

Engineering Materials (UES012)
School of Physics and Materials Science
Tutorial Sheet No 6

1. In an FCC lattice, the largest interstitial voids occur at positions like $(\frac{1}{2}, 0, 0)$, $(0, \frac{1}{2}, 0)$, $(0, 0, \frac{1}{2})$ etc. γ -iron crystallizes in FCC structure. Find atomic radius of the largest interstitial void in γ -iron.
2. An optical microscope can resolve a step of aluminum width 300 nm. A slip band was observed in a simple cubic crystal ($a = 3 \text{ \AA}$). How many (minimum) dislocations must have slipped out of the crystal?
3. Does the burger vector change with the size of the burger circuit? Explain.
4. Distinguish between the direction of the dislocation line, the burgers vector and the direction of motion for both the edge and screw dislocations. Differentiating between positive and negative types.
5. An aluminum crystal has a dislocation density of 10^{10} m^{-2} . The sheer modulus of aluminum is GNm^{-2} . Calculate the elastic energy of line imperfections stored in the crystal.
6. Average energy required to create Frenkel defect in an ionic crystal is 1.4 eV. Calculate the ratio of Frenkel defects at 20°C and 300°C in 1 gram of crystal.
7. The small angle boundary in FCC copper is due to extra (100) planes of atoms as edge dislocations. If the angle of disorientation is 1° , what is the distance between two neighboring edge dislocations? Given lattice parameter for Cu = 3.62 \AA .
8. Calculate the spacing between dislocation in a low angle tilt boundary in Iridium (FCC) when the angles of tilts are 1° and 3° . Lattice constant of Ir is 3.84 \AA .
9. A positive edge dislocation 1mm long climbs down by $2\mu\text{m}$ in a Polonium crystal whose radius is 1.7 \AA , Calculate the number of vacancies created or lost.