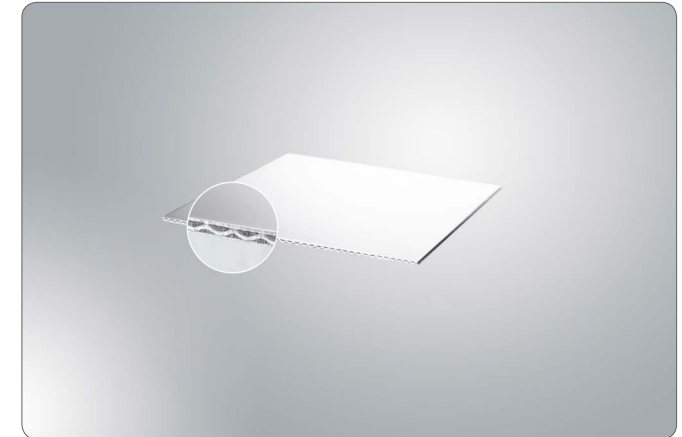
Name of member: Outokumpu
Manufacturer: Outokumpu
Field: Architecture, Building & Construction, Automotive, Transport, Other
Location: Krefeld, Germany
Environment: Industrial
Grade and surface: Flexible/various

The Stainless Weldable Sandwich with a 3D-profiled core is the first direct weldable (stainless) steel-polymeric composite structure ("sandwich") for the automotive car body, transport and construction engineering industry. Former sandwich solutions had not been successful in spite of their enormous lightweight potential because of their insufficient weldability. The Stainless Weldable Sandwich is now able to combine the automotive challenges consisting of lightweight (-25%), stiffness (+80%), acoustic, energy absorption, crash safety and deep-draw-ability with a weldable solution. The 3D profiled core enables at every time a metallic contact between both thin stainless outer-layers which results in a constant electrical current during resistance welding. Thereby no changes during manufacturing are necessary: The Stainless Weldable Sandwich can be handled like a conventional steel sheet during component manufacturing. The Stainless Weldable

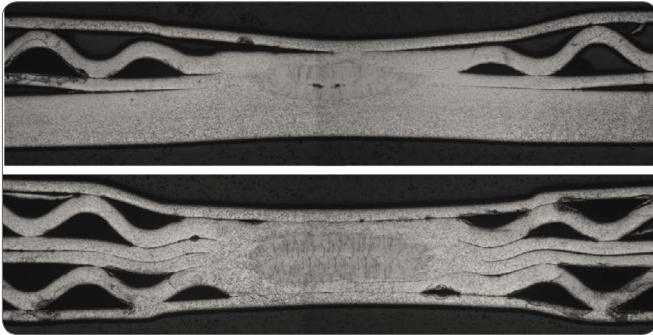
Sandwich will accomplish a key contribution for the lightweight and CO₂-emission targets with high safety at the same time. Furthermore, the Stainless Weldable Sandwich offers a high flexibility and can be adapted to the requirements of the final application: As one example, it is possible to combine a high corrosion resistance stainless steel on the one outer-layer with a more cost-efficient stainless steel on the other outer-layer side. The new sandwich structure solution enables the material "stainless steel" new possibilities in markets, where stainless steels were not represented in the past.



Layer set-up of Outokumpu's Stainless Weldable sandwich with a stainless 3D-profiled core and polymeric material plus two thin stainless outer-layers.



Outokumpu's Stainless Weldable Sandwich with a focus on the stainless 3D-profiled core and the metallic contact to the outer-layers.



Weldability of Outokumpu´s Stainless Weldable Sandwich, here: resistance spot welding in a lap-joint configuration with sheet thicknesses in each case $t = 1.5\text{mm}$.



Outokumpu´s Stainless Weldable Sandwich offers also a high ability to other joining methods like the mechanical joining process of riveting. Because of the stainless 3D profiled core, the connection results in an outstanding power transmission with an enormous, state of the art not possible compressive rigidity. Background is the possibility to work out an interlocking between the profiled core inside the sandwich and the rivet.

Hydrogen Fueling Receptacle in the Toyota MIRAI Fuel Cell Vehicle

Name of member: Aichi Steel Corporation
Manufacturer: Toyota Motor Corporation
Field: Automotive
Location: Japan
Environment: Industrial
Grade and surface: AUS316L-H2 (equivalent to JIS SUS316/316L)

Aichi Steel's self-developed AUS316L-H2 has contributed to Eco-friendly society by the use for hydrogen fueling Receptacle of Toyota MIRAI Fuel Cell Vehicle.

Features: In high-pressure gaseous hydrogen, AUS316L-H2 has excellent mechanical properties such as ductility. Furthermore, AUS316L-H2 can have higher strength by cold drawing process, which enables to realize lighter-weight and lower-cost, keeping its superior ductility.

Please see the page from the catalogue of AUS316L-H2.

From now on, AUS316L-H2 will keep on playing important roles not only in the automobile industry but also in hydrogen gas stations, hydrogen society.

AUS316L-H2 Stainless Steel for Use with High-Pressure Hydrogen

AUS316L-H2 is a stainless steel for use with high-pressure hydrogen, AUS316L-H2 is known as both SUS316 and SUS316L. AUS316L-H2 has been manufactured since 2003.

Product	SUS316 (JIS G4302)		SUS316L (JIS G4303)		High Pressure Gas Safety Act	
	Composition	Mechanical property	Composition	Mechanical property	Strength (MPa)	Yield Ratio (%)
AUS316L-H2	○	○	○	○	○	○
Conventional SUS316L	○	×	○	○	×	×
Conventional SUS316	○	○	×	○	×	×

○: conforms, ×: does not conform

Product Forms Available

- ◆ Hot-drawn bar (Standard length 9000mm)
- ◆ Cold-drawn bar (High-strength specification) (Standard length on request, see application manual)

Stainless steel with solution heat treatment.

The superior ductility facilitates the design of apparatus for use with high-pressure hydrogen, for which high safety and reliability are required. High strength and near-net-shaping for AUS316L-H2 are achieved with cold drawing technology.

Technical properties of AUS316L-H2

Developed steel AUS316L-H2 high-strength specification

Conventional SUS316L

Original composition steel

Developed steel AUS316L-H2

Strength → MPa

Ductility in high-pressure hydrogen → High

Results of SSRT (at 233K, RT, 363K)

Cold-drawn AUS316L-H2 (high-strength specification, reduction of area: 85%)

AUS316L-H2 does not exhibit a remarkable decrease in ductility in high-pressure gaseous hydrogen.

Stress, MPa

Displacement, mm

- at 363K in air
- at 363K in 10MPa high-pressure gaseous hydrogen
- at RT in air
- at RT in 10MPa high-pressure gaseous hydrogen
- at 233K in air (at room temperature)
- at 233K in 10MPa high-pressure gaseous hydrogen

SSRT data were obtained as part of the NEDO R&D program "Development of Technologies for Hydrogen Production, Delivery and Storage Systems".

AUS316L-H2 has gained market acceptance for use in FCV and hydrogen stations.

Toyota MIRAI Fuel Cell Vehicle

Photo courtesy of Toyota Motor Co., Ltd.

