In this issue

Soft condensed matter

Soft condensed matter (SCM) deals with systems where the relevant interactions are weak and thermal fluctuations play an important role. Softness also implies a relatively high bulk or osmotic compressibility. The constituents of the SCM are supramolecules of size ~ 10 Å to 10,000 Å, much bigger than conventional molecules. Colloidal solutions, emulsions, gels, foams, micellar solutions, membranes, polymers, ferrofluids, liquid crystals and granular materials, etc. are the examples of SCM. In general, these materials cannot be classified as simple solids or liquids and are also referred to as 'Complex fluids' in the literature. In his Nobel Lecture, de Gennes pointed out that the expression 'Complex Fluid' incorporates two major features, viz. the complexity of the structure and the flexibility. The latter results in a strong response to modest perturbations. Unlike atomic solids whose elastic constants are of the order of 10^{12} dynes/cm^2, the elastic constants of colloidal suspensions are around 10 dynes/cm^2. It is because of this reason that these systems are referred to as soft condensed matter. The other characteristic feature of these materials is that on a *given time scale*, their shear moduli are much smaller than their bulk moduli.

SCM materials are widely used in day to day life like in plastics, paints, shaving creams, cosmetic creams, pesticides, blood, ink, grease, disk drive lubricants, display devices, medicines, detergent, etc. Chemists, chemical engineers and biologists have been interested in these materials for quite some time. In recent years, physicists and mathematicians have also started working on these systems. The renewed interest in SCM is not only because of their technological importance but also due to the realization that these systems are fertile grounds for new science. The condensed matter and materials science communities, world over, recognize SCM as a separate, exciting and growing field. *Physical Review E* is now fully devoted to this subject.

A large number of groups in India, both from universities and research institutions, are working on soft condensed matter. This special section in this issue of *Current Science* on soft condensed matter gives a flavour of the kind of research that is being pursued in India in this field. There are ten articles covering some of the aspects of SCM. Two of these papers deal with colloidal dispersions, two on micellar solutions, two on polymers and two on liquid crystals. There is one paper dealing with applications of microemulsions and another on vortex matter. Many other topics (e.g. ferrofluids, granular materials, etc.) in which Indian scientists have made significant contributions could not be included in this issue because of the constraint on the number of pages.

The first article by Tata (**page 948**) deals with suspension of polymer latex particles in water. In addition to an excellent introduction to the subject, this paper reviews how structural ordering and phase transitions are brought about in charged colloidal dispersions by varying parameters such as particle volume fraction, surface charge density, salt concentration and polydispersity. The paper by Chinmay Das *et al.* (**page 959**) reviews current developments in the area of laser-induced freezing of colloidal dispersions and its theoretical understanding based on analytical and simulation work. The next two articles deal with micellar solutions. Micelles are aggregates of surfactant molecules in water and the sizes and shapes of these micelles depend on several different parameters. The paper by Goyal and Aswal (**page 972**) discusses the use of Small Angle Neutron Scattering in study of micellar structure and inter-micellar interactions in micellar solutions. The paper by Hassan *et al.* (**page 980**) discusses the use of rheology, light scattering and other techniques in characterizing worm-like micelles. Applications of micellar solutions and microemulsions are the subject matter of the next paper wherein Paul and Moulik (**page 990**) have reviewed the possible uses of microemulsions in enhanced oil recovery, lubricants, coatings and textile finishing, detergency, cosmetics, agrochemicals, food industry, pharmaceuticals, environment remediation, biotechnology and development of chemical sensor materials. The aggregation behaviour of block copolymers by Bahadur (**page 1002**) and the dynamics of polymeric gels as studied by dynamic light scattering techniques by Bohidar (**page 1008**) are the subjects of the next two papers. Madhusudana has reviewed the nature of thermotropic liquid crystals (**page 1018**) and this is followed by a paper by Singh (**page 1026**) which deals with theoretical treatment of elastic properties of liquid crystals. The last paper by Chaddah and Roy (**page 1036**) is somewhat of a different category and deals with the vortices (quanta of flux) of magnetic flux in superconductors. The vortex lattice falls in the category of soft matter as the elastic moduli of these systems are also quite small.

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