



## ~~Special Polymer Physics Seminar ~~

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**10:00 AM Tuesday, February 16<sup>th</sup>, 2010**  
**301 Steidle Bldg.**

### **Nanocomposites of Immiscible Polymer Blends & Inorganic Nanofillers: Thermodynamics-based Design of Selective Nanofiller Dispersion and of Filler-Induced Compatibilization**

The nanocomposite formation of immiscible polymer blends with mica-type pseudo-2D nanofillers is discussed. Experimental studies are used to exemplify the –often counter-intuitive– thermodynamics that underlie these systems. In the first example, PET/PC blends with organically-modified montmorillonite is presented as a model system to tailor thermodynamics, so as to achieve (a) selective filler dispersion exclusively in the PET phase, and (b) promote physical mixing ("compatibilization") of the PET and PC phases. Dispersion is controlled by design of appropriate surfactant chemistries used for nanofiller modification. The desired composite structure is obtained markedly independent of processing conditions, indicating that, for these systems, the thermodynamics of dispersion overwhelmingly determine the resulting structure rather than the processing conditions. The resulting changes in PET crystal morphology afford novel new mechanical properties, that combine substantial increases in modulus with accompanying increases in ductility and toughness. In a second example, LLDPE/LDPE/EVA blends are reinforced with similar nanofillers, whose dispersion is promoted by a fourth polymer (LLDPE-g-MAH). In this case, fillers are again designed to mostly disperse in the EVA phase and, going beyond morphology, are also designed to "dial-in" specific values for selected materials properties. Specifically, the melting point and fracture toughness of the composite are designed to be in predetermined value-ranges, over wide ranges of composite compositions and matrix-polymer characteristics.