Equipment used in hydrogen station

Photo courtesy of Toyota Motor Co., Ltd.

Photo courtesy of Toyota Motor Co., Ltd.

Photo courtesy of JFE Steel

AICHI STEEL CORPORATION

<http://www.aichi-steel.co.jp/>

1-1-1 Watanabe Aso-cho 416-4181 Aichi-shi 416-0818 Japan | Development Dept. (New Technology) | aichi@aisc.co.jp | TEL: 056-653-4054



Fuel cell vehicle MIRAI (TOYOTA).



MIRAI's Hydrogen Fueling Receptacle.



MIRAI's Hydrogen Fueling Receptacle.

Black Stainless steel for premium appliances

Name of Member: POSCO
Manufacturer: LG, Samsung Electronics, Electrolux
Field: Home and Office Appliances
Location: USA, Mexico, China
Environment: Indoor
Grade and surface: ASTM430 Black Anti-finger Coated

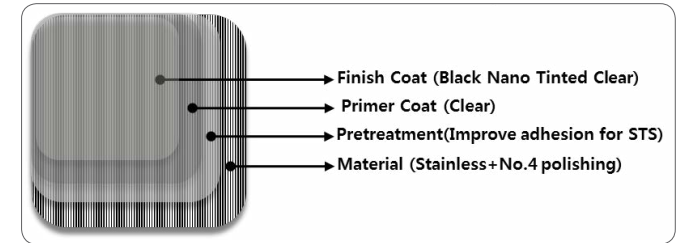
Over the past decade, stainless steel has been widely used for high-end appliances due to its elegant surface and durability. Despite the wide usage of stainless steel, there were consumer's needs of both functional and aesthetic aspect. Traditional stainless steel requires constant maintenance and cleaning due to fingerprints. Black stainless steel, on the other hand, is easy to care because it is smudge-proof. Also by adding dark-tint to coating liquid, it became to have better look on the surface.

Black stainless is a type of anti-finger coated steel with black nano powder added. It requires high quality control from base material to coating process. Base material has to have clean surface free of any defect, because it affects the quality of polished steel, and coated steel at the end. The most important control factor is a color match. Keeping color consistent by managing manufacturing condition (curing temperature,

thickness of coating, and liquid composition) require sophisticated and complex technical skill.

There had been trend transition from white goods to stainless steel in the past decades. Black Stainless created the new trend in premium segment and it has moved stainless steel category to an exclusive high-end market. Starting from LG and Samsung, major home appliances companies including GE, Frigidaire, KitchenAid, and Whirlpool has begun to manufacture a full line of Black Steel. It now accounts for 30% of package sales.

By going through successful experience in home appliances market, we found a high potential in black stainless steel. To extend the market, we've been approach to other industries such as art, furniture, architecture and building. Since each usage has different key quality requirement, we develop suitable coating system and manufacturing process. In the near future, black stainless would settle down as one of alternative material to satisfy consumer's unlimited desire.



Structure



Applications

Ritz Carlton Hotel in Kyoto

Name of Member: Nisshin Steel Co. Ltd.
Manufacturer: GANTAN Beauty Industry Co.Ltd.
Field: Architecture, Building & Construction
Location: Kyoto, Japan
Environment: Urban
Grade and surface: SUS445J2 (NSS U-22), Dull

The Ritz-Carlton Hotel Kyoto is located near the Nijo-Ohashi Bridge crossing the Kamogawa River in Kyoto and creates an extremely refined atmosphere where modernity and tradition fuse.

Kyoto, with 17 world heritage sites, has strict landscape ordinances regulating the heights and designs of buildings. Against this background, the Hotel's Roof is patterned after Japan's traditional building technique of Sukiya-construction and the ferritic SUS445J2 sand-blasted provides a "matt-looking finish". The rectilinear roof and eave with horizontally-laid panels blend nicely in the landscape facing thirty mountains of Higashiyama, harmonize with the townscape of Kyoto and are well appreciated by hotel guests and strollers. The parties concerned worked and succeeded in sandblasting the ferritic roofing stainless steel of 0.4 mm in thickness, which had been previously deemed difficult, and in meeting requirements of various parties including the owner, designer and builder. The parties have contributed in providing

the Hotel with flavors of genuine Japanese architecture to match the city of Kyoto.



ABACO Anti-bacterial coating

Name of member: Centro Inox
Manufacturer: The ABACO® Project has been supported by:

- Protec Surface Technologies Srl (PVD antibacterial equipment)
- Protim Srl (PVD antibacterial coatings)
- MORI 2A Srl (specialized in designing and manufacturing of stainless steel products for the HO.RE.CA industry)
- Almar SpA (antibacterial door handles)

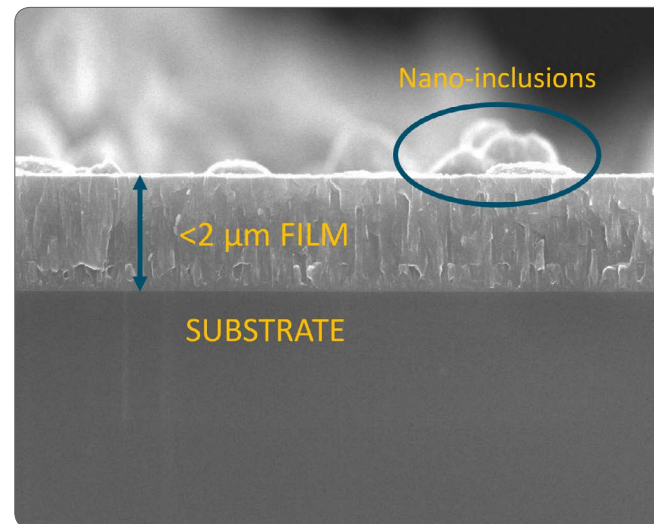
and financed by:

- Regione Lombardia
- MIUR - Italian Ministry of University and Research

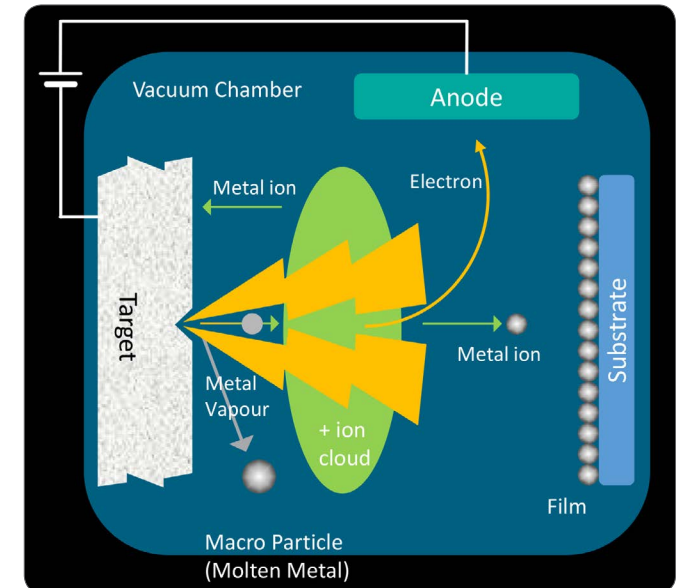
Field: Cookware, Hollowware and Cutlery, Food and Beverage Indoor
Environment: Indoor

