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Probing the Intercalation Behavior and Confining Effect of Clay Particles on an Amorphous Dendritic Polyester KEVIN MEYERS, JEREMY DECKER, SERGEI NAZARENKO, University of Southern Mississippi — Hydroxylated dendritic hyperbranched polyesters (HBP) based on 2,2-bis-methylopropionic acid (bis-MPA) with an ethoxylated pentaerytriol core were combined with sodium montmorillonite clay (Na^+MMT) using water to generate a broad range of polymer clay nanocomposites (0 to 100% wt/wt Na^+MMT). X-ray diffraction (XRD) and transmission electron microscopy (TEM) were used to investigate the morphology of the clay galleries where intercalation was observed to be the dominant state. It was shown that the interlayer spacings changed with clay loading in 0.5 nm step-like increments which corresponded to a flattened conformation of the confined HBPs. Analysis with differential scanning calorimetry (DSC) showed a deviation in heat capacity, ΔC_p, with clay content at the T_g from a two-phase trend which was attributed to the formation of an immobilized rigid amorphous fraction (RAF) in the interlayer spacings. This deviation also occurred in the step-like fashion which we attributed to the changes in the interlayer spacings. A simple series model was utilized to quantify the interlayer spacings based on the ΔC_p values and showed good correspondence with the XRD results. The RAF was quantified from changes in heat capacity with clay content and was verified by a novel positron annihilation lifetime spectroscopy (PALS) approach. PALS quantification of the RAF was possible through an analysis of changes in the hole size thermal expansivity of the nanocomposites as a function of clay composition.

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