

Code No: 07A70606

R07**Set No. 2**

IV B.Tech I Semester Examinations, November 2010

X-RAY METALLOGRAPHY**Metallurgy And Material Technology****Time: 3 hours****Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

1. What are the reasons for development of residual stresses in materials. Explain those reasons. What are the disadvantages of presence of residual stresses? How are they relieved? Discuss. [16]
2. Discuss the disappearing phase method for detection of solvus lines/curves by x-ray diffraction method. [16]
3. Explain the following:
 - (a) Lorentz factor
 - (b) Structure factor. [8+8]
4. Discuss on the effect of lattice distortion on the shape of a Laue spot in
 - (a) Transmission method
 - (b) Back-reflection method. [8+8]
5. (a) Explain
 - i. Transmission and
 - ii. Back-reflection Laue methods in the formation of Laue spots.
 (b) What is Rotating crystal method? Explain its advantages and disadvantages. [10+6]
6. Describe the Debye-Scherrer method of X-ray crystal analysis and show how it can be used to determine the lattice spacing of FCC solid solution. [16]
7. With a neat sketch explain the following:
 - (a) Seemann-Bohlin focusing cameras
 - (b) Back-Reflection focusing cameras. [8+8]
8. (a) Compare and contrast long range and short range order with suitable sketches.
- (b) Explain about Lorentz polarization factor.
- (c) Briefly explain about atomic scattering factor. [8+4+4]

Code No: 07A70606

R07**Set No. 4****IV B.Tech I Semester Examinations, November 2010****X-RAY METALLOGRAPHY****Metallurgy And Material Technology****Time: 3 hours****Max Marks: 80****Answer any FIVE Questions****All Questions carry equal marks**

1. (a) What do you understand by the K absorption edge of an element? At what wavelength does it occur? Why? Discuss.
(b) Discuss the applications of stress measurement by x-ray diffraction methods over other methods of stress measurement. Explain the advantages and disadvantages in X-ray diffraction methods over other methods. [10+6]
2. (a) Explain Vegard's law in respect of solid solutions.
(b) Distinguish between continuous solid solutions and Random solid solutions with neat figures and examples. [7+9]
3. Explain the determination of the lattice constant of a cubic crystal by X-ray diffraction method. [16]
4. (a) What are the characteristic properties of X-rays?
(b) Describe briefly the production of X-rays. [6+10]
5. Explain different means of recording the diffraction pattern in Hull/Debye-Scherrer method. [16]
6. Consider the diffraction geometry for $\alpha = 0$ in the transmission method for determining preferred orientation and for $\alpha = 90^\circ$ 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. (a) Suppose you are given a powder photograph of a FCC metal and another one belonging to a BCC metal. Is it possible to identify 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]
8. (a) What is Thomson equation? Derive it from the fundamentals.
(b) What is structure factor? Derive different values of structure factor for NaCl crystal. [8+8]

Code No: 07A70606

R07

Set No. 4

FIRSTRANKER

Code No: 07A70606

R07**Set No. 1**

IV B.Tech I Semester Examinations, November 2010

X-RAY METALLOGRAPHY**Metallurgy And Material Technology****Time: 3 hours****Max Marks: 80**

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- Explain the role of intensifying screens in Laue cameras.
 - Explain the role of angular relationships in pinhole method. [8+8]
- What are the possible Extinction rules for cubic systems?
 - Derive an equation for determining the diffraction directions for cubic systems. [8+8]
- How Lang method is useful in finding out the crystal quality?
 - Compare Field and Merchant method with Schulz reflection method. [8+8]
- Discuss in detail the long range order in AuCu_3 and calculate long range order parameter, if 70% of Au atoms occupy cube corner positions.
 - Write short notes on systematic and random errors. [10+6]
- Explain the effect of interstitial carbon atom added to Austenite and Martensite with regard to dimensional changes in their unit cell lengths.
 - Explain how to find out the densities of interstitial solid solutions (with examples). [8+8]
- The entry point and the exit point of x-rays on a powder pattern taken from a cubic material could not be distinguished. Assuming one of the points to be the exit point, the following S values were obtained: 311.95, 319.10 & 335.05 mm. The camera radius is 57.3 mm. Molybdenum k_α radiation was used. Determine the structure and lattice parameter of the crystal. [16]
- Why Rotating crystal method was not developed?
 - Distinguish between X-ray spectroscopy and Diffractometer. [8+8]
- Suppose that a nickel filter is required to produce $\frac{I_{\text{Cu}K_\alpha}}{I_{\text{Cu}K_\beta}} = \frac{100}{1}$ in the filtered beam. Calculate the thickness of the filter required and the transmission factor for the Cu K_α radiation given:

In the unfiltered beam $\frac{I_{\text{Cu}K_\alpha}}{I_{\text{Cu}K_\beta}} = \frac{7.5}{1}$

$\left(\frac{\mu}{\rho}\right)$ of wickel for Cu K_α radiation: 49.3 cm^2/gm

$\left(\frac{\mu}{\rho}\right)$ of wickel for Cu K_β radiation: 286 cm^2/gm .

Density of Nickel: 8.9 gm/cc . [16]

Code No: 07A70606

R07**Set No. 3**

IV B.Tech I Semester Examinations, November 2010

X-RAY METALLOGRAPHY

Metallurgy And Material Technology

Time: 3 hours

Max Marks: 80

Answer any FIVE Questions
All Questions carry equal marks

1. (a) Explain, how the quality of a powder pattern is improved even in the presence of fluorescent radiation.
(b) Explain the method of measuring coating thickness by fluorescent radiation method. [8+8]
2. Write short notes on the following:
(a) Thomson equation
(b) Polarisation factor
(c) Compton effect. [5+5+6]
3. Discuss the following:
(a) Energy-dispersive diffractometry.
(b) Rate meters. [8+8]
4. (a) Discuss on the role of extinction on image formation in X-ray topography
(b) Explain the role of crystal defects on diffraction contrast. [8+8]
5. Write short notes on the following:
(a) Stereographic projection
(b) Coolidge tube. [8+8]
6. (a) Derive the necessary equations and discuss how x-rays are used in the study of order-disorder transformations
(b) Explain about short range order and clustering. [12+4]
7. 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 phase diagram? Explain why those names are assigned to phase diagram?
c) Explain the limitations of thermal analysis method [5+6+5]

Code No: 07A70606

R07

Set No. 3

8. A powder made with Cu K_α radiation contains ten lines whose $\sin^2 \theta$ values are 0.117, 0.136, 0.284, 0.403, 0.432, 0.573, 0.631, 0.772, 0.872, 0.981.

Index these lines and calculate the lattice parameters.

[16]

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