

METAL CHARACTERISTICS

Aluminum

This silver white metal is very malleable and quite corrosion resistant, since the surface reacts with oxygen to form a protective aluminum oxide coating. This coating is quite resistant to many chemicals—even acids, but can be penetrated by alkaline substances. It is lightweight and easy to machine, forge and cast. Alloys of aluminum are formed by adding a variety of other elements such as copper, manganese, zinc to produce products that can vary in strength, corrosion resistance, weight, and ease of forging.

Brass

Brass is an alloy primarily of copper and zinc with trace elements typically including silicon and iron. Brass is a golden yellow and weathers to a green color but is relatively corrosion resistant.

Bronze

An alloy of primarily copper and tin with traces typically including silicon and iron. Bronze was the first widely used metal strong enough for weapons and tools (hence the Bronze Age). Bronze is a reddish color and weathers to green but is relatively corrosion resistant. Adding beryllium produces an alloy hard enough for production of springs and hand tools.

Cast Iron

Also called pig iron, cast iron describes a wide range of irons with 2% or more carbon. The high carbon content makes cast iron somewhat brittle. Cast iron cannot be forged, but must be formed by casting or machining.

Copper

Copper is element #29, a reddish metal that is the primary metal in alloys of brass, bronze, and monel. Small amounts of copper added to aluminum, silver, and gold make those metals harder, and added to steel copper gives corrosion resistance. Copper pennies were actually bronze, not copper, since copper is too soft. Many modern copper coins are now zinc with a copper coating.

Ductile Iron

Also known as malleable iron, this product is made from cast iron by adding magnesium during the casting process. The magnesium causes the carbon to collect as graphite specks, so that the surrounding iron is low enough to be ductile to some extent. (Ductile means capable of being hammered out thin without cracking). Many items identified as cast iron are actually ductile iron. Ductile iron can be arc welded.

Iron

Pure iron is a soft ductile metal that rusts rapidly. Adding up to 1.5% carbon creates steel which can be hardened. Adding more carbon gives cast iron which is hard but brittle.

Stainless Steel

Stainless steel is a generic name for a class of steels that are used primarily because of their corrosion resistance. All stainless steel alloys contain a minimum of 10.5% chromium. Other elements, particularly nickel and manganese, are added to produce different physical and mechanical properties such as hardness, ease of machining, and ease of welding. Molybdenum may be added to further increase corrosion resistance. While there are many grades of stainless, 70% of production is Type 304 (also known as 18/8, since it is 18% chromium and 8% nickel). The amounts of various elements affect other characteristics. Basically, alloys of principally chromium and iron are known as 400 series and are all magnetic. Alloys with both chromium and nickel are 300 series, and chromium, nickel, manganese alloys are known as 200 series. These two series are generally non-magnetic. For hose fittings and clamps, the major types are:

Type 201 and 202

Uses manganese in place of some of the nickel. Similar to 301 and 302 in corrosion resistance. Commonly found as band material for clamps.

Type 301, 302, and 304

General use stainless steel.

Type 316

For most chemicals — has a very high corrosion resistance. Used where harsh cleaning chemicals are used, or where chemical concentrations are high.

Type 410 and 420

Easily hardened by heat treatment. Used in machine parts and cutters as well as clamps.

Steel

Iron with a small percentage of carbon is steel. The more carbon, the harder the steel can be made by heat treatment. Mild steel is 0.18 to 0.20% carbon. High carbon steels start at roughly 0.75% carbon and go up to around 1.5%. Alloy steels contain other ingredients for special purposes such as corrosion resistance.

Wrought Iron

True wrought iron is pure iron with thin layers of silica slag that gives a grainy appearance. Wrought iron was the primary ductile form of iron for thousands of years, but it is no longer in common use. Today the term wrought iron is used to describe low carbon steel pipe and also decorative ironwork made of any metal.

Zinc

Element #30 is a bluish white ductile metal that is the secondary alloy in brass. Zinc is used to harden aluminum alloys, and aluminum is used to make light strong zinc alloys.