

MEE1005 Materials Engineering and Technology B1+TB1

- 1.(i) Draw (111) plane in iron (Fe) (FCC) to show the arrangement of atoms, which are to be represented as hard spheres.
- (ii) On the sketch you have drawn in answer to part (i), draw and find out the directions along which slip occurs and name the family of directions to which they belong.
- (iii) Calculate the planar density in the (111) plane of Fe. Express your answer in units of atoms cm^{-2} . Assume that the lattice parameter of $\alpha\text{-Fe} = 0.316 \text{ nm}$.

2The atomic weight, density, and atomic radius for two hypothetical alloys are given in below. For each determine whether its crystal structure is FCC, BCC, or simple cubic and then justify your determination.

Alloy	Atomic Weight (g/mol)	Density (g/cm^3)	Atomic Radius (nm)
P	77.4	8.22	0.125
Q	107.6	13.42	0.133

3. (i) Determine the ASTM grain size number and calculate the grain size (mm) of the single phase metal shown in Figure 1 (100X magnification). [Assume all grains are same size]

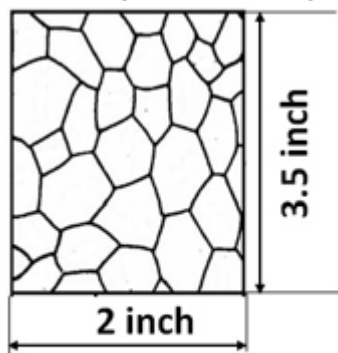


Figure 1

- (ii)The average grain diameter of an aluminum alloy is 0.00014 mm with strength of 185 MPa . The same alloy with an average grain diameter of 0.0005 mm has a strength of 140 MPa . (a) Determine the constants for the Hall-Petch equation for this alloy. (b) How much more should you reduce the grain size if you desire a strength of 220 MPa ?