ABACO® is an antibacterial coating that combines the advantages of strength, durability and beauty of PVD (Physical Vapour Deposition) with an assured nanotechnology providing exceptional antibacterial properties. It is able not only to completely inhibit the growth of bacteria but also to eliminate them, guaranteeing a durable and perfectly hygienic surface. ABACO® has therefore not only a bacteriostatic effect, but it is also bactericidal. The bacterial efficiency, certified by precise lab test, is due to the nano inclusions

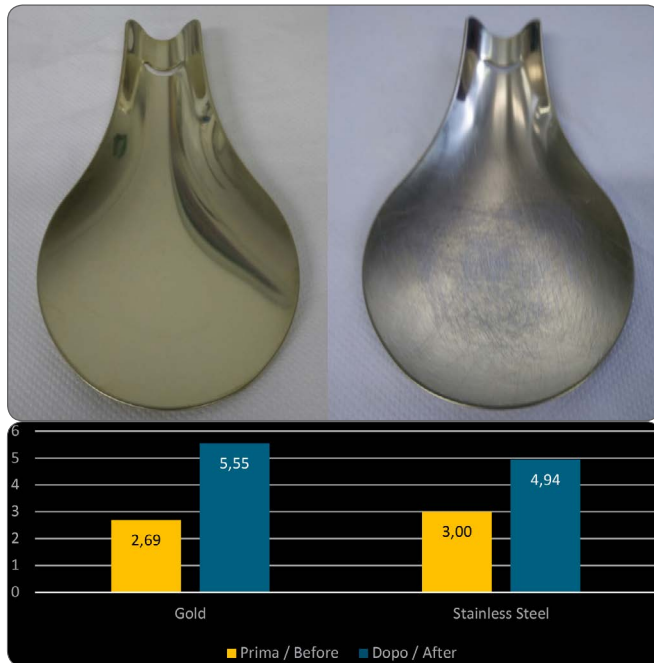
present in the complex architecture of the multilayer coating, which destroys the bacterial cell membrane by blocking its nutrition, thus stopping the cell division cycle. The antibacterial action continues throughout the active life of the object. This antibacterial coating can be applied on a wide range of stainless steel products, such as gastronomy, containers, lids, baking pans, trays, sink bowls, basins and accessories for ice-cream shops and much more.



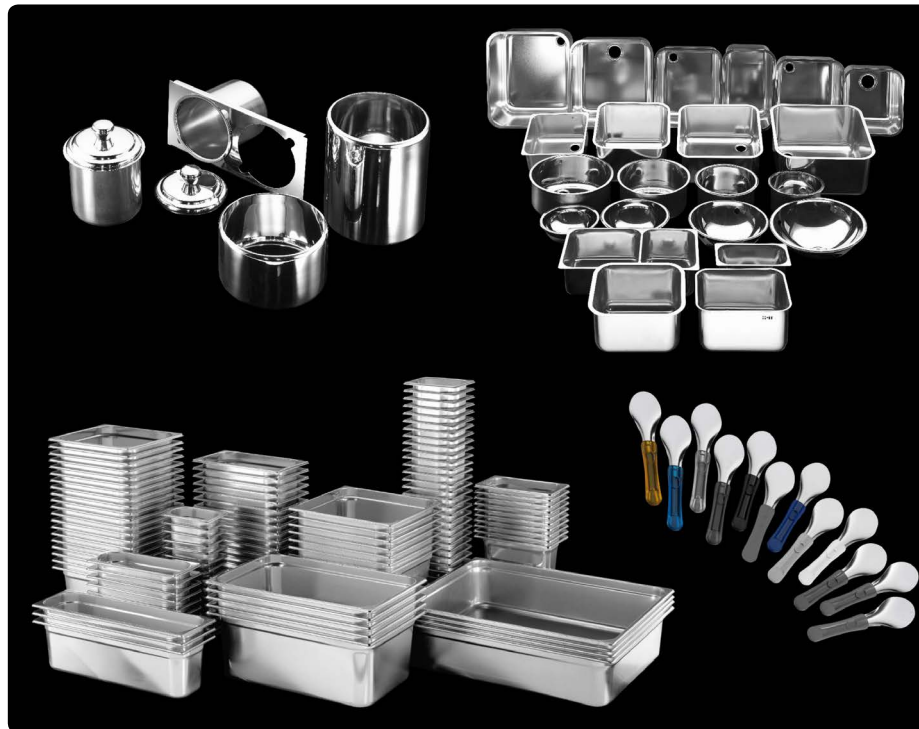
Scanning under an electron microscope (SEM) shows the antibacterial ions forming clusters (nano inclusions) within the complex architecture of the multilayer coating. These groupings release the antibacterial ions on the surface by destroying the cell membranes of the bacteria, blocking their source of power and thus interrupting the cycle of cell division.



ABACO's coatings are obtained through the CAE (Cathodic Arc Erosion): the solid evaporation of the metal is due to a device that generates an electric arc on the surface of the metal to be evaporated, the electric arc melts the metal which sublimates.



The antibacterial and quantified efficiency is measured through the parameter R: if R is a value between 0 and 2, the activation of the coating is considered to be bacteriostatic. If R is greater than 2, the coating activity is considered bactericide. The graph shows the values of R of the coating (Gold and Stainless Steel finishes) before and after use. In both cases the bactericide hectare remains.



Different examples of stainless steel applications that would qualify to use the ABACO coating.



Showerbooths of the Grand Hyatt in Fukuoka

Name of Member: NSSC
Manufacturer: Toyo Stainless Polish Industry Co. Ltd.
Field: Architecture, Building & Construction
Location: Fukuoka, Japan
Environment: Indoor
Grade and surface: NSSC®FW2 Powder Snow Finish

Alloy-saving stainless steel NSSCFW2 was used for shower booths of Grand Hyatt Fukuoka, one of the high-end hotel Fukuoka City.

This NSSC's original stainless steel, containing just 16% Chromium only and no Nickel, being added micro amount of Tin can achieve the corrosion resistance equivalent to SUS304. The polished surface of NSSCFW2 is characteristic silvery-white color, which cannot be achieved by other stainless steel grades. It is also effective for nickel allergy.

Moreover, the unique polishing techniques owned by Toyo Stainless Polish Industry Co., Ltd. are the one of the key elements for this award. The surface finish is called "Powder Snow" which reduces glare and has a three-dimensional impression with inhomogeneity.

In addition, "MD treatment", a special treatment

to harden the surface and usually used on the countertops of high-end kitchens, was applied on the surface. The treatment can bring better scratch resistance against water washing brackets.

