Code No: 07A70606 | R07 | | Set No. 2 |

IV B.Tech I Semester Examinations,May 2011
X-RAY METALLOGRAPHY
Metallurgy And Material Technology

Time: 3 hours   Max Marks: 80

Answer any FIVE Questions
All Questions carry equal marks
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1. (a) What is atomic scattering factor?

   (b) Calculate structure factor for a face centered cubic cell.   [6+10]

2. (a) Explain in detail order-disorder transformations.

   (b) Distinguish between qualitative and quantitative analysis with suitable examples.

                                                                           [8+8]

3. What is the importance of precise parameter measurements? Explain. How do you determine solves curves by parametric method.   [16]

4. (a) Show that short wavelength limit of a continuous spectrum depends only on the applied voltage?

   (b) Explain the factors on which the total intensity of the continuous spectrum depends?

   (c) What is Moseley law? Explain.   [6+5+5]

5. (a) Explain the effect of interstecial carbon atom added to austenite and mertensite with regard to dimenstional changes in their unit cell lengths.

   (b) Explain how you will find out the densities of interstecial solid solutions(with examples).   [8+8]

6. (a) Explain the working of back reflection cameras.

   (b) Explain the mathematical expression connecting the uniaxial stress, with spacings of the planes before & after applied stress, poisson's ratio etc, during the determination of stress, by diffraction methods.   [8+8]

7. (a) Explain the reasons for existence of appreciable background intensity in powder photograph cameras.

   (b) What are pinhole cameras? Explain its working principle.   [8+8]

8. (a) What is the effect of plastic deformation on the quality of crystal using X-rays?

   (b) Explain the principle of double crystal topography method.   [8+8]

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Code No: 07A70606 | R07 | Set No. 4

IV B.Tech I Semester Examinations,May 2011
X-RAY METALLOGRAPHY
Metallurgy And Material Technology

Time: 3 hours | Max Marks: 80

Answer any FIVE Questions
All Questions carry equal marks
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1. What do you mean by crystal structure? What are the basic principles involved in the crystal structures determination of any material. Explain the steps involved in the determination of unknown structures. [16]

2. Explain the principle involved in chemical analysis by diffraction. What are its merits over conventional chemical method? discuss. [16]

3. A certain tetragonal crystal has four atoms of the same kind per unit cell, located at 0 1/2 1/4, 1/2 0 1/4, 1/2 0 3/4, 0 1/2 3/4.

   (a) Derive simplified expression for F^2.
   (b) What is the Braveis lattice of this crystal?
   (c) What are the values of F^2 for 1 0 0, 0 0 2, 1 1 1 and 0 1 1 reflections? [8+4+4]

4. (a) Discuss on advantages and limitations of Laue photographic methods.
   (b) Explain the importance of collimators used in Laue methods. [8+8]

5. (a) What voltage must be applied to a molybdenum target tube in order that the emitted X-ray excites K-fluorescent radiation from a copper metal placed in the copper beam? What is the wavelength of the fluorescent radiation?
   (b) Explain the safety precautions to be taken by an operator of the X-ray apparatus. [10+6]

6. Consider the diffraction geometry for $\alpha = 0$ in the transmission method for determining preferred orientation and for $\alpha = 90^0$ in the reflection method. Let t_{inf} be the infinite thickness required in the reflection method, and assume t_{inf} is that thickness which would diffract 99 percent of the intensity diffracted by a specimen of truly infinite thickness. Let t_{opt} be the optimum thickness for the transmission method.

   (a) Show that $t_{inf}/t_{opt} = 2.30 \tan \theta$
   (b) If the thickness t of a transmission specimen is $2t_{opt}$, by how much is the diffracted intensity decreased? [8+8]

7. Explain in detail experimental technique applying the two-exposure techniques to the 'measurement of stress' by diffraction method. [16]

8. (a) Explain about K_α and K_β radiation in the analysis of crystal structures.

(b) What is a phase diagram? What details are revealed by a phase diagram? What are the other names for a phase diagram? Explain why those names are assigned to phase diagrams.

