

Emerging Intelligent Polymer Materials: From Science to Industrial Application

Overview

Intelligent and adaptive materials are emerging class of smart materials that possess unique properties and multi-functionality, including the ability to sense and respond to different stimuli, such as electrical, magnetic, mechanical, thermal, optical, and biological, in a prescribed fashion. Intelligent polymers are a remarkably versatile materials class that pervades our life in a variety of applications. Therefore, smart polymer materials are becoming increasingly more prevalent as scientists learn about the induced conformational changes in materials structures and formulate the ways to programme the systems. Emerging responsive materials are being engineered that sense specific environmental changes and adjust in a likely modus, making them useful tools for advanced applications. Functional materials using intelligent materials in order to reduce the system complexity by the integration of multiple functions in one material, called multifunctional materials are being investigated. In this course, the spectrum of emerging smart materials such as shape memory polymers, self-healing polymers, piezoelectric and dielectric polymers, electrostrictive polymers, and smart polymer gels will be discussed. Their Synthesis, processing and performance evaluation of smart polymers, including smart instructive polymer substrates for tissue engineering; smart polymer nanocarriers for drug delivery, the use of intelligent polymers in medical devices for minimally invasive surgery, diagnosis, use of smart polymers as energy harvesters (nanogenerators) and future challenges will be discussed. This is a research cum higher undergraduate level course and is interdisciplinary in nature. The course brings together novel methodologies and strategies adopted in the research and development of smart polymer materials and technology.

This interdisciplinary course is prepared for students and researchers from diverse backgrounds such as chemistry, materials science, physics, mechanical and biomedical engineering. The interdisciplinary flora of the topics will help students to find new directions in their research.

Objectives

The primary objectives of the course are as follows:

- Design, synthesis and processing of multifunctional shape memory polymers including dual-, multiple-, and two-way shape-memory polymers and their composites.
- Potential applications of self-healing and self cleaning polymers in structural and electronic applications

- To implement the smart polymeric materials for drug delivery and the use of intelligent polymers in medical devices at the industrial level.
- Processing and characterization of piezoelectric and electrostrictive polymers and their composites for energy harvesting application
- 3D printing of multifunctional smart polymers

Modules	<p>Module A: Design, synthesis and processing of Intelligent polymer systems</p> <p>Module B: Multifunctional smart polymeric materials and their composites</p> <p>Dates: 16 July 2018 to 27 July 2018 Number of participants for the course will be limited to Sixty.</p> <p>Selection will be based on first come first serve</p>
You Should Attend If...	<ul style="list-style-type: none"> • Students at all levels (B.Tech/M.Sc/M.Tech/Ph.D) or Faculty from reputed academic institutions and technical institutions. • Executives, engineers and researchers, serving in academic and government organizations including R&D laboratories
Fees	<p>The participation fees for taking the course is as follows:</p> <ul style="list-style-type: none"> • Participants from Host Institute: Rs. 1000/- • Indian Participants (from Academic Institutes): Rs. 2000/- • Industry/ Research Organizations (Indian) : Rs. 4000/- • Participants from abroad: US \$200 <p>The above fee includes all instructional materials, computer use for tutorials and assignments, laboratory equipment usage charges and working lunch</p>

Course Co-ordinator

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The Faculty (International Faculty)



Prof. Prashantha Kalappa is a Professor at Polymers and Composites Technology & Mechanical Engineering Department, Institut Mines-Télécom, Lille-Douai, France (Formerly known as Ecole Nationale Supérieure des Mines de Douai, France). Prof. Prashantha's research mainly focuses on Advanced Smart Polymers, Biopolymers, Nanocomposites and Blends their synthesis, processing, 3D printing, rheology, morphology and Structure-property relationships. Prof. Prashantha received Doctor of Science(Habilitation) from University of Lille, France for the contributing in the field of Advanced Polymeric Materials. Prof. Prashantha has published 80 research papers in peer-reviewed international journals and presented in a number of international conferences. Prof. Prashantha is the program coordinator of the postgraduate degree in Polymer Advanced Materials and Process Engineering offered by Institut Mines-Télécom (IMT), Lille-Douai. He has also in charge of national and regional projects/programs with industries and European Projects (Horizon 2020 and Interreg). He has successfully supervised 5 PhD and 10 MS students and currently 5 PhDs and 3 MS students are working under his guidance. Dr. Prashantha obtained his Master (1999) and Ph.D., (2002) degrees from Kuvempu University, India. Before moving to France, Prof. Prashantha has worked as a visiting scientist at Chonbuk National University, South Korea, there he has worked on the various kinds of all polymer (nano) composite materials for electrical and automobile applications. Dr. Prashantha has visited more than 15 countries and delivered many key note and invited lectures at International conferences. He is editorial board member for International Journal of Material Science

Host Faculty



Prof. Siddaramaiah obtained Ph.D., (1993) degree from University of Mysore, Mysore, India. He worked as a Post Doctoral Research Fellow under Brain Korea (BK-21) Fellowship for a period of one year (2007-08), Chonbuk National University, South Korea. He visited University of Federal, Rio de Janeiro, Brasil, two times (2005 and 2009 for a period of 3 months each under UNESCO-TWAS visiting Fellowship. He had undergone training on Haake rheocord at M/s. Thermo Fisher Scientific, Karlsruhe, Germany and at M/s. Bosch-Rexroth new Drive & Control Academy,

Würzburg, Germany, during 16 - 26 March 2009. He is working as Professor & Head, Department of Polymer Science & Technology, Sri Jayachamarajendra College of Engineering, Mysore, which is affiliated to Visveswaraya Technological University, Belgaum. He is the recipient of SERC Visiting Fellowship from DST, New Delhi (2000) and Visiting Scientist fellowship from IIT, Kharagpur (2000).

He has authored more than 300 research articles in reputed referred journals, more than 270 conference papers, 12 book chapters, 4 review articles, one book, three monographs and is a co-inventor of 3 Indian patents. 24 students have successfully completed their Ph.D., degree under his supervision and he has supervised 6 M.Sc., (Engg) by research, and one M.Phil.

He is a recipient of “Young Scientist Award-1997”, in ‘Chemical Science’ awarded by KAAS, Bangalore, India and “Sir C.V. Raman Young Scientist Award – 1999” in ‘Chemical Technology’ by KSCST, Government of Karnataka, Bangalore (2002). His name listed in Marquis (USA) Who's Who in the World (biography) in 16, 17, 18 & 20th Edition – 1998, 1999, 2000 & 2002. He is the recipient of ‘PROJECT OF THE YEAR’ award two times and "Certificate of Commendation", award from KSCST, Bangalore. He and his research team received “Best Paper Award” more than nine times. Recently he received, “Silver Trophy Plasticon Award-2012 in the category of Best Research, Plastindia Foundation, New Delhi.

Very recently he is the recipient of Runner-Up of 6th National Award for Technology Innovation 2015-16 in Innovation in Polymeric Products, "Design and development of highly flexible and visibly transparent UVA radiation sensing polymer nano composite hybrids", by Ministry of Chemicals and Fertilizers, Dept. of Chemicals & Petrochemicals, Govt. of India, New Delhi, 20th Jan 2016.