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SARDAR PATEL UNIVERSITY
M.Sc. Materials Science, IVth Semester Examination
Wednesday, 05-12-2012
Time: 02:30 p.m. to 05:30 p.m.
Subject: PS04CMTS03: Modern Characterization Techniques
Maximum Marks: 70

Note: Figures on the RIGHT indicate marks for the question.

Q.1 All the questions are compulsory. **(8)**

Answer the following questions by showing your **correct choice** against each one.

(i) The kilo X (kX) unit is only slightly larger than
(a) 1 angstrom (b) 0.1 angstrom (c) 10 angstrom (d) 100 angstrom

(ii) As the tube voltage, V is increased, the short-wavelength limit, λswl, _____.
(a) increases (b) decreases
(c) does not change (d) first increases and then decreases

(iii) Debye-Scherrer camera often has a diameter of
(a) 5.73 cm (b) 5.37 cm (c) 7.35 cm (d) 7.53 cm

(iv) In rotating crystal method continuous X-radiation is used.
(a) true (b) false

(v) With reduction in grain size, number of diffraction spots on diffraction pattern _____.
(a) reduces (b) increases (c) gets doubled (d) remains same

(vi) The energy of X-ray line is proportional to _____of the atomic number of the radiation emitting element.
(a) square (b) square root (c) cube (d) cube root

(vii) The W-hairpin filament has an approximate diameter of
(a) 5 μm (b) 20 μm (c) 50 μm (d) 100 μm

(viii) The extent of elastic scattering is related to the_____ of the atomic number of the target material.
(a) square (b) square root (c) cube (d) cube root

Q.2 Attempt any **SEVEN** of the followings: **(14)**

(a) Draw stereograms for 1, 2, 3, 4 and 6 fold uniaxial proper rotation.
(b) Differentiate between unresolved and resolved Kα doublet.
(c) Based on relative position of specimen and film name the three powder methods in use.
(d) Differentiate between transmission and back reflection Laue methods.
(e) What do you understand by recrystallization texture?
(f) Define linear and mass absorption coefficients.
(g) How does microstructure of a material differ from that of macrostructure?
(h) Mention different illumination variations of an optical microscope.
(i) Write full form of FEG, SADP, EDS and EELS.

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Q.3 (a) How are continuous and characteristic X-ray spectrums generated? Define intensity of X-rays and differentiate between the intensities of the two spectra. (6)

(b) Differentiate between transmission and back reflection Laue cameras. How does change in the tube voltage influence Laue patterns and what information does this method provide? (6)

(OR)

(b) Mention the similarities and differences between Debye-Scherrer camera and X-ray diffrectometer. With suitable diagram explain Debye-Scherrer method.

Q.4 (a) What is meant by preferred orientation or texture? Differentiate between deformation and annealing texture. (6)

(b) State and mathematically derive Mosley's law. What is Rydberg constant? (6)

(OR)

(b) Differentiate between wavelength dispersive and energy dispersive X-ray spectrometers and with suitable diagram explain any one of the two.

Q.5 (a) Classify structure of a material on the basis of levels of study and how can it be studied using different aids? (6)

(b) Write about the fundamental components, function of an objective lens and eyepiece and important characteristics to the user, of an optical microscope. (6)

(OR)

(b) Differentiate between elastic and inelastic scattering events occurring due to electron beam - specimen interactions in an electron microscope. Write about different possible inelastic scattering events.

Q.6 (a) Write about different high energy electron sources used in electron optical instruments and compare them. (6)

(b) What is meant by Selected Area Diffraction Pattern (SADP)? Explain the three types of electron diffraction patterns that can be generated in SADP. (6)

(OR)

(b) Draw schematic of electron optical column in Scanning Electron Microscope. Also, mention about kind of samples used and give examples of applications of the same.

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