

Hierarchical Self-Assembly of Nanoparticles and Polymers

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The incorporation of nanoparticles in polymers offers an effective way to control the mechanical, optical, and electrical properties of soft materials for various applications ranging from toughened plastics to the fabrication of flexible, low-cost solar cells. Our interdisciplinary research effort aims to bring together the two seemingly different types of materials (*i.e.*, inorganic solids and polymers) to create new types of highly processible composites with enhanced optical and electrical properties. Firstly, we present how to control the organization of nanoparticles through the cooperative self-assembly of nanoparticles and block-copolymers in solution phase. Secondly, we incorporate semiconducting polymers into block-copolymer structure in order to tune their optical and electrical properties and to create large area nanoscale arrays of conducting materials. Finally, we synthesize DNA block-copolymer/nanoparticle composites to develop effective gene detection and delivery systems by combining cooperative DNA interactions and useful physical properties of nanomaterials.

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