Prof. Chieh-Tsung Lo

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Research Interests

My research interests involve a fundamental understanding of relationships between structure and properties of novel macromolecular and composite materials. Design and optimization of the processes needed to prepare such materials is included as part of this research focus, and the goal of which is to predict macroscopic behavior from knowledge of the physicochemical nature of the material of interest. This will facilitate the design of advanced materials for specific applications. Additionally, a synergistic relationship between academia and industry is mutually beneficial, and collaboration between the two is therefore an important aspect of my research approach. An example of my research interests is as follows:

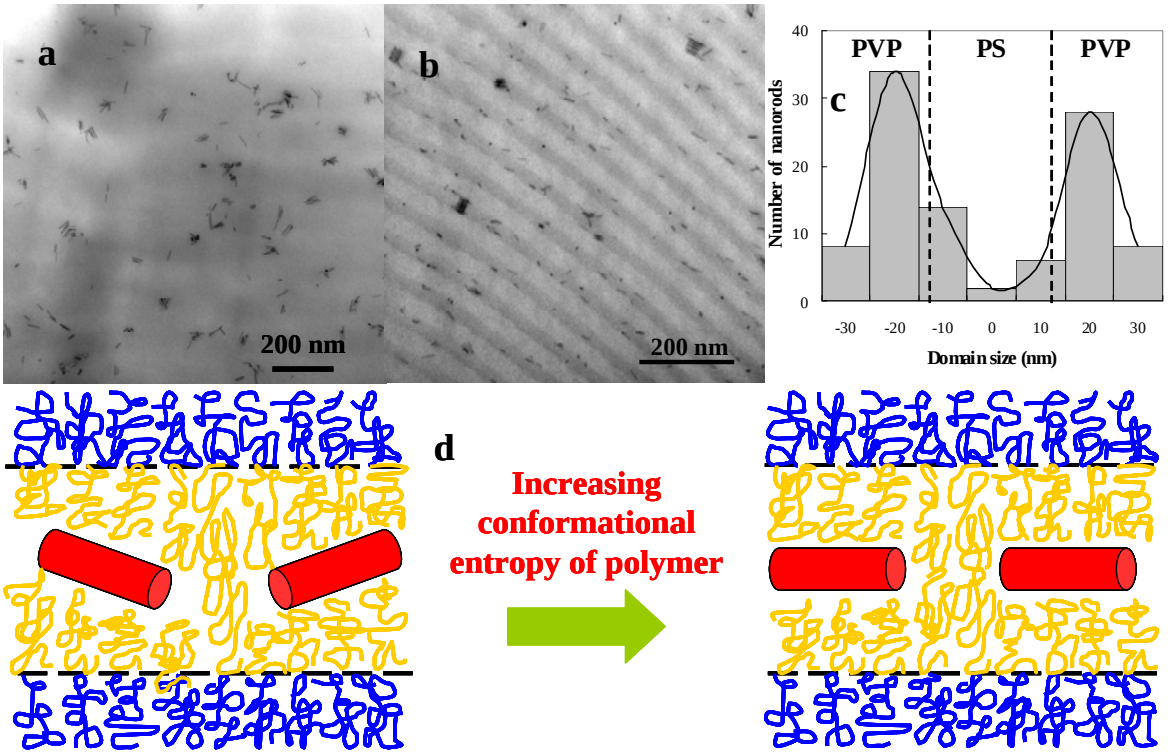
Synthesis and Characterization of Hybrid Diblock Copolymer Nanocomposites with Ordered Arrays of Inorganic Nanoparticles

Self-organization of nanoparticles in polymer matrices offers a powerful route to design novel materials as they combine the characteristics of both constituents. One can envision development of nanocomposites with significantly different properties by controlling the nature of dispersion and ordering of nanoparticles in the matrices. Recently, it has been suggested that block copolymers exhibiting rich phase behavior at the nanoscale can be exploited in creating composites with ordered arrays of nanoparticles. Strategies for the fabrication of such nanocomposites focus on sequestering the nanoparticles into the preferred domain of the diblock copolymers by manipulating the specific nanoparticle/polymer segments interactions followed by altering the conditions for incipient microphase separation of block copolymers. However, only limited success has been achieved in the synthesis of such highly ordered nanocomposites. This shortcoming could be due to the lack of fundamental understanding of 1) the thermodynamics of the interaction of nanoparticles with the polymer segments and the solvents, 2) the detailed structure and nanoscale dynamics in the nanocomposites, and 3) kinetic pathways along the transitions. It is my objective to take a lead using powerful characterization tools in addressing these inadequacies and contribute to the advancement of this fastest growing field of nanotechnology.

