

Challenges and Opportunities in Functional Conjugated Polymers and Materials NEMS/MEMS Devices: A Synthetic Chemistry Approach

Anil Kumar

*Chemistry Department, National Center for Photovoltaic Research and Education (NCPRE) and
Center for Excellence in Nanoelectronics (CEN)
Indian Institute of Technology Bombay, Mumbai 400076, India*

Conjugated polymers also known as inherently conducting polymers (ICPs) provide an ideal platform for the design and fabrication of various printable electronic devices because of their ability to respond reversibly to an external physical (temperature, light, electric, magnetic or mechanical) or chemical (pH, chemical agent) stimuli. ICPs exhibit changes in physical (conformation), optical and electrical properties on the applications of these stimuli. Therefore, these polymers have been developed for various applications such as Light Emitting Diodes (LEDs), memory devices, rechargeable batteries, super capacitors, electro optic materials, photovoltaics, thin film transistors, RF tags, biological and chemical sensors, MEMS, actuators, electrochromic materials, displays, electro active fabrics and host of other applications.

One of the major challenges in this area is to integrate the organic semiconductors in various electronic devices. Apart from this, another challenge is the ability to design and synthesize processable and stable organic semiconducting polymers which then enables one to use traditional printing technologies for the fabrication of electronic devices. These not only reduces cost but also increases throughput for production. In this direction, we have been working in the area of design and synthesis of transparent conductors based on 3,4-alkylenedioxythiophenes and graphene and also polymers based on regioregular Poly (3-hexyothiophene) to improve mobility and for photovoltaic applications. Recently we have developed a novel synthetic route for the synthesis of ultra high molecular weight polymers based on dialoxythiophenes. Apart from this, we have also developed a novel route for the functionalization of SU-8, a material used extensively for NEMS and MEMS devices. Some of the recent results in these directions will be highlighted in this talk. I will also discuss some of the challenges and possible opportunities where scientists from Physics, Chemistry, Mechanical and Electrical Engineering backgrounds can make significant contributions.