Morphology Characterization of Polymer Nanocomposites using Electron Tomography and Analytical TEM

LAWRENCE DRUMMY, UES Inc., RICHARD VAIA, Air Force Research Laboratory — Polymer nanocomposites often display complex hierarchical structures that require high resolution morphological and chemical analysis. Here we describe methods for and quantitative results from electron tomography of polymer/layered silicate nanocomposites. High angle annular dark-field scanning transmission electron microscopy (HAADF-STEM) and subsequent tomographic reconstruction produced fully segmented 3D data sets from the nanocomposites. A 3D power spectrum of the fast Fourier transform (FFT) was calculated, radially integrated, and compared with the one dimensional SAXS from the same sample. As a tool for determination of nanoparticle global dispersion, the analysis revealed good agreement between the techniques from the sub-nm regime up to a length scale of 1 micron. Currently, energy filtered TEM and energy dispersive spectroscopy in STEM mode are being investigated for providing high spatial resolution chemical information at interfaces and inhomogeneities in polymer nanocomposites.

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Date submitted: 30 Dec 2008

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