

PMM212: CRYSTAL GROWTH AND PROCESSING TECHNIQUES

L	T	P	Cr
3	1	0	3.5

Course Objective(s): To provide a clear understanding of super-saturation, and nucleation of phases, different crystal growth processes. To familiarize with single crystal growth processes such as Czochralski and Bridgman method. To introduce the recent trends in crystal growth, Quantum wells and superlattices, Heterostructures.

Introduction: Crystal growth, Velocity of growth, Theories and mechanism of growth, Twinning, growth twins, Deformation twins, Transformation twins, Growth in the solid state recrystallization and grain growth.

Crystal Growth Techniques: Growth from melt, Thermodynamic principles and crystal growth equilibria, Nucleation from solution, Melt, vapour and solid phase.

Preparation of Single Crystals: Czochralski method, Bridgman method growth from epitaxy.

Purification: Zone refining and floating zone methods.

Epitaxial Growth: Lattice matching in epitaxial growth, Liquid –phase epitaxy, Vapour phase epitaxy, Molecular beam epitaxy, Growth for polycrystalline materials, Quality assessment by X-ray diffraction and optical techniques, Current trends in crystal growth, Quantum wells and superlattices, Heterostructures.

Course Learning Outcomes (CLO):

Student will be able to:

1. Explain crystal growth and epitaxy and the necessary concepts in thermodynamics and kinetics;
2. Explain the connection between growth parameters and the quality and properties of the grown material;
3. Know about recent trends in crystal growth, super lattices and heterostructures;
4. Evaluate and select a crystal growth method, suitable for a specific situation.

Recommended Books:

1. Azaroff, L.V., *Introduction of Solids*, McGraw Hill (1960).
2. Vere, A.W., *Crystal Growth, Principles and Progress*, Springer (1988).
3. Streetman, B.G., *Solid State Electronic Devices*, PHI, (2005)
4. Fleming, M.C., *Solidification Processing*, McGraw Hill (1974)