~~Special Polymer Physics Seminar ~~

Professor Enrique Gomez

Department of Chemical Engineering,
Penn State University

10:00 AM Tuesday, June 15th, 2010
301 Steidle Bldg.

Quantifying the degree of phase separation in polymer solar cells

Polymer solar cells are a promising class of devices that have the potential to produce abundant, inexpensive renewable power. The photoactive layer of these devices is composed of electron donor/acceptor mixtures whose structure and morphology is critically important for device performance. Thus, we have quantified the domain size and local composition of polythiophene/fullerene solar cells through a combination of energy filtered transmission electron microscopy (EFTEM) and grazing-incidence small angle X-ray scattering (GISAXS). The differences in elemental composition between polythiophene and fullerene allows us to unambiguously image the mesoscale structure of the photoactive layer of high-performance polymer solar cells through EFTEM elemental mapping. Furthermore, the contrast in our images is quantitatively related to the composition in each of the phases. GISAXS provides a robust measure of the domain size, and is in good agreement with our EFTEM data. We find that both the domain size and composition are a strong function of processing temperature, and consequently our data suggests how the mesoscale structure of the photoactive layer might affect device performance.