## UNIT – I CRYSTAL PHYSICS

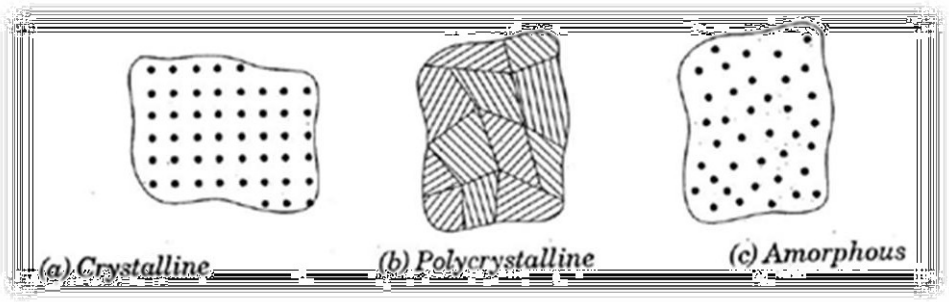
### Single Crystalline, Poly Crystalline and Amorphous materials

**The matter** is usually regarded to exist in solid state or fluid state. All the materials are composed of atoms and molecules. A solid is an essentially an ordered array of atoms, bound together by electric forces to form a very large molecule. There are three different types of solids. Crystalline, poly crystalline and amorphous.

In a crystal, atoms are arranged into a regular periodically repeated structure that extends throughout the whole sample. The atoms are said to have long range order. Poly crystalline material is composed of many small crystals or grains of somewhat irregular size. In an amorphous solid a long range order is absent. (i.e.,) they have short range order. There is no periodicity in which atoms are arranged in space. They are also regarded as super cooled liquids. ***Examples :*** metallic crystals : copper, silver, aluminum etc.,

Non metallic crystals: Germanium, silicon

Amorphous or non crystalline materials: glass, rubber, plastic




**Difference between crystalline and amorphous material.**

| S.No | Crystalline | Amorphous |
|---|---|---|
| 1 | Regular arrangement of atoms gives definite and geometric shape. | Random arrangement of atoms does not give definite and Geometrical shape. |
| 2 | They are anisotropic | They are isotropic |
| 3 | They have sharp Melting Point | They do not have sharp Melting Point |
| 4 | They possess internal symmetry | They do not possess internal symmetry |

***Crystal Physics'*** or '***Crystallography'*** is a branch of physics that deals with the study of all possible types of crystals and the physical properties of crystalline solids by the determination of their actual structure by using X-rays, neutron beams and electron beams.

**CLASSIFICATION OF SOLIDS**

Solids can broadly be classified into two types based on the arrangement of units of matter.

The units of matter may be atoms, molecules or ions.

They are,

- Crystalline solids &
- Non-crystalline (or) Amorphous solids

**CRYSTALLINE SOLIDS**

- A substance is said to be crystalline when the arrangement of units of matter is regular and periodic.
- A crystalline material has directional properties and therefore called as anisotropic substance.
- A crystal has a sharp melting point.
- It possesses a regular shape and if it is broken, all broken pieces have the same regular shape.
- A crystalline material can either be a single (mono) crystal or a polycrystal.
- A single crystal consists of only one crystal, whereas the polycrystalline material consists of many crystals separated by well-defined boundaries.
    - Examples
        - Metallic crystals – Cu, Ag, Al, Mg etc,
    - Non-metallic crystals – Carbon, Silicon, Germanium,
- In amorphous solids, the constituent particles t arranged in an orderly manner. They are randomly distributed.
- They do not have directional properties and so they are called as `isotropic' substances.
- They have wide range of melting point and do not possess a regular shape.
    - Examples: Glass, Plastics, Rubber etc.,