

Continuous Flow Process: A New Paradigm in Smart Materials Syntheses

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Abstract

Smart Materials (small molecules, polymers, and nanomaterials) have been gaining interest as for various large area optoelectronic device applications. Interest in these materials stems from their ease of fine-tuning of the properties combined with cost-effective synthesis and processing. Though the synthesis has been easy and cost-effective, scale-up of these materials along with good batch-to-batch reproducibility remains a major challenge. One of the steps to overcome these difficulties is the Continuous Flow Process. It provides a potential alternative to batch synthesis because of its inherent advantages such as very efficient heat exchange, excellent batch-to-batch reproducibility, fast mixing, high throughput, safety, and the ability to do multistep telescoping synthesis. Due to these advantages, these processes are referred to as the most promising “Green Technology”. In fact, continuous flow processes are projected to be the “CHEMICAL FACTORIES” of tomorrow. Continuous flow processes also provide an “On-Demand” synthesis with complete control over reproducibility, size, shape and these parameters can be achieved at various scales (lab synthesis to pilot to bulk production) with excellent reproducibility. Therefore, continuous flow process opens up the opportunity for synthetic chemists to prepare materials with precise control over critical molecular design parameters. It also enables one to carry out material synthesis at higher temperatures that were outside the domain of an organic synthetic lab. We have been exploring continuous flow processes for the synthesis of conjugated polymers (for transparent conductors, electrochromics, chemical and biological sensors applications), nanoparticles and nanofibers etc. In this presentation, I will review some of the recent advances in these directions and some results from our laboratory.

Biodata

Anil Kumar is currently a Professor at IIT Bombay, in the Department of Chemistry, Center for excellence in Nanoelectronics, National Center for Photovoltaic Research and Education and National Center for Excellence in Technologies for Internal Security. His group's research interests are in the area of continuous flow processes and printable optoelectronic devices based on conjugated polymers. In this direction, the main focus is on the development of handheld explosive sensors, electrochromic devices, thin film optoelectronic devices and transparent conductors etc. They have developed a state-of-the-art continuous flow process lab and also conduct regular training programs and workshops in Continuous Flow Process to train the next generation of human resources in this important emerging technology. Based on these processes, he started a company "Sycon Polymers India Pvt Ltd" (<http://sycon.in/Home>). His group also has developed many technologies including transfer of technology in the domain of handheld explosive sensors and continuous flow processes.

Apart from research, his other hobbies are teaching, sports, technical financial analysis, magic and music. He has developed an outreach program based on "Science & Magic" to promote teaching and practice of science among students and research scholars of different grades and has been conducting such workshops around the country.