CHARACTERIZATION OF POLYMERS, ELASTOMERS AND COMPOSITES

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INTENDED AUDIENCE: 3rd and 4th year UG, 1st and 2nd Year PG/PhD students studying in Polymer Science and Technology/ Rubber Technology/ Plastic Engineering Science and Technology/ Industrial Chemistry/ Applied Chemistry/ Metallurgical and Materials Engineering/ Materials Science/ Ceramic Science and Technologyl Nanotechnology and Personals from various R&Ds of Indian Industries having the prerequisites as mentioned below.

PREREQUISITES: For students: High school knowledge in Chemistry, Physics and Mathematics are required. For R&D personals: UG or PG degree(s) in any of the mentioned subjects as mentioned earlier

INDUSTRY SUPPORT: Tata Steel R&D, Reliance, Tata Chemicals,IRMRA, CEAT Tyres, JK Tyres, Apollo Tyres, TATA Jamshedpur, Asian Paints, Pidilite Industries, Michelin Tyre, ALP Overseas, BKT, Ralson, Himadri Chemicals, Philips Carbon, B

ABOUT THE COURSE:
Introductory module will encompass the fundamentals on molecular and mesoscale organization of polymers and composites. The course embodies chemical analysis, identification of polymers, additives, elastomers and composites as per Indian and International standards. Spectroscopic techniques including IR, UV, NMR theory, principle and applications to polymers, elastomers, blends, composites and additives will be deliberated. Thermal analysis techniques including TGA, DSC, DMA, DETA will be elaborated in light of life prediction, degradation kinetics, thermal parameters as well for reverse engineering. Application of X-Ray diffraction techniques WAXS and SAXS will be covered. Surface characterization e.g. XPS, SIMS and Mass Spectroscopy will be covered. A detailed application of microscopy including optical, SEM, TEM and AFM will be elaborated along with case studies.

ABOUT THE INSTRCUTOR:
Prof. Santanu Chattopadhyay is currently a Professor of the Rubber Technology Centre, Indian Institute of Technology Kharagpur, India. He has been serving there as a faculty member since 2004. Prof. Chattopadhyay pursued his postdoctoral research work at the Georgia Institute of Technology, from the Chemical Engineering Department. Prior to that, he did his postdoctoral studies as well at the University of Western Ontario, Canada. Prof. Chattopadhyay earned his Ph.D. from IIT Kharagpur working on Rubber Technology. Prior to these, he earned his M.Tech. (Materials Science and Engineering) and M.Sc. (Chemistry) from IIT Bombay and IIT Kharagpur, respectively. His research interests include Fracture of elastomeric composites, Life prediction of rubber products, Smart rubber composites, Biomaterials, and Polymers for health care and energy harvesting, FEA of rubbery/textile material, Rubber-based nanocomposites, Rubber compounding and modification, Viscoelastic behavior of rubbers and polymer blends, Polymer processing and rheology.
Prof. Chattopadhyay has 170+ Research articles in reputed International peer reviewed journals, 120+ International/National Conferences, 12 Book chapters, a few patents, 30+ Conference sessions chaired and invited talks. He has guided 22 PhD scholars till 2022 and currently he is supervising 18 PhD students (all figures are till 2022).

COURSE PLAN:
Week 1: Introduction of structure-property-process correlation of polymer, elastomer and composites -1.
Week 2: Introduction of structure-property-process correlation of polymer, elastomer and composites -2.
Week 3: Identification by chemical techniques with reference to Indian or International standards.
Week 4: Introduction of UV-Vis and Infrared spectroscopy for polymers, elastomer and composites.
Week 5: Application of infrared spectroscopy for blends, modification of polymers, compatibilization, coupling, etc.
Week 6: Introduction to Photoacoustic spectroscopy (PAS), Raman spectroscopy, Atomic absorption spectroscopy and Electron spin resonance (ESR) spectroscopy.
Week 7: NMR spectroscopy — principles and fundamentals. Application of NMR in polymer, elastomer and composites.
Week 8: Thermal analysis techniques and applications in polymer, elastomer, and composites.
Week 9: XRD, XPS, and XRF- Principles, Fundamentals and Application in Polymer, Elastomer and Composites.
Week 10: Introduction to microscopy (Optical, AFM) with special reference to electron microscopy (SEM, FESEM, and HRTEM).
Week 11: Application of microscopy in polymer, elastomer and composites.
Week 12: Chromatography, DETA, Quantification from Rate Dependent Methods, Reverse Engineering and Recent Advances.