Classification of Materials

Engineering materials can also be classified as below-

•Metals and Alloys

•Ceramic Materials

•Organic Materials

Basically Engineering Materials can be classified into two categories-

1. Metals

2. Non-Metals

•Metals : Metals are usually lustrous, ductile, malleable, and good conductors of electricity They are divided into 2 categories:

A) FERROUS: The group which contains mainly iron (Fe). Iron is the most important metal in industrialized countries

B) NON-FERROUS: other metallic materials containing no iron like copper (Cu) or aluminium (Al)

Ferrous metals and alloys (irons, carbon steels, alloy steels, stainless steels, tool and die steels)

Nonferrous metals and alloys (aluminum, copper, magnesium, nickel, titanium, precious metals, refractory metals, super-alloys)

- Metals are element substances which readily give up electrons to form metallic bonds and conduct electricity. Some of the important basic properties of metals are:

(a) metals are usually good electrical and thermal conductors

(b) at ordinary temperature metals are usually solid

(c) to some extent metals are malleable and ductile

(d) The freshly cut surfaces of metals are lustrous,

Thermal, Chemical, Electrical, Mechanical Properties of Various Materials

Thermal Properties of materials

Engineering materials are important in everyday life because of their versatile structural properties. Thermal properties of engineering materials are diverse and so their uses in different applications. Thermal properties are those properties of material which is related to its conductivity of heat.

Thermal properties of material refer to characteristic behaviors of material under thermal load. Other than these properties, they do play an important role because of their physical properties. There are different thermal properties are thermal conductivity, thermal expansion, specific heat, melting point, thermal diffusivity.

Electrical Properties

Electrical properties are their ability to conduct electrical current. Various electrical properties are resistivity, Electrical conductivity, temperature coefficient of resistance, dielectric strength and thermoelectricity.

Optical Properties

Optical properties that define material response to incident radiation can be described as transmission, reflection and absorption.

Chemical properties

Chemical properties related to changes in chemical composition of material because it interacts with other substances. Chemical properties of engineering materials are needed because most of materials, when they come in contact with other substances can react to form new materials. It is deterioration of material by chemical reaction with its environment. It cannot be observed without changing chemical composition of substance. This chemical property includes pH, production of salt when an acid reacts with metal or unique color change in chemical reaction.

Present and Future Needs of Materials

The materials of the future have three key criteria to meet. They must be durable, lightweight, and economical. Since the historical periods of the Stone Age, Bronze Age and Iron Age, the development of materials has helped expand the limits of human endeavour and achievement. In the 21st century, demands from such industries as aerospace and automobiles are pushing the frontiers of material properties to more extreme levels.

Engineering materials always continue to play a significant role in the current and upcoming future world. The relevant factors that will influence this are economic/cost, environmental requirements, development trends, depletion of traditional materials, advances in research and market drives, etc.

The importance of engineering materials is in every aspect of life, therefore, need to be over emphasized. We ourselves are materials and so also is everything around us; to stop talking of and working with materials is to foreclose the essence of life existence. S

Overview of Biomaterials and Semi-conducting Materials

•A **biomaterial** is any substance that has been engineered to interact with biological systems for a medical purpose. Biomaterials can be derived either from nature or synthesized in the laboratory using a variety of chemical approaches utilizing metallic components, polymers, ceramics or composite materials.

•Biomaterials are also used every day in dental applications, surgery, and drug delivery. For example, a construct with impregnated pharmaceutical products can be placed into the body, which permits the prolonged release of a drug over an extended period of time.

•**Semiconductors** are materials which have a conductivity between conductors (generally metals) and nonconductors or insulators (such as most ceramics). **Semiconductors** can be pure elements, such as silicon or germanium, or compounds such as gallium arsenide

•A biomaterial may also be an autograft, allograft or xenograft used as a transplant material.

•A **semiconductor** material has an electrical conductivity value falling between that of a conductor, such as metallic copper, and an insulator, such as glass. Its resistance falls as its temperature rises; metals are the opposite.

• Its conducting properties may be altered in useful ways by introducing impurities ("doping") into the crystal structure.