LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING
(AUTONOMOUS)
Accredited by NAAC & NBA (CSE, IT, ECE, EEE & ME)
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FRESHMAN ENGINEERING DEPARTMENT

UNIT II Crystallography & X-Ray diffraction

1	Define space lattice, basis, unit cell, lattice parameters and crystal structure.	L1
2	Draw the seven crystal systems with lattice parameters with Bravias lattices	L2
3	Show that FCC is more closely packed than BCC & SCC.	L3
4	What are Miller indices? How they are obtained.	L2
5	Derive an equation for the interplanar spacing between successive planes of cubic and orthorhombic lattice.	L3
6	State and explain Bragg's law.	L2
7	Illustrate Bragg's spectrometer to determine lattice constant and interplanarspacing.	L2
8	Describe the construction and working of a powder method to determine the interplanar distance.	L2
9	Draw the planes (100) ,(110) ,(111) in a cubic lattice.	L1
10	Define atomic radius, coordination number, and packing fraction with examples.	L1

Short Answers

1. Define space lattice, basis, unit cell.
2. What is meant by crystal structure?
3. What are lattice parameters of a unit cell?
4. Define primitive cell and non -primitive unit cell.
5. Name the seven crystal systems.
6. State Bragg's law.
7. Draw the planes (100) ,(110) ,(111) in a cubic lattice.

8. Define atomic radius, coordination number, and packing fraction with examples.
9. Define Miller indices.
10. Write the lattice parameters for Ortho rhombic crystal structure.
11. Draw the unit cell for SCC,BCC and FCC.
12. Give the coordination number for FCC &BCC.
13. Define miller indices.

Problems

1	Find the maximum radius of the interstitial sphere that can fit into the void at (1/2,1/2,1/2) between the atoms in the body centred cubic lattice.
2	Metallic iron changes from BCC to FCC form at 910^0 C and corresponding the atomic radii vary from $1.258A^0$ to1.292 A^0.Calculate the percentage of volume change during this structural change.
3	Show that the maximum radius of the sphere that can just fit into the void at the body centre of the FCC structure coordinated by the facial atoms is 0.414r , where r is the radius of the atom.
4	X-rays of wavelength are diffracted by (111) planes in a crystal at an angle of 30 in the second order. Estimate the interatomic spacing.
5	Estimate the value of d-spacing for (111) planes in a rock salt crystal of a =$2.8149A^0$
6	Calculate the interplaner distance for the (321) & (101) planes in a SCC lattice with interatomic spacing equal to $4.12A^0$.
7	Copper crystalline in the FCC structure.The density and atomic weight of copper is 8960 kg/m and 63.54 respectively. Estimate the lattice constant.
8	GaAs has its principle planes separated at $5.6534A^0$.The first order reflection is located at 14^0. Calculate the wavelength and angle in the second order diffraction.
9	A beam of X-rays is incident on a NaCl crystal with lattice spacing 0.282nm.Estmate the wavelength of X-rays if the first order Bragg reflection takes place at a glancing angle of 9^0.Also calculate the maximum order of diffraction possible.
10	X-rays of wavelength $1.5418A^0$ are diffracted by (111) planes in a crystal at an angel of 30^0 I the first order.Find the interplanar spacing.
11	Lattice constant of copper is 0.38nm.Calculate the distance between (111) planes.
12	Show that in a simple lattice the separation between the successive lattice planes (100),(110) and (111) are in the ratio of 1:0.71:0.58.
13	Obtain the Miller indices of a plane which intercepts at (a,b/2,3c) is a simple cubic unit cell.Draw a neat diagram showing the plane.

Objective Questions:

1. **The number of atoms per unit cell in an fcc lattice is** **(a)**

   (a) 1 **(b) 2** **(c) 4** **(d) 8**

2. **The coordination number of a simple cubic** **(a)**
   (a)6 **(b) 8** **(c) 12** **(d) 13**
3. **The coordination number of fcc is** **(c)**
   a) 6 **(b) 8** **(c) 12** **(d) 13**
4. **Single crystal is used in** **(c)**

   (a) Bragg's method **(b) powder method**

   (c) laue's method **(d) all the above**

5. **The Atomic packing factor of simple cubic structure is** **(a)**
   (a)0.52 **(b) 1.00** **(c) 0.74** **(d) 0.68**
6. **The Atomic packing factor of BCC structure is** **(d)**
   (a)0.52 **(b) 1.00** **(c) 0.74** **(d) 0.68**
7. **The Atomic packing factor of FCC structure is** **(c)**

   (a)0.52 **(b) 1.00** **(c) 0.74** **(d) 0.68**

8. **There are _____basic crystal systems.** **(c)**
   a)six **(b) five** **(c)seven** **(d) four**
9. **Miller indices of the crystal plane parallel to y and z axes are** **(a)**
   (a)(100) **(b) (010)** **(c) (001)** **(d) (110)**

10. **The number of atoms per unit cell in an BCC lattice is** **(d)**

a) 1 **(b) 2** **(c) 4** **(d) 8**

11. Atomic radius of BCC IS ……$\frac{a\sqrt{3}}{4}$……

12. Lattice parameters of cubic crystal is ……$a = b = c \;\&\alpha = \beta = \gamma = 90^0$……

13. Bragg's equation is ……$2dsin\theta = n\lambda$…….

14.Atomic packing facor for FCC is ……0.74……..

15. For a cubic system ,if a is the lattice constant, then the interplanar separation for (111) planes is ……$\frac{a}{\sqrt{3}}$……..

16. If a plane is parallel to any axis, Miller index for that plane is ……zero……

17.Examples of simple cubic crystal is ……Polonium……..

18. Lattice parameters of Hexagonal system is …… $a = b \neq c \;\&\alpha = \beta = 90^0, \gamma = 120^0$….

19. Interplanar distance between the successive planes is ……$\frac{a}{\sqrt{h^2+k^2++l^2}}$…….

20. The Miller indices oa plane whose intercepts are 2a,b,3c is ……[362]……