Liquid processing of carbon nanotubes

P. Poulin
Centre de Recherche Paul Pascal – CNRS, Université Bordeaux I, Avenue Schweitzer,
33600 Pessac, France
poulin@crpp-bordeaux.cnrs.fr

Carbon nanotubes have to be properly spatially distributed in material to manifest their properties on macroscopic scale. Processing nanotubes in liquid states offers a variety of opportunities to control their spatial organization. The use of dispersants such as low molecular weight surfactants or polymers allows the interactions between the nanotubes to be finely tuned. As a consequence various states can be obtained from disordered dispersions with very low percolation thresholds to ordered liquid crystalline phases in which the nanotubes exhibit long range orientational ordering. Experimental observations (1-2) will be discussed and compared with recent theoretical models and simulations proposed in the literature (3, 4). Flow of nanotube dispersions is also the opportunity to orient nanotubes and develop new processes for the fabrication of structured composites and fibers with a large fraction of carbon nanotubes. We will discuss in particular the thermomechanical properties of fibers obtained by the coagulation of nanotube dispersions in the flow of polymer solutions. Such fibers exhibit shape memory phenomena with a giant stress generation and a surprising temperature memory (5). They can also be used as microelectrodes potentially useful for novel bio-fuel cells (6) and actuator applications (7).

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