Subject Code : P8PYE3

EC-III - CRYSTAL GROWTH AND THIN FILM PHYSICS

Unit 1 : Nucleation and Growth

Nucleation – Different kinds of nucleation - Concept of formation of critical nucleus – Classical theory of nucleation - Spherical and cylindrical nucleus - Growth Kinetics of Thin Films - Thin Film Structure – Crystal System and Symmetry.

Unit 2 : Growth Techniques

Solution Growth Technique:

Low temperature solution growth: Solution - Solubility and super solubility – Expression of super saturation – Miers T-C diagram - Constant temperature bath and crystallizer - Seed preparation and mounting - Slow cooling and solvent evaporation methods.

Gel Growth Technique :

Principle – Various types – Structure of gel – Importance of gel – Experimental procedure – Chemical reaction method – Single and double diffusion method – Chemical reduction method – Complex and decomplexion method – Advantages of gel method.

Unit 3 : Melt and Vapour Growth Techniques

Melt technique:

Bridgman technique - Basic process – Various crucibles design - Thermal consideration – Vertical Bridgman technique - Czochralski technique – Experimental arrangement – Growth process.

Vapour technique:

Physical vapour deposition – Chemical vapour deposition (CVD) – Chemical Vapour Transport.

Unit 4 : Thin Film Deposition Techniques

Thin Films – Introduction to Vacuum Technology - Deposition Techniques - Physical Methods – Resistive Heating, Electron Beam Gun, Laser Gun Evaporation and Flash Evaporations, Sputtering - Reactive Sputtering, Radio-Frequency Sputtering - Chemical Methods – Spray Pyrolysis – Preparation of Transparent Conducting Oxides.

Unit 5 : Characterization Technique

X – Ray Diffraction (XRD) – Powder and single crystal - Fourier transform Infrared analysis (FT-IR) – Elemental analysis – Elemental dispersive X-ray analysis (EDAX) - Scanning Electron Microscopy (SEM) – UV-Vis-NIR Spectrometer – Etching (Chemical) – Vickers Micro hardness.

Books for Study and Reference: Relevant Chapters in

1. J.C. Brice, Crystal Growth Processes, John Wiley and Sons, New York (1986)
2. P. SanthanaRagavan and P. Ramasamy, Crystal Growth Processes and Methods, KRU Publications, Kumbakonam (2001)
3. A. Goswami, Thin Film Fundamentals, New Age International (P) Limited, NewDelhi (1996)
4. H.H. Willard, L.L. Merritt, J.A. Dean, F.A. Settle, CBS, Publishers and Distributors, New Delhi