

welcome

Mechanical engineering Materials

Subject code:-27031

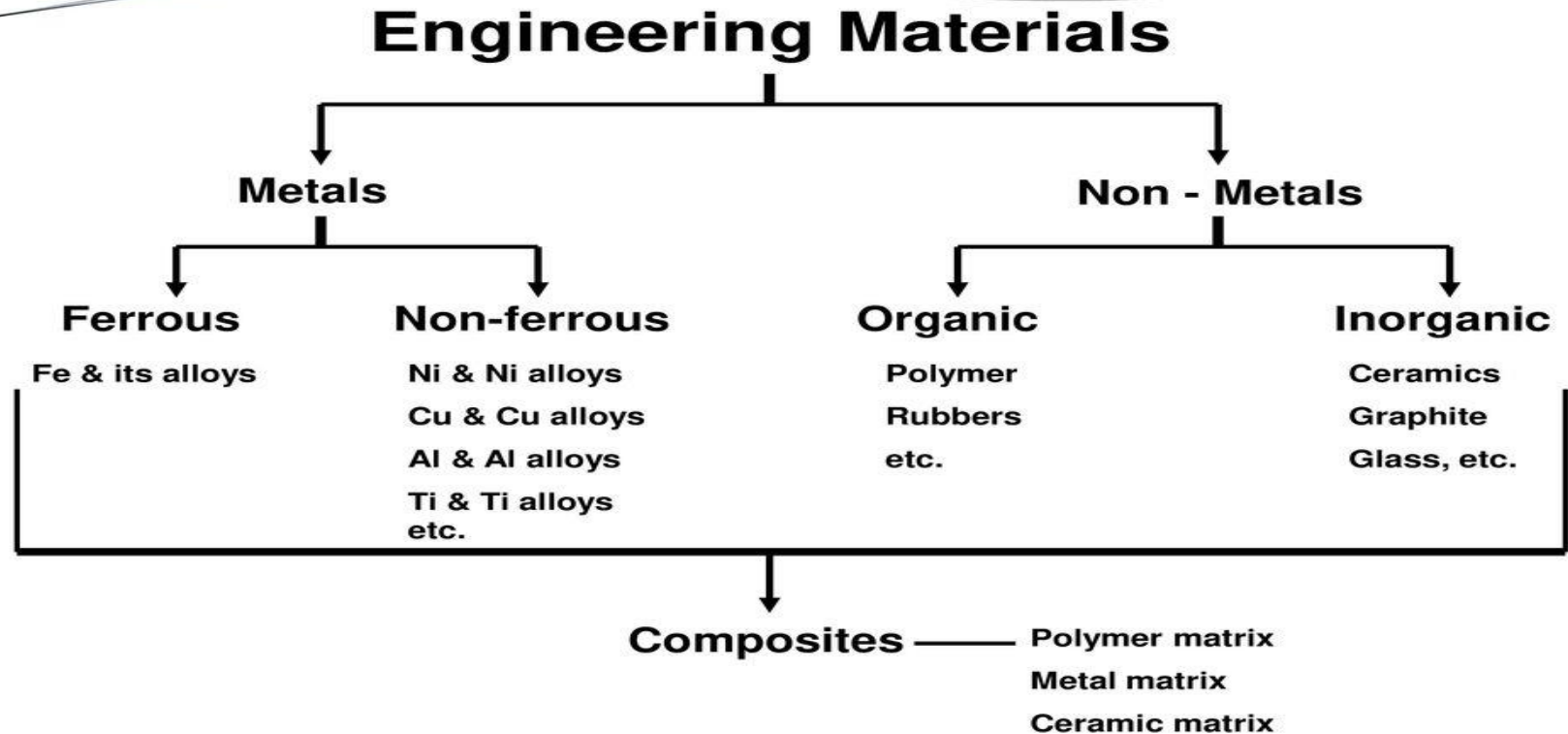
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Chapter number :-01

Base of Mechanical engineering materials



Metal

- In chemistry, a metal is defined as an element with a valence of 1,2 or 3.
- All metals possess metallic properties such as luster, opacity, malleability, ductility and electrical conductivity.
- Typical examples of metallic materials are iron, copper, aluminum, zinc etc., and their alloys.

Ceramics

- A ceramic can be defined as a combination of one or more metals with a non-metallic element.
- Metal oxides, carbides, nitrides, borides and silicates are considered as ceramics.
- These are characterized by high hardness, abrasion resistance, brittleness and chemical inertness, and are poor conductors of electricity.
- Examples of ceramics include refractories, glasses, abrasives, and cements.

Polymers

- Polymers are organic substances and derivatives of carbon and hydrogen.
- They are known as plastics
- Most plastics are light in weight and are soft as compared to metals.
- They possess high corrosion resistance and can be molded into various shapes by application of heat and pressure.
- Typical examples of polymers are polyesters, phenolics, polyethylene, nylon and rubber.

Materials

Ferrous metals: carbon-, alloy-, stainless-, tool-and-die steels

Non-ferrous metals: aluminum, magnesium, copper, nickel, titanium, superalloys, refractory metals, beryllium, zirconium, low-melting alloys, gold, silver, platinum, ...