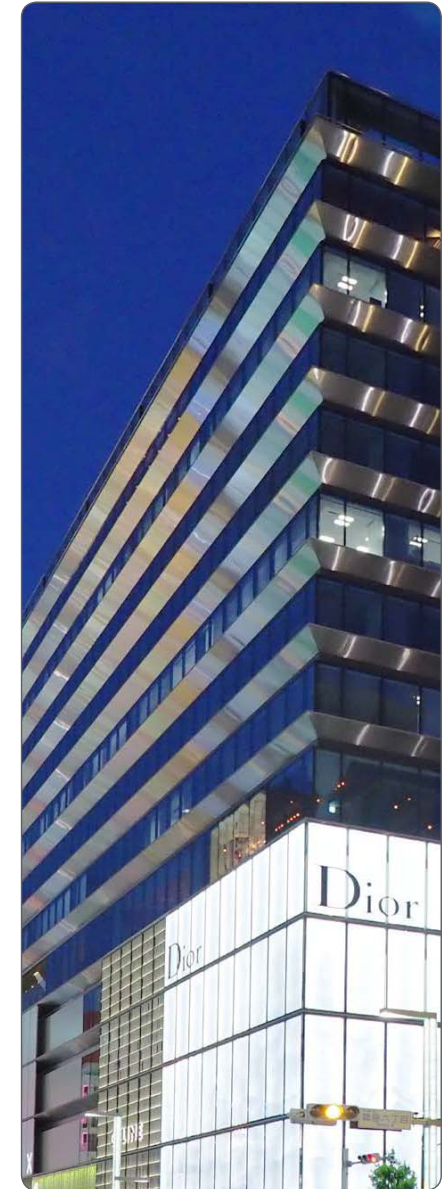
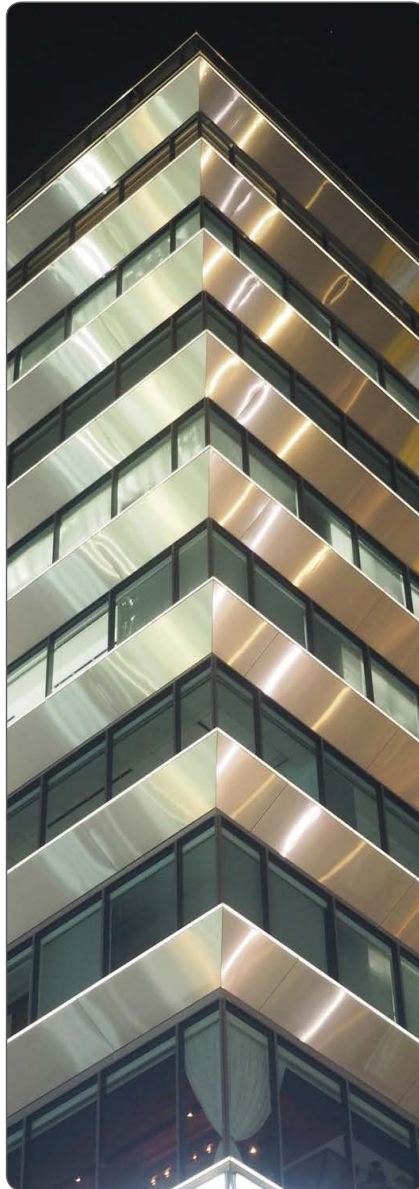
Thus, it was applied for the famed hotel in Fukuoka, as the material was highly evaluated because of the advantages of the alloy-saving stainless steel, designed polishing, and treatment to suit to the usage environment.



GINZA SIX

Name of Member: NSSC
Manufacturer: Mitsubishi Chemical Corporation
Field: Architecture, Building & Construction
Location: Tokyo, Japan
Environment: outdoor
Grade/surface: NSSC@220M(22Cr-1.6Mo-LC,N), hairline polished finish

GINZA SIX was designed by internationally acclaimed architectural firm Taniguchi and Associates and Kajima Corporation as a redevelopment project of two blocks in Tokyo's Ginza upscale neighborhood. The building, which has 13 floors above ground and 6 floors underground, was constructed by Kajima Corporation, with a total area of 148,000 square meters. For the trademark eaves of the building, which can be seen from a distance, Mitsubishi Chemical Corporation's stainless steel composite material "ALPOLIC/fr@SCM" which uses NSSC@220M was applied. This ferritic stainless steel has excellent rust-resistance (superior to SUS316) and a lower thermal expansion coefficient. The building is recognized as the new symbol of Ginza, one of the most famous areas for shopping and sightseeing in Japan.



Stainless Steel Bottles

Name of Member: Centro Inox
Manufacturer: 24Bottles® is a registered trademark of DESIGN24
 -40055 Villanova di Castenaso BO - ITALY
 -Via Bruno Tosarelli 284,
www.24Bottles.com /
Designer: Luca D'Ambrosio
Field: Food and Beverage
Environment: Urban, Indoor
Grade and surface: 304 (EN 1.4301) and painted stainless steel

The all-Italian innovative “24 Bottles” brand was created in 2013 to rediscover the theme of sustainability. The first collection of EN 1.4301 (AISI 304) stainless steel bottles was designed for the purpose of containing and limiting the use of disposable plastic bottles and glasses. The choice of using stainless steel has allowed to produce bottles that are as light as aluminium canteens, strong but at the same time safer and healthier, since they have no plastic internal lining. In addition to the collection of stainless steel bottles, this manufacturing company proposes a line of original and exclusively “made in Italy” fashion accessories.



Water Supply Tank in Yonago

Name of Member: NSSC
Manufacturer: Morimatsu Industry Co. Ltd.
Field: Architecture, Building & Construction, Water Equipment
Location: Yonago City, Japan
Environment: Outdoor
Grade and surface: SUS329J4L/No4
 SUS304/No1, No2B
 SUS316/No1, No2B

Duplex stainless steel SUS329J4L is used for the new water supply tanks built by the Bureau of Yonago City Waterworks in Tottori, Japan. The Central Water Supply Tank which is one of the new tanks, is one of the largest cuboid type stainless steel water supply tanks in the world, whose capacity is 16,000m³.

Aesthetic appearance was required on the outer surface of the tanks, as symbols of this area. Moreover, high corrosion resistance to withstand severe corrosive environments was indispensable to material for both inner and outer surface of the tanks. They were installed on the top of the mountain near the coast of Japan Sea and expected to be exposed to strong seasonal sea breeze, and water stored in the tanks contains sodium hypochlorite to be disinfected. Furthermore, high strength was required for the

material to resist pressure from large quantities of water stored in the tanks. The duplex stainless steel is the best solution in order to meet all these requirements. The material also enabled to cut maintenance cost as painting and coating are not necessary. Stainless steel is superior to other material for water supply tanks, as it has excellent earthquake-proof and water-tightness Also, Tanks made of stainless steel can be installed in a shorter period of time compared to concrete-made tanks.

As demands for renewal of deteriorated concrete-made water supply tanks built around the 1970s are increasing, it is expected that demands for stainless steel in this application also will grow.





Stainless steel lined water reservoir

Name of Member: POSCO
Manufacturer: Moonchang Co., Ltd.
Field: Water equipment
Location: Gangneung City, Korea
Environment: Urban, rural, industrial, indoor
Grade and surface: STS329LD, STS329J3L / 2B

Most water purification plants and reservoirs in South Korea were built 20 years ago which has led to water pollution due to the aging of concrete. The corrosion and deterioration of concrete has contaminated purified water as well as cause leakage of the water itself.

