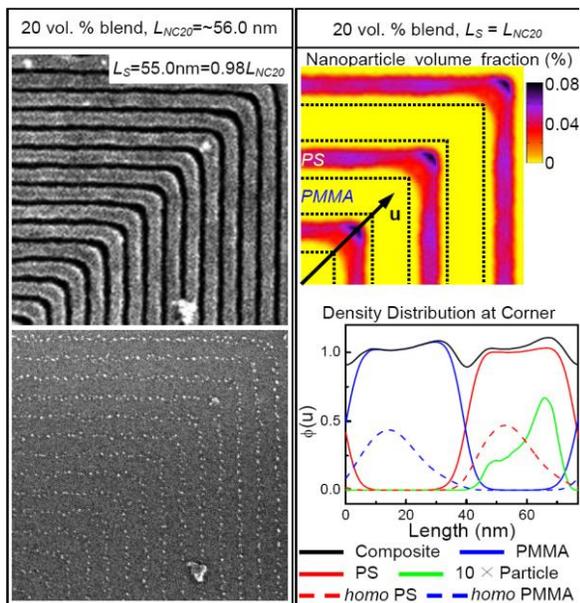


## SCIENTIFIC ACCOMPLISHMENTS: NANOMATERIALS (PCA 2)

### Hierarchical Assembly of Nanoparticle Superstructures from Block Copolymer-Nanoparticle Composites

Previous experimental and theoretical research related to block copolymer nanoparticle composites has focused on the equilibrium location and distribution of nanoparticles in bulk block copolymers as a function of the size and chemistry of the particles. Researchers at the Nanoscale Science and Engineering Center at the University of Wisconsin–Madison have demonstrated through theory and experiment a truly hierarchical approach for directing the assembly of block copolymer/nanoparticle composites. A nanocomposite film is assembled on a surface by equilibration in the presence of a chemical pattern. Strong and specific interfacial interactions between the surface and the copolymer, tailored interactions between the nanoparticles and one block, and the thermodynamic state of the assembled film act concertedly to yield ultra low-defect arrays of nanoparticles at the scale of 20 to 40 nanometers, and to provide an unprecedented level of influence over the local distribution of nanoparticles within the arrays at the scale of a few nanometers. This research suggests that it may now be possible to create arrays of nanoparticles with adequate positional control and spacing to better investigate the electrical, magnetic, optical, and plasmonic properties of complex assemblies of these materials by optimizing the loading, size, and thickness of the functionalization layer of the particles, the block copolymer and homopolymer properties, and the pattern geometry.



*Far Left: SEM images of the assembled nanocomposite film and selectively aligned CdSe nanoparticles after O<sub>2</sub> plasma ashing on 90° bends geometry. The SEM images of the CdSe nanoparticle array correspond to the same region of assembled morphology with ternary blends. Left: Simulation results for the nanoparticle volume fraction and density distribution of components at the corner. Data have been averaged over the thickness of the film; the arrow represents the direction of cross-section. Credit: University of Wisconsin-Madison.*

Kang, H., F. A. Detcheverry, A. N. Mangham, M. P. Stoykovich, K. Ch. Daoulas, R. J. Hamers, M. Müller, J. J. de Pablo, and P. F. Nealey, *Physical Review Letters*, (in press)

Patents and other steps toward commercialization:

NSF Award # 0425880 ([www.nsf.gov/awardsearch/](http://www.nsf.gov/awardsearch/))

**Contributing Agency: NSF**