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Observation of Small Particle Driven Chain Disentanglements in Polymer Nanocomposites ERKAN SENSES, NIST NCNR / Univ of Maryland, SIYAM ANSAR, CHRISTOPHER KITCHENS, Clemson University, SURESH NARAYANAN, Advanced Photon Source, Argonne National Lab, YIMIN MAO, NIST NCNR / Univ of Maryland, ANTONIO FARAONE, NIST NCNR — We apply neutron spin-echo spectroscopy on athermal and isotopically labeled PEO-gold nanoparticle composites to evaluate the role of particle size on single chain dynamics at space-time resolution relevant to the segmental and the collective polymer motion in melt. We found a $\approx$ 25 percent increase of the reptation tube diameter with addition of nanoparticles smaller than entanglement mesh size ($\approx$ 5 nm), at a volume fraction of 20 percent. No significant effect, however, is observed on the local segmental relaxation. The effects of decreasing topological confinement on the bulk viscoelastic behavior of the nanocomposites are discussed along-with the rheological trends. These results provide the first direct experimental observation of particle size driven disentanglements that can cause non-Einstein-like viscosity trends often observed in polymer nanocomposites.

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