In order to prevent these problems, crack repair and epoxy waterproof coating has been applied as a countermeasure. However, because these applications only have temporary effect, not to mention cost increase, the need to install PE or stainless steel panel as a permanent solution is increasing. Since the water tanks have a chlorine atmosphere due to the storage of water which undergoes chemical treatment and disinfection, the need to apply stainless steel as a means to

provide a corrosion resistant and environment friendly surrounding is on the rise.

The advantages of stainless steel as a lining material are as the following. First of all, deterioration will become absent, thereby preventing contamination as cracks will be non-existent. Second, it is possible to reduce the cost due to frequent maintenance of concrete structure through a periodic cleaning. Finally, since stainless steel suppresses microbial generation as compared to concrete or PE, microbial corrosion and water contamination can be prevented.

The stainless steel applied for lining material is a duplex type which is resistant to the corrosive atmosphere of chlorine environment. Grades such as STS329LD, STS329J3L etc. are utilized, and considering the excellent corrosion resistance and durability compared to the classical 304, it is expected that the demand for these grades will increase

The major types of technology that is applied

in stainless steel lining construction is welding and anchoring. Welding is used for the stainless steel panel applications and anchoring is for when attaching stainless steel panels to concrete walls. Currently, POSCO is developing automation welding technology to improve the workability.

The global water industry market is expected to grow to more than \$ 900 billion in 2025. It is estimated that the water treatment market where stainless steel is widely used accounts for more than 40% of that. In case of Korea, The stainless steel lining market is about 100,000MT, which can be calculated into 10 million m³ of water tank capacity. As the existing structures continue to naturally age, the demand of stainless steel is expected to increase gradually. It is important that aggressive actions are taken from the steel suppliers to persuade consumers that stainless steel can be applied to their current applications which do not consume stainless steel. These activities will accelerate the growth of stainless steel consumption in piping, water tank, and water tank lining fields.



Before



After



Solar Drier

Name of Member:	Columbus Stainless
Partner:	Feed a Child and Africa Outreach
Manufacturer:	Mpumalanga Stainless Initiative
Field:	Food and Beverage
Location:	Middelburg, Mpumalanga
Environment:	Rural
Grade and surface:	3CR12 Stainless with 2B finish

Due to the Economic conditions in the country most schools have vegetable gardens to feed the children. The problem is that these gardens are seasonal and still creates supply problems for the rest of the year. The other source is fruit donations from Supermarket chains however the same seasonal problem remains.

The objective remained to design a device to increase the life span of the vegetable and fruit. That is when the Organisation Feed a Child came up with the idea of solar fruit driers.

This is a very simple design but very practical. It is manufactured with 3CR12 Stainless material. The frame is from Stainless with a solid stainless back plate. At the front it is covered with a plastic product to let the sun through creating heat. Hot air will flow upwards and dry the fruit and vegetables. There are 8 racks that slide in and

out on which the fruit and vegetables are dried on. The dimension of these racks are 2435 mm by 390 mm. The total height of the drier is 2m. The base is 1230mm by 2435mm.

The first prototype drier was completed February 2017. The first trial started with this drier it was very successful. The plan is to manufacture more of these driers and place them in strategic locations in the communities where needed. With the water problems in our country it will definitely add value to the life's of people.

The advantages are:

- No wastage and optimal utilisation of fruit and vegetables
- Nutritional value of dried fruit and vegetables remain after dried
- Increase the shelf life to 12 months
- No refrigeration required
- Easy to handle and clean

It remains a vision of the four companies involved to nourish, train and ensure sustainability of this valuable product.

This is an example where the natural resource namely the sun, people and Stainless are utilised to make a big difference and provide a better quality of life.



Jenny Nawa from Feed a Child feeding vegetables to be dried in feeder.



Development of PossFD for refrigerant piping

Name of Member: POSCO
Manufacturer: LG Electronics
Field: Home and Office Appliances
Location: South Korea
Environment: Urban, Rural, Industrial, Indoor
Grade and surface: PossFD, No.2D

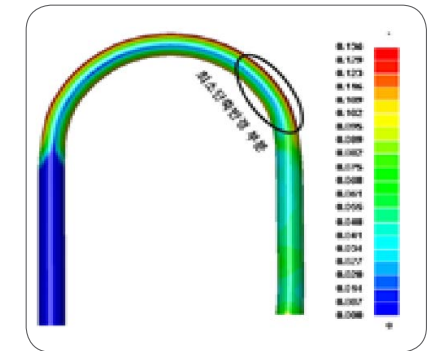
Copper is one of the most consumed metals in the industry, however, the price of copper is relatively higher than other competitive metals and has sharply increased recently. Copper tubes also have been used for refrigerant piping between components of air conditioning systems for its excellent formability. With the interest to reduce the manufacturing cost by replacing copper with other materials, the development of soft stainless steel was initiated.

Stainless steel may not be able to be as soft as copper, however, very soft austenitic stainless steel, PossFD has been developed with excellent flexibility and drawability. Copper tubes are so flexible to bend that elbow or U bend are easily formable. Several bending tests with pipes made of PossFD have been performed to evaluate its formability and deduce the optimized thickness for each pipe with different diameter. PossFD has equivalent corrosion resistance compared with copper and PossFD tubes prove the better

performance under pressure test compared with copper tubes due to its higher strength. After optimizing the manufacturing process for PossFD in the factory where only copper has been processed in advance, PossFD tubes were finally approved for refrigerant piping at several major air conditioner models to replace copper tubes.

PossFD for air conditioning systems can be a good example to create a new market for stainless steel by replacing competitive materials. Furthermore corrosion resistance is still the dominant characteristic of stainless steel therefore higher chromium stainless steel may be considered for some parts of air conditioning systems under

severe conditions. Along with the innovation of home appliances, stainless steel will also develop new grades and create more applications.



Flap-Gate Type Seawall against flood disaster

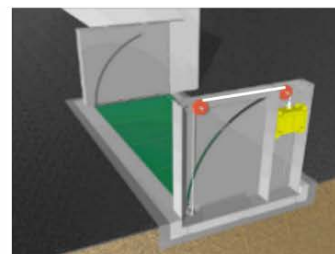
Name of Member: NSSC
Manufacturer: Hitachi Zosen Corporation
Field: Architecture, Building & Construction
Location: Japan
Environment: Outdoor
Grade and surface: NSSC®2120(ASTM S8122)

Before the Great East Japan Earthquake in 2011, aluminum-alloy slide gates had been one of the main countermeasures against tsunamis, however adoption of a new technology called "Flap-Gate" has been advanced after the disaster. When tsunami comes, the gate stored in the ground at normal time rises by its buoyancy with no electricity to prevent it. It was originally applied for small gates which were installed at the doorway of buildings to prevent from flood, and now it has been applied for countermeasures against tsunamis.

