MATERIALS

METALS

CONCEPT Metals are hard, non-adhesive materials that show a lustrous appearance, conduct electricity and heat, readily forms positive ions, and have metallic bonds. They are also able to be stretched out and malleable without breaking easily, which makes them valuable for countless applications.

TERMINOLOGY

FERROUS METALS - *Any metal that contains iron, which is then classified as a carbon steel.* Iron is too soft on its own, so carbon is added to achieve a desired properties. Carbon steels include mild, medium, high, stainless and grey cast. Lower amounts of carbon content, such as mild steel, are less ductile but harder and tougher than iron. Mild steel is used for screws, nuts, bolts, nails and oil drums. Grey cast is steel that has a relatively low amount of iron (94%) and contains carbon and silicon. It is extremely hard but brittle and is prone to rust. Grey cast is used for street lamps, tools and drain covers.

NON-FERROUS METALS - *Any metal that does not contain iron.* They are difficult to extract, so they are more rare and expensive. Examples of non-ferrous metals are aluminum, copper, brass, magnesium, tin, lead, bronze, and zinc. Aluminum is the most abundant and widely used metal. It is silver, light, resistant to corrosion, malleable, and good at conducting heat and electricity. Aluminum is used in high voltage power lines, planes, cars, bicycles, house construction, and drink cans.

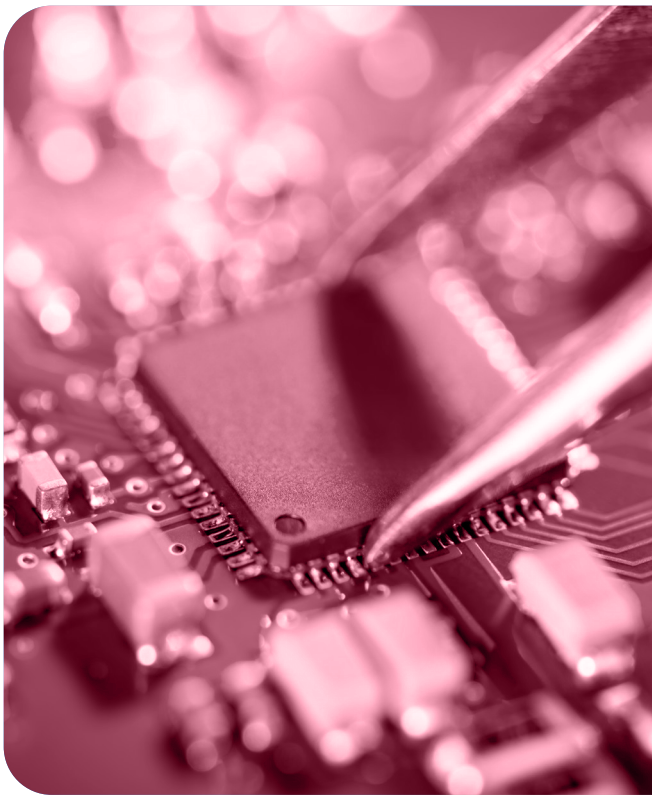
BACKGROUND

The earliest recorded metal was wrought (naturally occurring) native copper in 9000 BC in the Middle East. Native metals are metals in an unreacted state, such as gold, silver and copper. Altering these metals was not recorded until 5000 BC. Naturally found in riverbed sediment, gold and silver nuggets were easiest to find and use. The use of copper at this time is considered a precursor to the Bronze Age and where early metallurgy began. Users discovered that by hammering wrought copper, the metal became harder and stronger, which was the first step towards a nanotechnology that modern metallurgy is based upon. The ability to alter the hardness of metals allowed for the development of tools, knives, weapons, etc.

Today, metals are used extensively to transport electricity to electrical grids and in manufacturing machines for agriculture, farming, and vehicles which include road vehicles, railways, airplanes, rockets, etc. Here, the commonly used metals are iron, aluminum and steel. The world uses approximately six trillion pounds of metal every year for manufacturing.

EXAMPLES

Make sure it measures up



There are 91 metals in the periodic table, each with a symbol and unique atomic weight and amount of valence electrons. Examples are aluminum, copper, iron, tin, gold, lead, silver, titanium, uranium and zinc.

Alloys are recognized as metals. They are combinations of metals with other substances. Examples are stainless steel, brass, bronze, white gold and sterling silver.

Transition metals make up the largest section of the periodic table, which includes metals like copper, gold and titanium. These metals have been used for medicine and as tools for millennia. Egyptians were one of the first known civilizations to use these, as well as iron, to cure malaria during mid 15th century BC. However, today's developments in medicine have allowed us to support life-threatening conditions, improve cancer medications and control red blood cell production.

Platinum is a precious metal that has been used as a medical tool since the 1970s. Platinum's dense, malleable properties are essential to the production of pacemakers, catheters, stents and even cancer therapies.

REAL WORLD CONNECTIONS

Silicon, a natural semiconductor which can transmit or insulate electricity, is the most utilized substance for the fabrication of computer chips. The injection of imperfections to silicon can change its electrical characteristics, a technique known as doping. Adding to these properties, it is an effective substance for the fabrication of transistors.

Most beach sand contains high amounts of silicon. Silicon is cleaned, made molten and chilled into an ingot before being utilized to produce microchips. The ingots are then cut into 1-millimeter-thick wafers. These wafers are cleaned mirror-smooth before going through a complicated production process. This comprises photolithography; which imprints structures on wafers, which alters the electrical characteristics of silicon in specific locations; etching, which eliminates unnecessary silicon; and transient gate construction. After that, the metal circuitry is attached. Metal circuitry can be found in more than 30 layers on some computer chips. The carbon transistors are reduced in size, allowing charges to pass with minimal restriction. This allows the gadgets to turn on and off more quickly.