Menouifya University

Faculty of Engineering (Shebin El-Kom)

Basic engineering Science Dept.

Date 8/1/2017

Subject: Principles of magnetic materials and crystal growth

Total Mark: 100

Time : 3h

Question (1)   20 Marks

a) What are Miller indices? How they are determined? Explain with example

b) Sodium chloride crystallizes in FCC structure. The density of sodium chloride is $2180 kg/m^3$. If the atomic weight of sodium is 23 and that of chlorine is 35.5. Calculate

i) the effective number of atoms per unit cell.

ii) the distance between adjacent sodium and chlorine atoms. ($N_A = 6.023 \times 10^{26}$ atoms/kmol)

Question (2)   20 Marks

a) Explain electronic and ionic polarizability. For monatomic gas, show that electronic polarizability increases as atoms become larger

b) Explain and derive Bragg`s law for x-ray diffraction.

Question (3)   20 Marks

a) What means by polarization of substance? Mention the different mechanisms of polarization in a dielectric

b) The Bragg angle corresponding to the first order reflection from plane (111) in a crystal is $30°$ when x-rays of wavelength 1.75 Å are used .Calculate the interatomic spacing.

c) Explain electronic and ionic polarization of a dielectric material.

Question (4)   20 Marks

a) Explain the chemical composition and crystal structure of spinel ferrite.

b) What are the factors (in details) which can influence the cation distribution between the octahedral and tetrahedral sites?

c) Explain the behavior of the ferromagnetic, paramagnetic and diamagnetic materials and explain the occurrence of para and diamagnetic properties.

Question (5)   20 Marks

a) Explain and draw the behavior of the ferromagnetic, paramagnetic, ferrimagnetic and materials in an external magnetic field on the basis of their magnetic structures.

b) Explain with details the types of interactions in the ferrimagnetic materials.

c) Explain the dielectric behavior of dielectrics under static electric field and define the dielectric constant.

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