

Roll No.

Total Pages : 3

238405

May, 2019

M.Sc. IV SEMESTER

Material Science (PHL404-A)

Time : 3 Hours]

[Max. Marks:75

Instructions :

1. *It is compulsory to answer all the questions (1.5 marks each) of Part-A in short.*
2. *Answer any four questions from Part-B in detail.*
3. *Different sub-parts of a question are to be attempted adjacent to each other.*

PART-A

1. (a) The true stress-strain curve is always to the left of the engineering stress-strain curve. Explain. (1.5)
- (b) What do you understand by strain rate sensitivity? (1.5)
- (c) How hardness of a material is related to its flow properties? (1.5)
- (d) Why thin layer of polymer (mylar) is kept before detector in ERDA experiment? (1.5)
- (e) How ion-implantation is different from coating?(1.5)
- (f) Why Aluminum and Silver are not completely miscible? (1.5)

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- (g) What are Frank and Read sources? (1.5)
- (h) Explain Stacking Faults. (1.5)
- (i) What are hyper eutectoid alloys? (1.5)
- (j) What do you understand by super lattice dislocations? (1.5)

PART-B

2. (a) Calculate the elastic strain energy stored in a cylindrical solid of length L and radius R having screw dislocation at a distance r from its center. Further show that screw dislocations are non-equilibrium defects. (10)
- (b) Discuss in detail the twin interfaces. (5)

3. (a) A glass plate has a sharp crack of length 2 micrometer in its surface. At what stress will it fracture when a tensile force is applied perpendicular to the plane of the crack? Young's modulus 70 GNm^{-2} and surface energy $= 0.3 \text{ Jm}^{-2}$. (7)
- (b) Explain the phenomenon of work hardening. Discuss the mechanism of strengthening due to grain boundaries. (8)

4. (a) Discuss how necking in isotropic cylindrical specimen is different from rectangular cross-sectional specimen cut from a sheet. (7)
- (b) Differentiate between Schottky and Frenkel defects and also determine the equilibrium concentration of Frenkel defects in an ionic solid. (8)

5. (a) Discuss nucleation and growth transformation mechanism. Under what conditions coarse or fine dispersion of beta phase is achieved? How it is different from martensitic transformation? (10)
- (b) Describe the equilibrium phase diagram for a completely miscible solid solution. (5)

6. (a) What is principle of RBS technique? Show that the reduction in energy after scattering depends on the masses of the incident and target atoms and the scattering angle. Is it possible to distinguish silver isotopes using RBS? Justify your response. (10)
- (b) List the applications of Secondary Ion Mass Spectroscopy (SIMS). (5)

7. (a) What is ion implantation process? Why the properties of surface layers are modified as a result of implantation? (8)
- (b) What is diffusion? Discuss the atomic model of diffusion. (7)