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Suppression of segmental chain dynamics on particle's surface in attractive polymer nanocomposites

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The Rouse dynamics of polymer chains in model nanocomposite PolyEthylene Oxide (PEO)/Silica NanoParticles (NPs) was investigated using QuasiElastic Neutron Scattering (QENS). The fraction of segments immobile on the picosecond/nanosecond timescale, as they are adsorbed on the NP surface, was identified. The Rouse rate of the remaining polymer chains decreases as the particle loading increases. This experimental result is analyzed in terms of modified Rouse models for the chains in the NP interphase region. Thus, two chain populations, one bulk like and the other characterized by a suppression of Rouse modes, are identified and the spatial extent of the interphase region is estimated to be‘≈2 nm. These findings provide a detailed description of the suppression of the chain dynamics on the surface of NPs. The results are relevant for the fundamental understanding of surface effects and confinement and provide a foundation for the understanding of the rheological properties of well dispersed Polymer NanoComposites (PNCs).

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