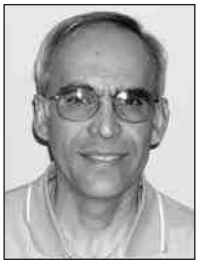

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Stainless Steel: Facts & Information

The metal finishing industry has a long working relationship with stainless steel. Numerous parts are processed from passivation to plating, electropolishing and black oxide, to name some popular cycles. Indeed, much of the equipment used is also stainless steel. We utilize baskets, tanks, racks, heaters and an assortment of other items. A finisher would be hard pressed to find suitable alternative equipment. The lower alloy stainless exhibits excellent corrosion resistance. Higher alloy stainless steels are corrosion resistant to most acids, chlorine containing and alkaline solutions. Our daily lives are closely associated with stainless steel. It is found in the home (appliances and utensils), commercial buildings, automotive, aircraft, military and many other applications. How can such a useful and critical material such as stainless steel get to be so prominent? Let us review some facts and useful information associated with stainless steel.

Almost 200 years ago, a French metallurgist, Pierre Berthier, discovered the corrosion resistance of iron-chromium alloys. In subsequent decades, notable researchers and metallurgists expanded on the initial findings, developing the alloy stainless steel. They found the alloy, containing at least 11.5 wt% of chromium did not corrode, stain or rust as is common to plain steel. Different grades and finishes were developed, meeting particular requirements for wear resistance and applications. Stainless steel is generally made using an electric arc furnace. In the furnace, recycled stainless scrap along with alloys of chromium and/or nickel and molybdenum are melted by passing an electric current. Once molten, the material is treated to remove excess carbon. There are generally no other additives used. Aside from working with very high temperatures and specific process parameters, this is a relatively simple process. Stainless steel is cast into ingots, billets or slabs. The material can be cold or hot rolled. Final product can be formed into wire, rods, sheets, bars or rolls. This results in overall simpler fabrication cycles. In many cycles, stainless steel is annealed, for surface softening. Descaling is achieved by acid pickling. This step promotes the naturally occurring surface passivation. Additional chemical passivation, meeting a variety of specifications, has been traditionally achieved by the nitric acid or nitric acid/dichromate methods. In recent years this has been supplanted by environmentally safer citric acid proprietary passivation.

In the current economy, metals in general have experienced steep price increases. Stainless steel, due its content of nickel and chromium, has certainly experienced higher prices. The good points about stainless include its excellent corrosion resistance, stability to high and low temperatures, overall strength aesthetic pleasing appearance, cleanliness and hygiene. These benefits, along with others, make it a tough material to replace. For economic reasons, stainless may also slow down the market price increases. This is because it is totally recyclable. A 100% turnaround signifies no waste with regards to the material. More than half of newly made stainless is derived from older scrap material. There is an added important fact, in that a full life cycle as recyclable material would comply with RoHS and other, similar environmentally driven directives.

Types of stainless steel

Austenitic

Over three quarters of annual stainless steel production is of the austenitic type. A popular designation for austenitic is the 300 series. Austenitic alloys are non magnetic. They exhibit excellent hardness in a wide range of exposure temperatures. The material derives its name from the sufficient addition of nickel, changing the alloy crystal structure to austenite. In general, the alloy contains a minimum of 16% chromium and a maximum of 0.15% carbon. The following term may also clarify why we sometimes refer to particular designations. 18/10 stainless contains 18% chromium and 10% nickel. Several of the austenitic alloys consist of 18/8. Improved corrosion resistance is achieved by adding 2 to 3% molybdenum to the particular alloy. Popular applications include building and architecture along with food and beverage processing equipment and jewelry (316L). In general, austenitic steels are the most widely used of these stainless steels.

Series designations:

301. Excellent welding characteristics, ductile, with good wear resistance.
302. Similar corrosion resistance to 302, but higher strength.
303. The additions of sulfur and phosphorus improve machining characteristics.
304. The previously described 18/8 material. This is the most common of the series of 300 alloys.
304L. Essentially 304 that has been modified to improve welding characteristics.
309. An improvement to the temperature resistance of 304.
316. Second most common alloy after 304. Specialized for application in food and pharmaceutical industries. Also more tolerant to chloride corrosion, therefore it is a preferred marine grade.

