

3. POLYMERIC NANOMATERIALS PROCESSING TECHNIQUES & THEIR APPLICATIONS

(3-1-0) 4 Cr

Module I (12 hours)

Processing of Nanoparticles - Binding mechanisms in Nanoparticles, Dispersion of Nanoparticles, Stabilization of Nanoparticles. Processing and fabrication of polymer nanocomposites - Melt blending, Solvent casting, In-situ polymerization, Solution polymerization, Template synthesis, High shear mixing.

Module II (10 hours)

Homogeneous/heterogeneous nucleation, plasma promoted nucleation, Cold Plasma Methods, Atomic layer deposition fundamentals, Laser ablation, Vapour – liquid – solid growth, particle precipitation aided CVD.

Module III (12 hours)

Processes for producing ultrafine powders - Mechanical grinding; Wet Chemical Synthesis of nanomaterials- sol-gel process, Liquid solid reactions. Gas Phase synthesis of nanomaterials- Furnace, Flame assisted ultrasonic spray pyrolysis; Gas Condensation Processing (GPC), Chemical Vapour Condensation (CVC).

Module IV (12 hours)

Polymer nanocomposites with structural, gas barrier and flame retardant properties, carbon fiber reinforced polymer composites, elastomer and thermoplastic elastomer nanocomposites for propulsion systems, water borne fire-retardant Nanocomposites, hybrid composites for cosmetics, protective and decorative coatings.

Text Books

1. Chung; Deborah D. L., Composite Materials: Science and Applications, Spinger International Edition, Springer-Verlag, London (2004)-Indian Edition 2006
2. Ishida; Hatsud, Characterization of Composite Materials, Butterworth Heinemann, Boston (1994).
3. Fundamentals of Fiber Reinforced Composite Materials, AR Bunsell, J Renard, Institute of Physics, Series in Materials Science & Engg.
4. Introduction to Nanotechnology - Charles P Poole Jr, Frank J Owens
5. Chu; Paul K. and Liu; Xuanyong (Eds.), Biomaterials Fabrication and Processing Handbook, CRC Press, Boca Raton (2008)

Reference Books

1. Carl C. Koch, Nano-structured materials: Processing, Properties and Potential Applications, Noyes Publishers & William Andrews Publishers, New York 2002
2. Guozhong Cao, Nanostructures and Nanomaterials, Imperial College Press, London 2004
3. Mechanical Metallurgy - George E Dieter
4. Mechanical Behaviour of Materials - Thomas H Courtney
5. B. T. Astrom, Manufacturing of Polymer Composites, Chapman and Hall, London 1995
6. T. G. Gutowski, Advanced Composites Manufacturing, John Wiley and Sons, New York 1997
7. T J Pinnavaia, G M Beall Hardcover, Polymer-Clay Nanocomposites, December 2000, Wiley