Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Spherulite Growth in Polymer-Nanoparticle Blends[1]
GORAN UNGAR, Seoul National University and University of Sheffield, EUNWOO LEE, Seoul National University, RUIBIN ZHANG, University of Sheffield, JYONGSIK JANG, Seoul National University, SEOUL NATIONAL UNIVERSITY, WCU C2E2 TEAM, UNIVERSITY OF SHEFFIELD TEAM — Blends of polymers with inorganic nanoparticles (NP) were studied by polarized optical and fluorescence microscopy. Silica nanoparticles with a range of diameters from 7 to 100 nm were used. Neat NPs as well as NPs surface-functionalized with a range of groups from strongly to weakly interacting, were blended with poly(ethylene oxide). A purpose-built T-jump microscopy cell was used allowing rapid temperature equilibration at high supercoolings. Lautitzen-Hoffman type analysis revealed that, although the NPs slow down the standard growth rate G_0in the order PEO - Me-treated SiO2 - untreated SiO2 - COOH-treated SiO2 - NH2-treated SiO2, the surface free energy σ decreases in the same order. This suggests that the NPs reduce macromolecular mobility, but at the same time help reduce the secondary nucleation barrier to some extent. Other polymers and NP types, including quantum dots, were also studied. The work also examines the spatial distribution of NPs in the spherulitic polymer nanocomposites.

[1]Supported by WCU program through the National Research Foundation of Korea (R31-10013).

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Date submitted: 11 Nov 2011 Electronic form version 1.4