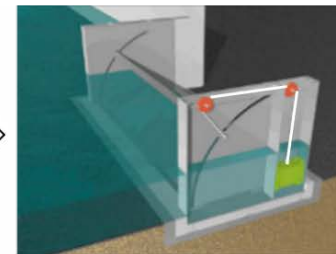
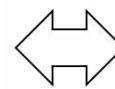
There were three major requirements for the main material to materialize Flap-Gate Type Seawall. Firstly, as large vehicles pass over the gate, it has to have high strength against deformation and abrasion resistance. Secondly, high corrosion resistance was required to reduce the painting and repairing cost. Thirdly, the material has to be light enough to enable the gates to flip up by its buoyancy.

The features of NSSC2120 could give solutions to these requirements. This lean duplex stainless

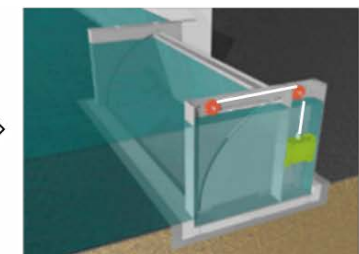
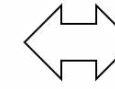
steel contributed to the implementation of Flap-Gate Type Seawalls against flood disaster, by improving durability and corrosion resistance, and reducing weight simultaneously. The largest flap gate whose size was 80m² was constructed. More than 1,200 tons of stainless steel has already used for this usage in Japan, and the total domestic demand is estimated to be 5,000 tons. Moreover, these gates are now considered to be installed in Southeast Asian countries, as countermeasures against the sea level rise caused by climate change.



Normal position



Rising start



Highest water level

Biomass Wagons

Name of Member: Columbus Stainless/
Cedinox
Manufacturer: WH DAVIS
Field: Green Energy, Transport
Location: North Yorkshire
Environment: Industrial
Grade and surface: Ferritic 3Cr12 Hot Rolled
No.1

200 new wagons made in ferritic stainless grade 3Cr12. Each vehicle has a capacity for transporting biomass almost 30% higher than other UK wagons. The load capacity is 71,6 tonnes. Pelletized biomass will be transported from the ports of Tyne, hull and Immingham to Drax power station in North Yorkshire.

The wagon's shape held the key. By working on its design, UK engineering company WH Davis achieved a significantly increased cubic capacity.

The wagon has a 3Cr12 stainless steel main structure, chosen in key part due to its higher corrosion resistance and reduced friction to mild steel. 3Cr12 is recognized as the original 12%chromium utility ferritic stainless steel, due to its toughness, (even when welded), and its capacity of retaining toughness at temperatures below freezing point. It's performance resists high levels of corrosive attacks, especially storage and abrasion resistance in materials handling, which all contributes to reduce reparation cost



in many engineering site applications. In general it can be shown that in real industrial situations, where corrosion is present, 3Cr12 is shown to be vastly superior to carbon and low alloy steels. When cost per unit volume loss is also taken into consideration, 3Cr12 is superior to all types of steel that have been tested.

Other rail applications using 3Cr12 grades includes coal ore, sugar, agriculture, abattoirs plus, light rail and rail infrastructure road transport covers passenger vehicles coaches & buses., trucks & freight and utility vehicles applications.



Stainless steel trays instead of disposable containers in the school dining halls

Name of Member: Centro Inox
Manufacturer: Italian catering cooperative: CIR food
Field: Food and beverage
Location: Scandicci (FI), Italy
Environment: Indoor
Grade and surface: EN 1.4301 (AISI 304) stainless steel

Starting from September 2017, in the Municipality of Scandicci (FI) - ITALY, 850 "gastronorm" containers in stainless steel, with their lids, were introduced for the school catering, instead of the disposable containers in polypropylene. The stainless steel containers are used for packaging and distribution of food and then be cleaned and sanitized at the end of the meal. The Municipality of Scandicci is another example, after that of the Municipality of Milan, dating back to 2012, where the school dining halls, for greater respect for the environment and also for better hygiene, decide to choose stainless steel.



Collector Electrode

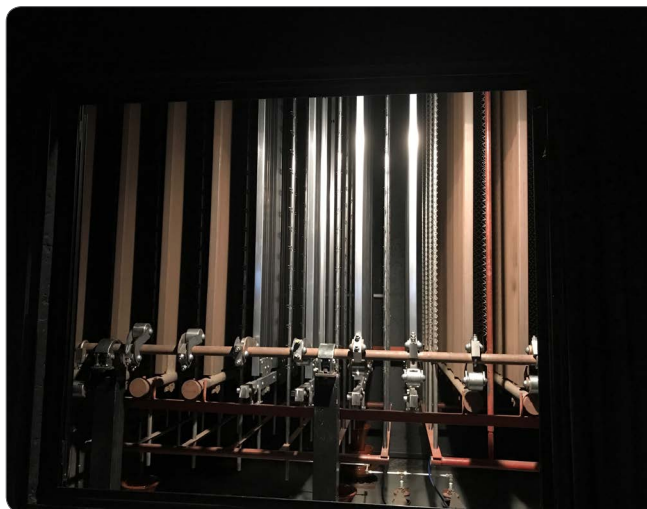
Name of Member: Columbus Stainless
Manufacturer: Geecom (PTY) Ltd
Field: Architecture, Building & Construction
Location: Gauteng, South Africa
Environment: Industrial
Grade and surface: 3CR12/EN1.4003, 2B surface

Summary of entry

Use of stainless steel sheeting rolled into individual elements duly structured into self-supporting hanging plates onto which various brackets are attached by means of rivets/huck bolts in order to create a unit termed "Collector Electrode Assembly" used in the collection of dust particles found in industrial gases by means of Electrostatic Precipitators.

Background to the entry

Electrostatic Precipitators (ESPs) are units widely used to remove particulate matter from gaseous emissions. In general, ESPs comprise a wide range of equipment that also includes a substantial number of "Collector Electrodes" having their surfaces designed to facilitate particle precipitation and their effective removal thereafter. It is known that the design, shape and material of a "Collector Electrode" affects



the overall ionization process leading to effective precipitation. These "Collector Electrodes" form one of the main backbones of an ESP and are normally the subject of much research and development.

The "Collector Electrodes" are arranged vertically and attached to the main structure by means of support brackets to form a "curtain" electrode assembly that is suspended in the gaseous emission within the ESP. Some of these gaseous emissions are highly corrosive and the relevant dust content can be highly erosive as well. Any dust that settles on the "Collector Electrode" is

normally removed by means of striking the unit via an appropriate "rapping" device.

In the selection and design of "Collector Electrodes", there is a need to address specific requirements in order to meet some of the following conditions:

- Selection of correct materials to be used within an ESP environment;
- Electrical characteristics of material to be used;
- Mass of materials which directly affects the structural design for the overall system. Furthermore, need to ensure minimum weight contribution to any possible structural



adjustments in ESP refurbishment or upgrade projects;

- Rigidity and, most important, flexibility of the material to be used;
- Smoothness of the material and its disposition to dust particle removal;
- Longevity of the material;
- Propensity for a uniform transmission of acceleration waves imparted by striking the material;
- Sensitivity to riveting / huck bolting;
- Ease of manufacture by rolling process and relevant assembly;
- Cost Effectiveness.