(c) Explain the limitations of thermal analysis method. [5+6+5]

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Code No: 07A70606 | **R07** | **Set No. 1**

IV B.Tech I Semester Examinations,May 2011
X-RAY METALLOGRAPHY
Metallurgy And Material Technology

Time: 3 hours

Max Marks: 80

Answer any FIVE Questions
All Questions carry equal marks
⋆ ⋆ ⋆ ⋆ ⋆

1. (a) Discuss the effect of lattice distortion on the shape of a transmission Laue spot.

   (b) Explain the formation of Debye arcs on Laue patterns of deformed crystals.
   [6+10]

2. Write short notes on the following:

   (a) Determination of number of atoms in a unit cell

   (b) Determination of atom positions. [16]

3. (a) With a neat sketch of an X-ray tube, explain the production of X-rays.

   (b) Explain the importance of filament current, tube current and focal spot in the production of X-rays. [8+8]

4. (a) Nickel shows the diffraction maximum at $2\theta = 101.502^0$. The wavelength of X-rays is equal to 1.541 Å. Calculate the lattice parameter of Nickel cell if the above reflection corresponds to (310) plane (n = 1).

   (b) Determine the crystal directions from which diffraction occurs in a tetragonal system. [8+8]

5. (a) Distinguish between stress & strain.

   (b) 'X-ray diffraction can be used as a method of stress measurement.' Justify the above statement.

   (c) Between stress & strain, which is measured directly and which is measured indirectly? Why? Explain. [4+8+4]

6. Given a powder pattern of an unknown sample. Describe how you will identity the components in the sample given that the sample contains a mixture of two phases with no superposed lines. [16]

7. (a) Suppose you are given a powder photograph of a Fcc metal and another one belonging to a Bcc metal. Is it possible to identity as to which belongs to Fcc metal or Bcc metal at a glance, without any mathematical analysis. If so how and why? Discuss.

   (b) Explain the Hanawalt method of qualitative analysis by diffraction. [10+6]

4

R07

Set No. 1

8. A cubic crystal contains 8 carbon atoms in its unit cell positioned at locations as stated below: 0   0   0, 1/2   1/2   0, 1/20   1/2, 0   1/2   1/2, 1/4 1/4   1/4, 1/4   3/4   3/4, 3/4   1/4   3/4,   3/4 3/4   1/4. Find out the expression for structure factor of the above crystal.   [16]

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Code No: 07A70606 **R07** **Set No. 3**

IV B.Tech I Semester Examinations,May 2011
X-RAY METALLOGRAPHY
Metallurgy And Material Technology

Time: 3 hours Max Marks: 80

Answer any FIVE Questions
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1. (a) Distinguish between coherent and incoherent radiation.

    (b) Given a powder diffraction pattern of a cubic substance, discuss how the pattern can be solved. [8+8]

2. (a) What are the characteristics determined for a cold worked specimen using X-rays? Explain the diffraction effects by them.

    (b) Explain the changes in hardness and diffraction lines of alpha brass from cold worked state to annealed state. [10+6]

3. (a) Explain how monochromatic radiation is obtained in a diffractometer using Ross filters.

    (b) Briefly explain the different ways in which the Scalers can be operated to obtain the average counting rate. [8+8]

4. Explain with a neat sketch the pin hole camera method for stress measurement. What are the advantages & disadvantages of the over other methods of stress measurement. [16]

5. What is meant by suprelattice? considering a Cu_3 Au alone discuss how a superlattice line is formed and how it can be used in the study of order-disorder transformation. [16]

6. Discuss in detail the importance of extrapolation methods for the determination of precise lattice parameters. Explain the methods in detail. [16]

7. (a) Derive simplified expressions for F^2 for diamond, including the rules governing observed reflections.

    (b) Derive an expression for the absorption factor of a diffractometer where the specimen is in the form of a flat plate of finite thickness. [8+8]

8. Define the following terms with suitable explanation:

    (a) Linear Absorption Coefficient

    (b) Characteristic spectrum

    (c) Moseley law

    (d) Fluorescent radiation. [16]

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