Properties of Engineering Materials

Materials have different properties depending on what they are used for. Some materials are hard, others are soft. These are types of materials most commonly used in everyday life are given below.

- Physical Properties of Materials
- Chemical Properties of Materials
- Thermal Properties of Materials
- Electrical Properties of Materials
- Magnetic Properties of Materials
- Mechanical Properties of Materials

1. Physical Properties:

A. The Melting or Freezing Point:

The melting or freezing point of pure metal is defined as the temperature at which the solid and liquid phases can exist in stable equilibrium. When a metal is heated to melting point, the liquid phase appears, and if more heat is supplied, the solid melts completely at constant temperature.

The use of mercury in thermometers, manometers and other instruments arises from its low melting point; the use of tungsten filaments in incandescent high bulbs is possible because of its extremely high melting point.

B. Boiling Point:

The boiling point of a liquid is the temperature at which its vapour pressure equals to one atmosphere. The boiling points of the metals except mercury are high. The boiling point of zinc (907°C) and cadmium (865°C) are sufficiently low so that in recovery of these metals from their ores the metals are vapourised and condensed.

C. Density:

Mass per unit volume is termed as “density.” In metric system it is stated in kg/m^3. The low densities of aluminium and magnesium and of their alloys make them particularly valuable in aeronautic and transportation fields.

D. Linear Co-Efficient of Expansion:

The linear coefficient of expansion of a solid is defined as the increase in length, for each degree rise in temperature. These coefficients are important when metals are to be exposed to a considerable range of temperatures as in engine pistons, and other accurately fitting mechanisms.

Thermal Conductivity:

The thermal conductivity of a metal is defined as the number of kilojoules of heat that would flow per second through a specimen one sq. metre in cross-section and I metre in length when the temperature gradient is 1°C. Silver and copper show the highest thermal conductivities of all metals. Some metals like German silver exhibit very low conductivity and hence find applications where heat losses by metallic conduction should be kept to a minimum.

F. Electrical Resistivity:

The resistance of a metal is the reciprocal of its conductivity. The electrical resistivity of a metal is the resistance of a specimen of 1 cm in length and 1 sq. cm in cross-section. Since these values for metals are very small if expressed in ohms, they are usually given in micro- ohms

Electrical Properties of Materials:

One of the important characteristics of the materials is their ability to permit or resist the flow of electricity.

Materials to be used in electrical equipments can be selected on the basis of their properties, such as:

(i) Resistivity,

(ii) Conductivity,

(iii) Temperature coefficient of resistance,

(iv) Dielectric strength,

(v) Thermoelectricity, and

(vi) Other electrical properties.