Detailed description of entry

The submitted entry can best be described as:



Use of Stainless Steel material 3CR12 to form an elongated plate which is rolled by means of a purpose built rolling machine to specific lengths in order to form dust collecting curtains used as internal elements in Electrostatic Precipitator Units. The individual sheet is termed as "Collector Electrode - S/S".

The main benefits of using the "Collector Electrode - S/S" Units are as follows:

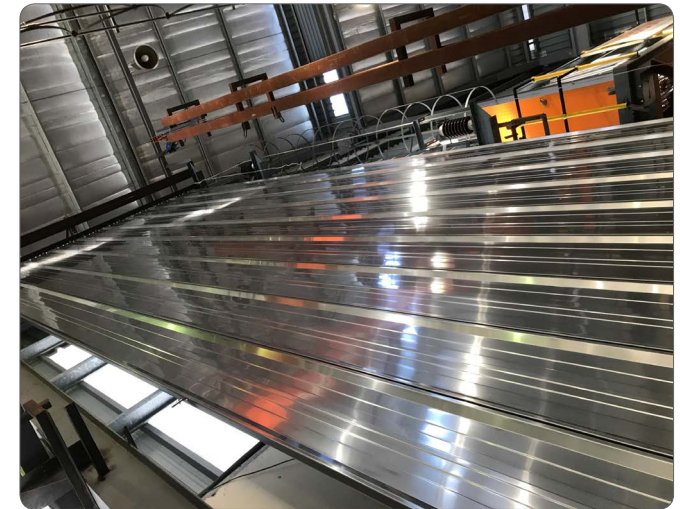
- Higher corrosion resistance than mild steel which is especially important to the ESP when units are washed regularly;
- Better impact resistance;
- Better performance at high temperatures;
- Proven success in several applications across numerous industries.

Product contribution to the stainless steel market

The main contributions of the "Collector Electrode - S/S" products are highlighted as follows:

- Utilisation of stainless steel material in an environment which was not contemplated previously i.e. Air Cleaning Dust Abatement Plants;
- Possibility for substantial increase in the production and corresponding usage of the Utility Stainless Steel.

The Gas Cleaning Industry has always been faced with process conditions which are extremely unfriendly to the use of normal steel materials in



areas or equipment directly exposed to the various off-gas streams. However, in the past, the use of various types of available stainless steels was not an economic proposition.

In principle, it should also be noted that the use of normal mild steel for "Collector Electrode" application is the most common practise world-wide. Large quantities of steel are also required in order to configure and implement the plants which are required to influence the specific gas cleaning process and meet stringent dust emission standards.

The replacement of mild steel with stainless steel in "Collector Electrodes" brings about



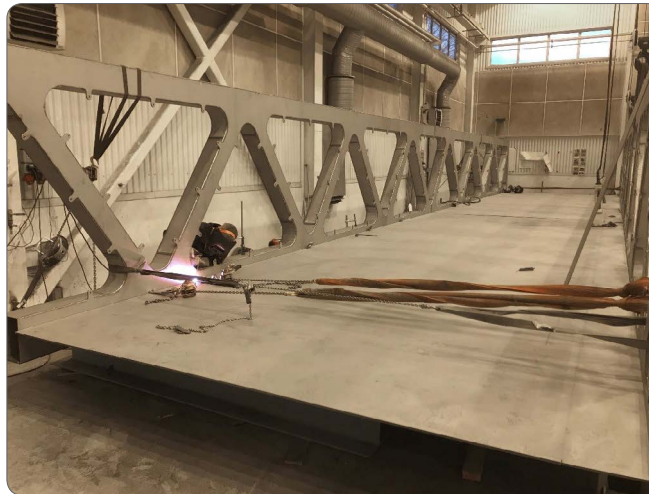
a conversion of well established norms with emphasis on already detailed benefits, which in the context of the South African market, are further influenced by the following:

- Most Electrostatic Precipitators in South Africa are 20 years or older and in need of replacement as well as refurbishment and/or upgrade;
- In most instances, the replacement of Collector Electrodes in their end-of-life-cycle is considered as a normal requirement leading to a need for a substantial amount of “steel” to be replaced;
- Any future project has to take into consideration the possible effect that changes to internal elements may have on structural condition of presently installed structural precipitator units;
- The proposal to use Stainless Steel for “Collector Electrodes” introduces a structural weight reducing factor which is obvious in providing the impetus for eventual selection of this type of equipment solution;
- The introduction of latest technology machines allow for the rolling of Stainless Steels of 0.4 to 1m thicknesses which further enhances the “friendly usage” of this material, thus providing a cost effective migration to its promotion under general and normal circumstances.

Pedestrian and Bicycle Bridge Concept in Duplex Stainless Steel

Name of Member: Outokumpu
Manufacturer: Stål & Rörmontage AB, Sölvesborg, Sweden
Field: Art and Street Furniture, Architecture, Building & Construction
Location: First bridge installed February 2018 over E4 in Södertälje, south of Stockholm, Sweden
Environment: Marine, Urban, Rural, Coastal, Industrial
Grade and surface: Lean Duplex Forta LDX 2404 in the sides and Forta DX 2205 for the load bearing parts. Surface was mill finish 1D.

The company Stål & Rörmontage in Sölvesborg, Sweden, has designed a new pedestrian and bicycle bridge concept with patented & protected design and design solutions. The bridge concept is scalable which makes it easy to vary the design parameters, such as the length, which simplifies the design calculations, optimizes the material thicknesses, reduces the weight and lowers the overall costs, including the transport and installation at site. Aesthetically appealing design features includes 10 mm "unbreakable glass" sections for maximum transparency and light sources integrated in the hand railings on both



First Duplex bridge of the new concept during manufacturing in the workshop.

sides.

The bridge is made of duplex stainless steel which is fully recyclable, have a high strength and a relative lean alloying content. The duplex steels have a high corrosion resistance in road environments and also in other infrastructure applications, giving a long design life of 120 years or more while minimizing the future maintenance costs as no painting or hazardous coatings are needed. The bridge concept can of course be made for marine and industrial environments as

well using higher alloyed duplex grades.

Also costs for shutting down traffic is minimized, which is crucial in highly populated areas and in cities. With LCC (Life Cycle Cost) in focus, maintenance free duplex stainless steel bridges are a very competitive material for bridges that, else, needs expensive on-site maintenance, such as carbon steel and wood bridges.

More information found at: <http://srmab.com/>



Show piece of the bridge concept.



The bridge installed over E4 in Södertälje south of Stockholm, Sweden.



The bridge installed over E4 in Södertälje south of Stockholm, Sweden.

Wynyard Walk

Name of Member:	Australian Stainless Steel Development Association (ASSDA)
Manufacturer:	Stoddart
Field:	Architecture, Building & Construction
Location:	Sydney, Australia
Environment:	Urban
Grade and surface:	445M2 grade stainless steel. 2B finish (Although not in a traditional sense. The had a slight grain to it).

Wynyard Walk is a major pedestrian walkway connecting Wynyard Train Station to the bustling Barangaroo waterfront precinct and Sydney CBD. Completed in 2017, the new infrastructure forms one of several solutions to break pedestrian congestion, with an estimated 75,000 commuters using the hub every day. It features over 1600m² of perforated and solid stainless steel sheeting into ceiling and fascia panelling installed at the Clarence Street entry façade and the tunnel lining. The panels twist and curve with the bends of the tunnel, creating a sense of flow and motion.



