HindPhotostat

Hind Photostat & Book Store

Best Quality Classroom Topper Hand Written Notes to Crack GATE, IES, PSU's & Other Government Competitive/ Entrance Exams

MADE EASY

MECHANICAL ENGINEERING

Material Science

By-Shastri Sir

- Theory
- Explanation
- Derivation
- Example
- Shortcuts
- Previous Years Question With Solution

Visit us:-**www.hindphotostat.com**

Courier Facility All Over India
(DTDC & INDIA POST)
Mob-9311989030

Material Science

Ref.

Callister's Matl Sc & Engg.

Email Id

~~Rajeev~~

materialsciencemadeeasy@gmail.com

• Crystal Structures

(Glass → Supercooled Liquid)

1. Material science is basically study of relationship between structure and Properties of Engineering materials.

2. Based on the structure all engineering materials are classified into two basic types: They are Crystalline materials and Amorphous material.

3. Amorphous material which do not exihibits regular, repeated & orderly arrangement of atoms / Ions / molecules
   eg: Waxes, Polymers, Glass, charcoal etc.

4. Crystalline materials are those materials which exibit 3-D, Long range, Periodicity of arrangement of atom, Ions or molecule in the Internal structure.

Crystalline Materials	Amorphous materials
↳ Atomic Solids → Metals	Can exist any state
↳ Ionic Solids → Ceramics	Can be converted into Crystalline materials
↳ molecular Solids → Crystalline Polymers	

Crystalline $\xrightarrow[\text{Cooling}]{\text{fast}}$ Amorphous

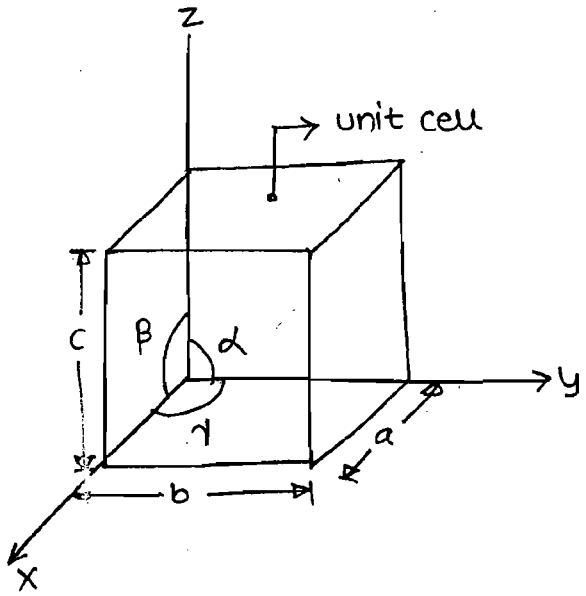
Material type
└ (We cannot Judge by Naked eye)

5. Crystal structure of unknown material are determine by X-Ray diffraction technique. This is experimental technique.

6. Based on X-Ray diffraction technique all Crystalline materials classified into Seven Crystal System and these are Sub classified into 14 Bravais Lattices

7. The term Crystal System refers to basic shape of Unit cell whereas bravais Lattices refers to Atomic Arrangements within a Unit Cell

8. A Unit Cell is defined as the smallest representative group of atoms, which when repeated in all the Crystallographic direction for Infinite number of times results in the development of Crystal lattice.



x, y, z = crystallographic axes

a, b, c = Lattice Parameter

α, β, γ = Interaxial angles

Stability → minimization of Potential energy

Crystal System	Geometry	Bravais Lattices
Cubic → Metal	$a=b=c$ $\alpha=\beta=\gamma=90^\circ$	Simple (S), BCC, FCC
Tetragonal	$a=b\neq c$ $\alpha=\beta=\gamma=90^\circ$	ST, BCT
orthorhombic	$a\neq b\neq c$ $\alpha=\beta=\gamma=90^\circ$	SO, BCO, FCO ECO
Rhombohedral	$a=b=c$; $\alpha=\beta=\gamma\neq90^\circ$	SR
Hexagonal → For metal	$a=b=c$ $\alpha=\beta=90^\circ, \gamma=120^\circ$	SH
Monoclinic	$a\neq b\neq c$ $\alpha=\gamma=90^\circ\neq\beta$	SM, ECM
Triclinic	$a\neq b\neq c$ $\alpha\neq\beta\neq\gamma\neq90^\circ$	STr

Simple (S)
Body centered (BC)
Face centered (FC)
End centered (EC)
→ Generally