Ferritic

These are highly corrosion resistant alloys, commonly referred to as the 400 series, which are magnetic. The chromium content may range from 12 to 18%. Some also contain increased chromium, up to 27%, for higher corrosion protection. The carbon

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long term average. The temporal variation in the solar activity displays a similarity to that of the mean temperature of the Earth. These scientific results therefore bring the influence of the Sun on the terrestrial climate, and in particular its contribution to the global warming of the 20th century, into the forefront of current interest.[9]

Summary

Why does all of this matter to us? Because this warming tells us a lot about our own planet. Namely, that climate changes occur regardless of human activity, and that planet temperatures are always cooling or warming.

After all, how do radical environmentalists explain the end of the Ice Age? Prehistoric SUVs? Neanderthals operating coal-fired power plants and using aerosol hair spray?

In Europe, governments have led the march in implementing the Kyoto Protocol's mandates. The results? Stagnant economies, high unemployment and failure to actually meet its environmental and requirements. The U.S. economy is growing nearly three times as fast as Europe's. Yet, Europe's greenhouse gas emissions have increased far faster than the U.S. and far faster than it had permitted itself under Kyoto.[10]

But this information about the sun will hardly be welcomed. Too many people have too much riding on greenhouse global warming - research grants, business subsidies, personal prestige, bureaucratic power and political agendas - to permit another theory to supplant it.[11]

And, if you haven't already heard, there is "consensus" that man is responsible for climate change on Earth. Let's not muddle this up with contrary facts.

Update

Just recently it's been reported that over the past year global temperatures have dropped precipitously. The total amount of cooling ranges form 0.65 to 0.75 C°. Some scientists link the cooling to reduced solar activity. Dr. Kenneth Tapping reports solar activity comes in regular cycles, but the latest one is refusing to start. Cooling will be much worse for humans than warming. A new campaign for Al Gore? **P&SF**

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Editor's Note: *We would like to mention that Mr. Dini is having so much fun providing these columns that he is churning them out at a rate faster than we can publish them on a monthly basis. Indeed, he has created a blog at http://myblogscience.blogspot.com. If you wish to see more of Mr. Dini's provocative works that might not have appeared in Plating & Surface Finishing, check it out.*

Finisher's Think Tank

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carbon level is typically low. There is at most, very little nickel in this alloy series. Inclusions are molybdenum and either aluminum or titanium. Alloys are magnetic. Applications include architectural and builders' hardware, appliances, liners and deck plates.

Martensitic

These are the first commercial stainless steels. They are also referred to as plain chromium stainless steels, part of the 400 alloy series. The high carbon level is alloyed with 12 to 18% chromium. The alloys are machinable, heat treatable for hardness and extremely strong and durable. Commercial applications include cutlery, fasteners, surgical instruments, aerospace, engineering, shafts, springs and nozzles.

Series designations:

405. Recommended for welding applications. Ferritic.
408. Better heat resistance.
409. Most economical. Highly visible as common automobile exhausts.
410. Good wear resistance. Martensitic.
416. Good machining characteristics, with addition of sulfur.
420. Martensitic. This grade is similar to the original formulation for rustless steel. It has good polishing characteristics. The major use is in cutlery.
430. Ferritic. Decorative automotive trim.
440. Higher carbon content improves hardness. This alloy, exhibiting a hardness of Rockwell 58, is one of the hardest stainless steels.

Stainless steel is very important, not only to equipment used in metal finishing, but in assorted industries, consumer, medical, technical and military. One of the successful methods to open clogged arteries has been the insertion of stainless steel stents. We can readily agree stainless materials of construction are quite obvious, if one chooses to acknowledge their presence. There are many structures throughout that incorporate stainless in their fabrication. The anti-weathering effect along with strength cast a shining tribute to stainless steel. Two famous architectural landmarks stand out: the Gateway Arch clad in alloy 304, the top of the Chrysler Building is clad in alloy 302. **P&SF**