Exam I

Mars 17ᵗʰ 2011

Duration: 1.30 minutes

Closed Book ☹

Write clearly your answers on the question sheet!

Name:

ID No:

1. Define briefly the following:
a) Composites, b) Semiconductors and c) smart materials. (0.75p)

2.Science and engineering of materials involve four interrelated components, please mention them. (1p)

3.What is/are the difference (s) between the Bohr and mechanical atoms models; please provide also with a simple sketch presenting these models in terms of electron distribution. (1.75p)

4.What does the Pauli exclusion principle state? (1p)

5.Mention one materials for each of the following crystal structures: FCC, BCC and HCP (1.5p)

6.What is the (if any) difference between Polymorphism and Allotropy and briefly explain the meaning of these phenomenon. (1p)

7.Briefly discuss the term "Anisotropy" and give a short explanation to what are meant by "grain boundaries, phase boundaries and twin boundaries. (2p)

8. X-Ray diffraction is a very well used tool in the field of materials science. Explain briefly the procedure mentioning also what kind of information it provides scientists with. (2p)

9. Iodine has an orthorhombic unit cell for which the a, b, and c lattice parameters are 0.481, 0.720, and 0.981 nm, respectively. (3points)

(a) If the atomic packing factor and atomic radius are 0.547 and 0.177 nm, respectively, determine the number of atoms in each unit cell.

(b) The atomic weight of iodine is 126.91 g/mol; compute its theoretical density in g/cm^3.

10. For tetragonal crystals, cite the indices of directions that are equivalent to each of the following directions (3p):
(a) [001]
(b) [110]
(c) [010]

11. Niobium forms a substitutional solid solution with vanadium. Compute the weight percent of niobium that must be added to vanadium to yield an alloy that contains 1.55×10^{22} Nb atoms per cubic centimeter. The densities of pure Nb and V are 8.57 and 6.10 g/cm^3, respectively (3p).