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Clay dispersion and interaction effects in supercritical CO2 processed polystyrene-clay nanocomposites. R. KANNAN, R. BELLAIR, M. MANITOU, S. HORSCH, Wayne State University, E. GULARI, Clemson University — The major challenges in producing high performance nanocomposites are in effectively dispersing the clay layers in the matrix and in promoting interactions at the polymer-clay interface. A novel process exploiting the properties of supercritical CO2 (scCO2) has recently been shown to be an effective means to delaminate clay platelets with or without a polymer matrix present. In this study we demonstrate the ability of scCO2 to exfoliate commercial, organically modified clay and to produce nanocomposites with significantly improved properties. Rheology shows solid-like behavior in loadings as low at 2wt%, and elastic modulus improvements as high as 2.5 orders of magnitude in 5wt% nanocomposites. TEM images indicate a rich morphology for scCO2 processed composites, with a large fraction of dispersed platelets. In contrast, solution blended control samples display much larger tactoids and a lack of individual clay sheets. Unexpectedly, XRD shows a strong intercalation peak that is unchanged between solvent blended and scCO2 processed composites even though TEM and rheology show large differences in the samples. Effects of scCO2 soaking, depressurization rate, solvent, and clay dispersion are investigated to better understand the mechanisms behind the significant rheological enhancements. The degree of enhancement in the properties appears to be not only dependant on the degree of dispersion, but also on how polymer-clay interactions are promoted by the supercritical fluid.

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