



DEFECTS IN CRYSTALLINE SOLIDS (PART-I)

PROF. SHASHANK SHEKHAR

Department of Metallurgical and Materials Engineering
IIT Kanpur

PRE-REQUISITES : Under graduate level mathematics, thermodynamics

INTENDED AUDIENCE : Undergraduate Students and first year graduate students of following discipline: Materials Engineering, Mechanical Engineering, Metallurgical Engineering, Industrial Engineering, Electrical Engineering.

INDUSTRIES APPLICABLE TO : Manufacturing Companies, Iron and Steel companies, Automobile companies, Equipment manufacturers

COURSE OUTLINE :

At the end of the course, the student should be able to

Have a broad understanding of defects in materials and their role in determining properties of materials

Have a thorough understanding of the structure of dislocations in various crystals and their elastic fields

Have an overview of plastic deformation mechanisms and the role of dislocations in plasticity, fracture, fatigue and creep

ABOUT INSTRUCTOR :

Prof. Shashank Shekhar is an assistant professor at IIT Kanpur. He joined IITK in 2010 and has since taught manufacturing related courses to 2nd year, 3rd year as well as 4th year UG students. His research interest lies in thermomechanical processing, particularly severe plastic deformation using techniques like machining and constrained groove pressing.

COURSE PLAN :

Week 1 : Introduction to Point defect, Defect structure, Energy and Concentration of Point defect

Week 2 : Intrinsic and Extrinsic defect, Defect reaction and its thermodynamics,

Week 3 : Interstitial and Substitutional Diffusion,

Week 4 : Fundamentals of dislocation, Dislocation model and Dislocation circuit

Week 5 : Stress and strain field around dislocation, Force and energy on dislocation

Week 6 : Image force, Dislocation motion, Slip system, Peierl Nabarro stress, Critical resolved shear stress

Week 7 : Glide, climb and Cross-slip to create steps, Dislocation intersection

Week 8 : Strain and strain rate due to dislocation motion, Dislocation in FCC and BCC, Thompson's Tetrahedron