Plastics: thermoplastics (acrylic, nylon, polyethylene, ABS,...)
thermosets (epoxies, Polymides, Phenolics, ...)
elastomers (rubbers, silicones, polyurethanes, ...)

Ceramics, Glasses, Graphite, Diamond, Cubic Boron Nitride

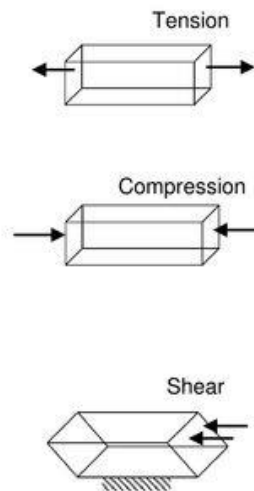
Composites: reinforced plastics, metal-, ceramic matrix composites

Nanomaterials, shape-memory alloys, superconductors, ...

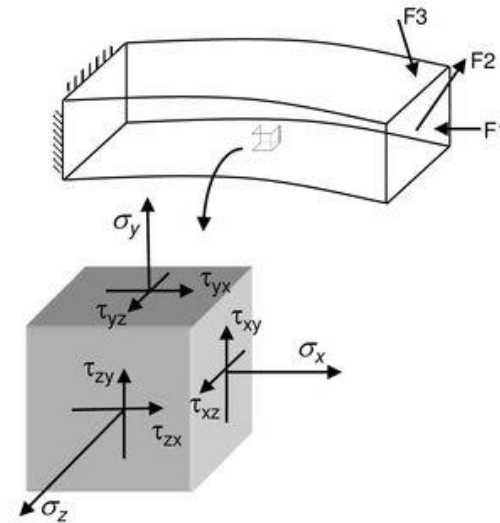
Mechanical properties: Stress analysis

$$\text{stress} = \sigma = \text{Force/Area}$$

Why do we need stress/strain (not just force, elongation) ?



Tensile, compressive and shear stresses



Stresses in an infinitesimal element of a beam

● Use of Aluminium



Chapter -2

Metal And Alloys



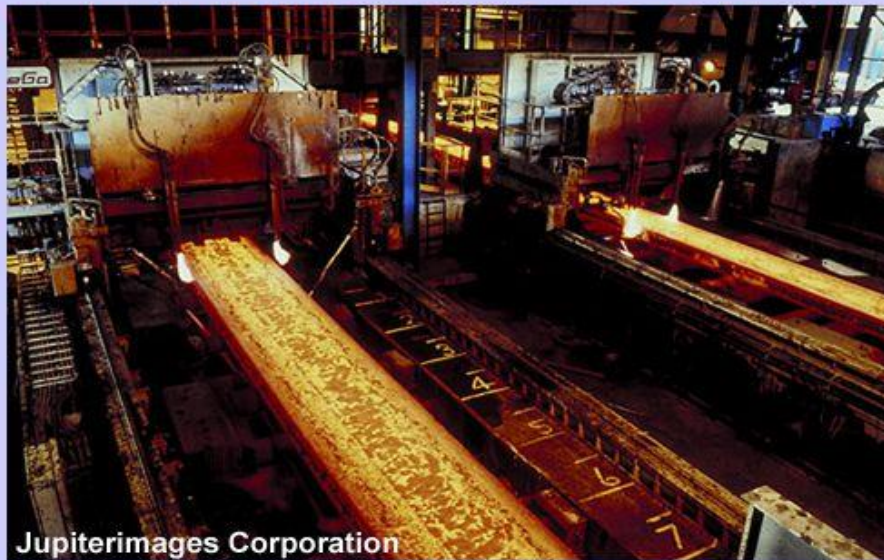
Properties and Uses of Metals

- Most of the Metals and alloys used in Building construction materials can be either welded or machined.
- The distinguishing characteristics or qualities that are used to describe a substance such as metal are known as its physical properties. Those physical properties which describe the behaviour of a metal when it is subjected to particular types of mechanical usage are called mechanical properties.

What is an alloy?

An **alloy** is a mixture of a metal with at least one other element.

Steel is a common example of an alloy. It contains iron mixed with carbon and other elements. Adding other elements to a metal changes its structure and so changes its properties.



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The final alloy may have very different properties to the original metal.

By changing the amount of each element in an alloy, material scientists can custom-make alloys to fit a given job.

METALS ALLOYS

An alloy is a homogeneous mixture of a metal with other metals or non metal:

- **Steel and cast iron – iron, carbon**
- **Stainless steel – iron, carbon, cobalt, nickel**
- **Brass – copper, zinc**
- **Bronze – copper, tin**
- **Solder – Lead, tin (used for welding electrical wires together)**
- **If one of the metals in an alloy is mercury, it is called an amalgam.**

NON FERROUS METALS AND ALLOYS

IN THIS CHAPTER WE HAVE TO STUDY-

- ⊕ COPPER AND ITS ALLOYS
- ⊕ ALUMINIUM AND ITS ALLOYS
- ⊕ BEARING MATERIALS



Copper's anti-bacterial and corrosion resistant properties help make it ideal for vessels.

- Use Of Copper, zinc, tin









