TECHNICAL MATERIALS II. METALS

METAL PROPERTIES

Metals are a material of great interest. They are used in industry because of its excellent strength properties and conductivity are useful in the construction of machines, structures, mechanisms, circuits and tools.

Want to meet some of the most important properties of these materials? Here are some of them:

They have a characteristic **luster**.
They are denser and heavier than other materials.
Its **high strength** allows them to withstand great forces, pressures and impacts.
Some of them are very **hard**.
They **conduct heat and electricity** very well.
They have great potential to be worked: they can be folded, cut, stamped, casted or moulded.

Objetos de metal

Some metals are used in almost pure state (copper, silver, gold ...), but most are combined with each other or with other elements to form alloys. These alloys improve their properties.

FERROUS METALS - Iron Alloys

When we **melted** metal and mix with other metals or elements, we are producing an **alloy**. The alloys are made to improve the properties of a metal for a particular use, if this pure metal may not be suitable for what we want to build. For example, we can be interested in a harder material, or more resistant to corrosion, or lighter, or better conductor, ...

The most used alloys in the industry contain **iron**. Some are **foundries** (between 1.7 and 6.6% carbon) and other **steels** (less than 1.7% of carbon). Steel is so used, which is considered as one metal, but we must not forget that this is an alloy (Fe + C). However, when we speak of alloyed steel, we talk about steel plus other metals (chromium, nickel, vanadium).

Steel is the most used metal. It is produced in more quantity than the other metals together. Therefore, its price is very affordable and its use is widespread.

FOUNDRIES + of 1.7% de C	Foundries have easy moulding, and higher corrosion resistance than ordinary steel, but less resistance. They are used in sewage, artistic pieces, forgings ...	
ORDINARY STEEL - OF 1.7% de C	Ordinary steels have an acceptable hardness and strength. They are cheaper. They are used in screws, building structures, cars, common tools, ...	
SPECIAL AND ALLOYED STEEL	The most important kind of special steels is stainless steel, which is obtained by mixing chromium, nickel and steel. Stainless steel is used in all kinds of utensils that come into contact with water, to prevent rust. We also have chromium steels, vanadium steels etc	

NON-FERROUS METALS

In addition to steel, other metals commonly used are copper, brass or bronze. They are all more expensive than steel, but some have properties that make them desirable for certain applications. Look at the characteristics of these metals in the following table:

COPPER	• It is not very hard and bends easily. • It has a characteristic red colour. • It has highly resistant to corrosion. • Copper is biocide. It doesn't allow growing life on its surface. • It is one of the best conductors of electricity and heat. It is used in electrical conductors (wires, coils etc.) and gas and heating pipes.	

BRASS (alloy of copper and zinc)	• It is yellowish and has a pleasing appearance. • It is quite resistant. • It is easier to mould and work than copper. • Fairly inexpensive. It is used in caps, locks, decoration, electrical contacts, etc.	
BRONZE (alloy of copper and tin)	• Highly resistant to efforts, wear, corrosion and very TOUGH and durable. • It is very suitable for melting. • It has a beautiful appearance. It is used in taps, machine components, bells and sculptures.	
ALUMINIUM	• One of the most lightweight metals. • It has not very high strength. • It conducts heat and electricity quite well. • Easy to work with. It is used in aerospace, some machine parts, containers, cooking utensils, etc.	
LEAD	• It is very heavy. • Easy to work with. • It has little strength. Is used as ballast or to isolate nuclear radiation and X-rays	
TIN	• It is very weak. • It melts at a low temperature (232 °C) • It does not rust from food or water. •It is used in soldering and for alloys.	
TITANIUM	• It is very lightweight, and has a very good mechanical strength. • It is very expensive. • It is biocompatible and it is used in aerospace, boats and in artificial bones.	

MERCURY	• It is the only liquid metal at room temperature. • It is very heavy. It is used mainly in the chemical industry, with care because it is highly toxic.	
CHROME	•There is no rust or corrosion. • It doesn't have a good mechanical properties, because is fragile. It is used for steel alloys and to coat the steel in a process called Chroming.	
ZINC	• It is a bluish-white metal that does not shine. • There is no rust or corrosion. • Its mechanical properties are not very good. It is used to make brass (copper + zinc alloy) and to coat ordinary steel in a process called galvanization.	
PRECIOUS METALS	• They are gold, silver and platinum. • Their beautiful appearance is preserved over time. • They can be found in nature in the form of nuggets. • They are the best electrical conductors. • They are used in jewellery and for precise instruments.	