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THE STUDY ON DISPERSED NANO-CLAY MORPHOLOGY IN POLYMER NANOCOMPOSITES BY SMALL-ANGLE X-RAY SCATTERING COMBINED WITH ELECTRON MICROSCOPY

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In this presentation we propose a new approach for the quantitative analysis of the degree of dispersion of clay particles in the polymer matrix by small-angle X-ray scattering (SAXS) combined with electron microscopy. Due to the low temperature processibility and good thermal stability, poly[(butylene succinate)-co-adipate] (PBSA) was chosen as a model polymer matrix for this study. The nanocomposites of PBSA with four different weight percentages of organically modified montmorillonite (OMMT) loadings were prepared by a melt-blending method. The dispersed structure of the clay particles in the PBSA matrix was studied by SAXS. Results show that the clay particles are nicely dispersed in the case of all nanocomposites. However, with a systematic increase in clay loading, the dispersed clay structure of the nanocomposites changes from a highly delaminated to a flocculated and then to a stacked intercalated one. The probability of finding neighboring clay particles in the PBSA matrix as well as their thickness was calculated using the Generalized Indirect Fourier Transformation technique developed by Glatter and the modified Caillé theory proposed by Zhang. The morphology of the nanocomposites was also extensively studied by scanning transmission electron microscopy (STEM). In the case of all nanocomposites, SAXS results were in good agreement with STEM observations. Finally, a correlation between the predicted morphology of nanocomposites and their melt-state rheological properties is reported.