Exam.Code:0975
Sub. Code: 7108

2123

M. Tech. (Micro-Electronics)
First Semester
MIC-106: Material Science and Engineering

Time allowed: 3 Hours **Max. Marks: 50**

NOTE: ***Attempt five questions in all, including Question No. I which is compulsory and selecting two questions from each Section. Use of scientific calculator is allowed.***

x-x-x

1. Answer the following:-

(a) What is Fermi function? (2)

(b) What is the difference between elastic and plastic deformation? (2)

(c) What is engineering strain and how it is depending upon the length of the specimen? (2)

(d) Calculate the dimensions of a cube containing 1 mol of solid magnesium. (Density of Mg = 1.74 g/cm^3, atomic mass of Mg = 24.31 amu) (2)

(e) Why GaN is preferred material in making chargers? (2)

SECTION A

2. (a) Calculate the density of Schottky pairs (in m^{-3}) in CaO, if the fraction of vacant lattice sites is 5×10^{-6}. (The density of CaO is 3.45 Mg/m^3) (5)

(b) All the impurities diffused inside the material are not electronically active, Why? Discuss in terms of misfit factor? (5)

3. (a) Sketch the atomic arrangement and Burgers vector orientations in the slip plane of a BCC material. (5)

(b) Compare the properties of Aluminum alloys and steel in terms of specific heat and conductivity. (5)

4. Steel surfaces can be hardened by *carburization.* During one such treatment at 1,000°C, there is a drop in carbon concentration from 5 to 4 at % carbon between 1 and 2 mm from the surface of the steel. Estimate the flux of carbon atoms into the steel in this near-surface region. (The density of γ-Fe at 1,000°C is 7.63 g/cm^3) (10)

SECTION B

5. (a) What is the significance of polymer matrix material in fibre-reinforced composites? Explain briefly. (5)

(b) How the carrier concentration of a material is dependent on the ambient temperature? What happens to the generation and recombination process if the temperature is suddenly raised? (5)

6. (a) A dispersion- strengthened aluminum contains 10 vol % Al_2O_3. Assuming that the metal phase is essentially pure aluminum, calculate the density of the composite. (The density of Al_2O_3 is 3.97 Mg/m^3) (5)

(b) What first aid procedures are needed to be followed if person comes in contact with the cryogens? (5)

7. A novel electronic material involves the dispersion of small silicon particles in a glass matrix. If 4.85×10^{16} particles of Si are dispersed per mm^3 of glass corresponding to a total content of 5 wt %, calculate the average particle size of the quantum dots. (Assume spherical particles and note that the density of the silicate glass matrix is 2.60 Mg/m^3.) (10)

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