Representative Publications

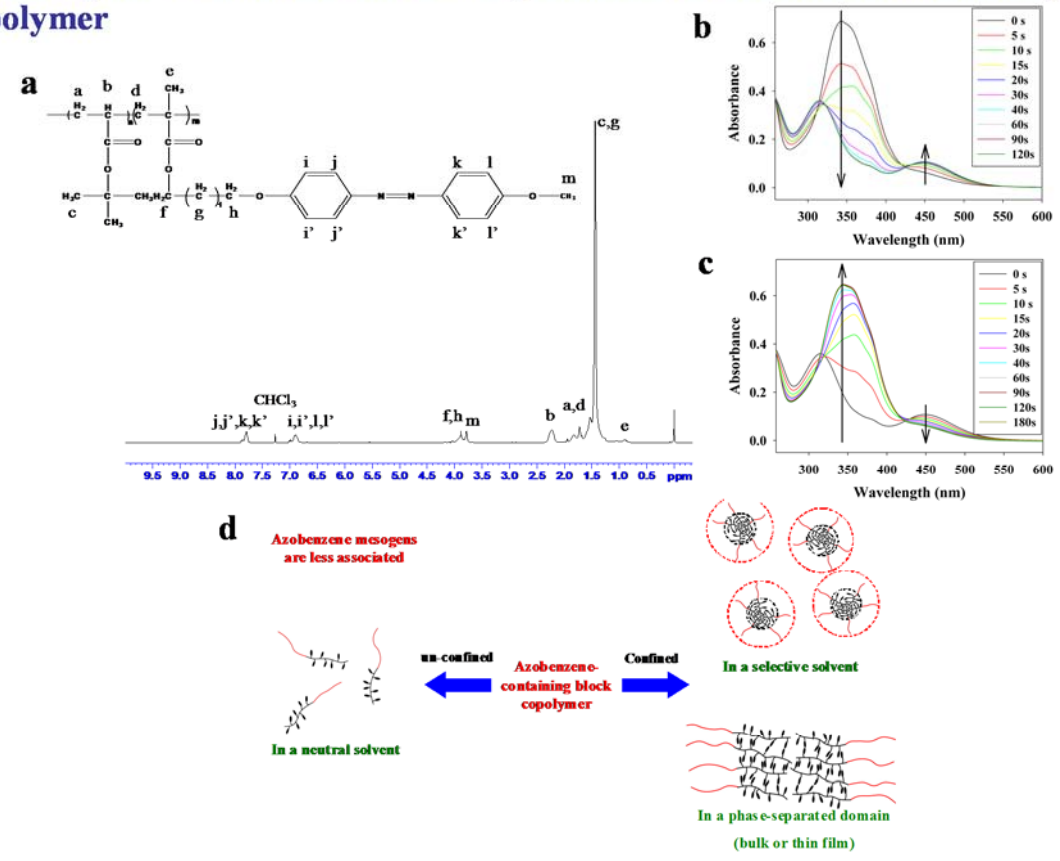
1. Chieh-Tsung Lo*, Ming-Hsuan Li, Wei-Ting Lin, “The Dispersion State of Magnetic Nanorods in Homopolymers and Block Copolymers”, *J. Chem. Phys.*, vol. 142, 184903, 2015.
2. Chieh-Tsung Lo* and Po-Wei Chou, “Effect of Molecular Properties of Random Copolymers on the Stability and Domain Dimension of Block Copolymer/Random Copolymer Blends”, *J. Phys. Chem. B*, vol. 118, 12763-12771, 2014.
3. Yen-Tzu Chen and Chieh-Tsung Lo*, “Self-assembled Structures in Block Copolymer/Graft Copolymer Blends with Hydrogen Bonding Interaction”, *Soft Matter*, vol. 9, 1756-1760, 2013.

Organization of magnetic nanorods in polymer



(a) Nanorods in homopolymer; (b) nanorods in block copolymer; (c) dispersion of nanorods in two microdomains; and (d) schematics of the nanorods organized in block copolymer

Photoresponsive behavior and self-organization of azobenzene-containing block copolymer



(a) Molecular structure of azobenzene-containing block copolymer; (b)(c) the variation of UV spectra of azobenzene-containing block copolymer in THF before and after UV irradiation; and (d) schematic illustration of molecular organization of azobenzene moieties in various environments.