Grain Boundaries and Interfaces

- Description, structure and thermodynamics of grain boundary and interface - Degrees of freedom, low and high angle boundaries – dislocation model – tilt and twist boundaries – stacking fault and twin boundaries (4 to 5 lectures)
- Interphase boundaries – coherent, semi-coherent and incoherent interphase – Antiphase boundaries (2 lectures)
- Description of orientation – Ideal orientation – Euler rotations – Rodrigues vector and Rodrigues space (3 lectures)
- Interface networks, dihedral angles - Interfacial energy and its anisotropy – Determination of interfacial energies (3 lectures)
- Introduction to 'coincidence site lattice (CSL)' theory – concept of 'special boundary' (3 lectures)
- Grain boundary character distribution (or Interface character distributions in the case of multi-phase materials) – Interface texture – misorientation (3-parameter) vs. boundary normal (5-parameter) (2 lectures)
- Strategy to measure 'five parameter' grain boundary character distribution – Five parameter stereological analysis – serial sectioning and 3D EBSD – pseudo 3D EBSD (5 to 6 lectures)
- Role of interfacial phenomena in deformation and failure of materials (viz, creep, grain boundary sliding, grain boundary migration, grain boundary embrittlement etc) (5 to 6 lectures)
- Interfacial phenomena in thin films and composite materials, bulk magnetic materials, solar cells (4 to 5 lectures)
- Introduction to grain boundary engineering (GBE) – Mechanisms of GBE - Possible routes for GBE - Applications of GBE to improve material properties viz corrosion, segregation, fracture etc (5 to 6 lectures)

Text Books

- Louisette Priester, Grain Boundaries, From Theory to Engineering, Springer 2013
- G.A.Chadwick and D.A.Smith, Grain Boundary Structure and Properties" Academic Press, London, 1976

Reference Book

- L.E. Murr, Interfacial Phenomena in Metals and Alloys, Addison-Wesley, 1975.
- V. Randle, The role of coincidence site lattice in grain boundary engineering, The university press, Cambridge, 1996
- V. Randle, The measurements of grain boundary geometry, Institute of Physics publishing, London, 1993