Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

A Study on the Packing and Phase Separation of Dissimilar Nanoparticles XIAOBO SHEN, Department of Polymer Science and Engineering, University of Massachusetts-Amherst, DONG WANG, WPI-Advanced Institute for Materials Research (WPI-AIMR), Tohoku University, DHANDAPANI VENKATARAMAN, Department of Chemistry, University of Massachusetts-Amherst, TADAFUMI ADSCHIRI, KEN NAKAJIMA, WPI-Advanced Institute for Materials Research (WPI-AIMR), Tohoku University, THOMAS RUSSELL, Department of Polymer Science and Engineering, University of Massachusetts-Amherst
— To develop a novel approach for the preparation of organic photovoltaic active layer using binary functional nanoparticle assemblies, the nature and characteristics of the interactions and packing between dissimilar nanoparticles must be understood. Here, polymer-based, namely polystyrene (PS), and inorganic-based, namely zinc oxide (ZnO) and titanium oxide (TiO2), nanoparticles are prepared by miniemulsion and hydrothermal reaction methods, respectively. Different functionalities on the particle surface are imparted by further functionalization. The binary assembly of the dissimilar particles is carried out in a variety of ways including solution mixing, non-solvent precipitation, thermal- and solvent annealing, etc. and characterized by Force Volume-AFM (FV-AFM), SEM, TEM and GISAXS techniques. The resulting packing and segregation of the dissimilar particles are shown to be effectively dependent on the molecular weight, inter-particle interactions, particle aspect ratios and sizes, etc.

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Date submitted: 08 Nov 2012 Electronic form version 1.4