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Relationships Between Rheology and Structure in Clay Containing Polymer Nanocomposites

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ABSTRACT

This presentation reports a new approach to estimate quantitatively the degree of dispersion of silicate layers in the polymer matrix using small angle X-ray scattering (SAXS) and correlate the predicted morphology with the melt-state rheological properties of nanocomposites. Due its low temperature processability and good thermal stability, poly[(butylene succinate)-co-adipate] (PBSA) was chosen as a model polymer matrix for this study. A series of PBSA nanocomposites with various amounts of organically modified montmorillonite (ommt), such as from 0.2 – 9 wt %, were prepared and the rheological properties were studied in detail. The dispersed structure of the layered silicate particles in the PBSA matrix was studied by SAXS and high resolution scanning transmission electron microscopy (HR-STEM). Results show that layered silicate particles are highly delaminated and nicely dispersed in the case of all nanocomposites. The probability of finding neighboring particles as well as their thickness was calculated using the Glatter's Indirect Fourier Transformation (GIFT) technique and by fitting theoretical scattering curves with experimentally obtained scattering patterns. In the case of all nanocomposites, SAXS results were in good agreement with HR-STEM observations. Finally, a correlation between the predicted morphology with nanocomposites' rheological properties is explained.