Unique to this stunning architectural application is the use of ferritic stainless steel, 445M2, rather than the conventional specification of 304

or 316. The key factors of formability, cost and corrosion resistance, as well as stainless steel's aesthetic appeal were the driving factors around the specification of this grade for this project. This application showcases strong innovation in stainless steel and opens the market to more opportunities. It is a good and different example to promote the material use (cost savings and life-cycle) in architectural and infrastructure applications, and stainless steel as a whole.

Another point of difference (in relation to drafting) was that the project was modelled from point clouds. These point clouds were generated using 3D surveying equipment and modelled to create a real world model in which the stainless steel panels were then generated to suit. This included the sub structure. This meant there were next to no discrepancies in panel sizes on site and allowed installation to go smoothly.



Toride Naruto

Name of Member: Nisshin Steel Co. Ltd.
Manufacturer: GANTAN Beauty Industry Co. Ltd.
Field: Architecture, Building & Construction
Location: Naruto City, Japan
Environment: Coastal
Grade and surface: Toughten Z (hot-dip galvanized stainless steel plate of SUS430)

This is a Japanese traditional fortress castle ruin and this three-layered tower used as a memorial museum of Mr. Torii who is an anthropologist. The museum was closed in 2010 by the aging and reopened with the earthquake-proof construction in 2016 as a free conference room and shelter for citizens. Then, it is nicknamed "TORIDE comes to". Formerly known as "Mr. Torii's museum", it



will become to a "TORIDE" means a fortress for region and citizens.

In order to ensure the earthquake resistance performance of building, press-formed metal roof tiles which do not burden the structural frame by 1 / 10th the weight of clay roof tiles are adopted as materials for roof repair work. The Toughten Z was selected, hot-dip galvanized stainless steel plate of SUS 430, it has both corrosion resistance of stainless steel and antirust effect of hot-dip galvanizing. It is a decorative roof and exterior material which has been subjected to hot-dip galvanizing with a calm appearance, exhibits a tone of gradation by chemical treatment.

In accordance with the high earthquake resistant structure, it creates a peculiar atmosphere of the castle and contributes to a new image of stainless steel.







Corrodur 18 – a new martensitic medium nitrogen stainless steel grade for bearing applications

Name of Member: Deutsche Edelstahlwerke
Speciality Steel GmbH & Co
KG

Manufacturer: Schaeffler AG

Field: Industrial Machinery and
Equipment, Water
Equipment

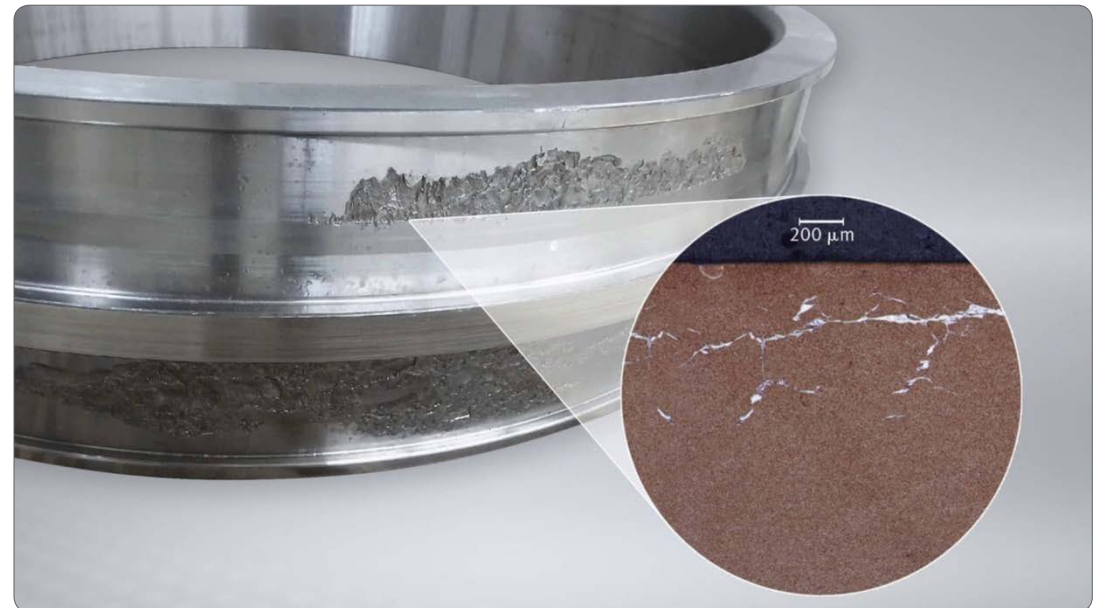
Environment: Industrial

Grade and surface: Corrodur 18

Deutsche Edelstahlwerke together with Schaeffler AG has developed a new middle nitrogen martensitic stainless steel, Corrodur 18, for bearing applications. Traditional bearing steels like 100Cr6 exhibit good mechanical properties, but are not resistant to corrosive media. Conventional martensitic stainless steels for use in bearings require high carbon and chromium contents in order to achieve the desired properties. However, they are prone to precipitate

coarse carbides, which is a drawback in such applications. As an alternative, high nitrogen martensitic stainless steels feature favorable mechanical and corrosion properties as well as fine dispersion of carbides or nitrides, but at the expense of high production cost (since high nitrogen contents require the use of pressurized metallurgy). Corrodur 18, which can be produced using a conventional route (electric arc furnace, hot rolling, and subsequent heat treatment), shows a high hardness combined with good impact bending energy and good corrosion properties. Furthermore, the medium nitrogen content induces a fine microstructure

featuring a uniform dispersion of carbides. Corrodur 18 has better resistance to white etching cracks (WEC), a type of bearing failures, than 100Cr6. In addition, fatigue properties are comparable or in some cases even better compared to traditional bearing steels. Corrodur 18 does not only show promising properties to be used as bearing steel but is also characterized by the combination of low content of alloying elements and its standard production route, which can make it less expensive at the same time.



Picture courtesy of Schaeffler AG



Help

Help page

Contents page.

Previous page.

Next page.

Previous view.

About ISSF

The International Stainless Steel Forum (ISSF) is a non-profit research and development organisation which was founded in 1996 and which serves as the focal point for the international stainless steel industry.

Who are the members?

ISSF has two categories of membership: company members and affiliated members. Company members are producers of stainless steel (integrated mills and rerollers). The association has 56 members from all over the world and currently represents approximately 90% of the total production of stainless steel.

Vision

Stainless steel provides sustainable solutions for everyday life.

More information

For more information about ISSF, please consult our website worldstainless.org.

For more information about stainless steel and sustainability, please consult the sustainablestainless.org website.

Contact us

issf@issf.org

+32 2 702 89 00

Disclaimer

The International Stainless Steel Forum believes that the information presented is technically correct. However, ISSF, its members, staff and consultants specifically disclaim any and all liability or responsibility of any kind for loss, damage, or injury resulting from the use of the information contained in this brochure.

worldstainless.org