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Tailoring Glassy Dynamics on the Nanoscale: Covalent Bonding versus Physical Adsorption in Polymer-based Nanocomposites ADAM HOLT, Univ of Tennessee, Knoxville, VERA BOCHAROVA, SHIWANG CHENG, Chemical Science Division, Oak Ridge National Laboratory, ALEXANDER KISLIUK, ADAM IMEL, THUSITHIA ETAMPAWALA, Univ of Tennessee, Knoxville, TYLER WHITE, TOMONORI SAITO, Chemical Science Division, Oak Ridge National Laboratory, NICOLE SIKES, Columbus State University, MARK DADMUN, ALEXEI SOKOLOV, Univ of Tennessee, Knoxville — Polymer grafted nanoparticles (PGNs) offer improved miscibility, stability, and most importantly dispersibility in a polymer matrix over traditional nanoparticle fillers. However, despite the large interest in the miscibility and dispersibility of PGNs within polymer melts, few attempts have been made to study the material properties of solvent-free PGNs and specifically how they compare to traditional polymer nanocomposites (PNCs). In this experiment, the structure and dynamical properties of PGNs of three different molecular weights with identical grafting densities are directly compared to PNCs with similar polymer volume fraction. We find that the segmental dynamics in the interfacial layer are more strongly influenced by the covalent bonding than in the composite system (chain adsorption) and ascribe this is to highly stretched chain conformations near the interface, similar to a polymer brush. These results show that the chain conformations in a polymer melt near an interface, especially on the nanoscale, can strongly influence segmental dynamics and offers an explanation to many of the disputed results in the polymer nanocomposite literature.

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