Supramolecular nanocomposites as advanced materials for opto-electronics

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Supramolecular systems are formed from molecular systems with the help of many types of interactions, such as π–π interactions; dipolar and quadrupolar interactions; van der Waals interactions, charge transfer; hydrogen bonding and metal coordination. Supramolecular assemblies are extremely important in biological and materials sciences. The unique geometry of columnar mesophase formed by disk-shaped molecules is of great importance to study the one-dimensional charge and energy migration in supramolecular organized systems. There are a number of potential applications of these materials, such as, one-dimensional conductor, photoconductor, photovoltaic solar cells, light emitting diodes and gas sensors. As the conductivity along the columns in columnar mesophases has been reported to be several orders of magnitude greater than in perpendicular direction, the columns may be described as molecular wires.

On the other hand, the past decade has witnessed an explosive development in the fields of nanostructured materials, such as gold nanoparticles, quantum dots, carbon nanotubes and graphene, due to their technological and fundamental interest. Functionalization of such nanoparticles (NPs) with mesogens and their incorporation in the supramolecular order of liquid crystals is not only of basic science interest but also lead to novel materials for many device applications. With this view, we have initiated a research program to functionalize these nanomaterials with discotic as well as other molecules and disperse them in monomeric, oligomeric and polymeric discotic liquid crystals (DLCs). We have observed that dispersion of such functionalized nanomaterials in columnar matrix significantly enhances physical properties such as, conductivity, photoconductivity, absorbance, *etc*.

In this talk, I will present our recent results on the dispersion of various metallic, semiconducting and carbon NPs in the supramolecular order of columnar mesophases. After brief introduction of discotic nanocomposites, the effects of NPs dispersion on thermal, electrical and supramolecular properties of DLCs will be presented.

References

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Speaker Biography

Sandeep Kumar obtained his Ph.D. in Chemistry from Banaras Hindu University, Varanasi in 1986. He did Postdoctoral Research at the Hebrew University of Jerusalem and at Technion, Israel, at the Scripps Research Institute, USA and at the University of Mainz, Germany. He joined the Centre for Liquid Crystal Research, Bangalore in 1995 and moved to the Raman Research Institute in 2002. He was a visiting Research Professor at the Naval Research Laboratory, USA, at the National Dong Hwa University, Taiwan and E.T.S. Walton Visiting Professor at the Trinity College, Dublin. He has published over 200 research papers in peer reviewed international journals like, *Nature*, *Angew. Chem. Int. Ed., Adv. Mater.*, *JACS*, *JOC*, *Chem. Mater.*, *Chem. Commun.*, *JMC*, *Soft Matter*, *PRL.*, *Langmuir*, *etc.* His papers have already received over 4000 citations. He also authored a book entitled Chemistry of Discotic Liquid Crystals and several book chapters. He is also having many patents in his credit. He was awarded the inaugural LG Philips Mid-Career Award by the International Liquid Crystal Society in 2008. His current research interests include synthesis and applications of liquid crystals and nanotechnology.