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XPCS Studies of Nanoparticle Motion within Glassy Polymer Melts HONGYU GUO, S.K. GHOSH, S.K. SINHA, UC San Diego, M. CUI, T.P. RUSSELL, Univ. Mass., Amherst, W. CHA, J. CARNIS, H. KIM, Sogang Univ., Z. JIANG, S. NARAYANAN, Argonne National Lab. — We report x-ray photon correlation spectroscopy (XPCS) experiments to investigate the motion of nanoscale gold particles within polystyrene (PS) melts of molecular weight between 30K and 900K g/mol. The particles, with diameter span from 5 nm to 22 nm, are dispersed in a highly dilute concentration (volume fraction 0.005) and are functionalized with PS chains to stabilize them against aggregation. We already know that for low molecular weight PS melts there are dynamics crossovers from diffusive motion to hyper-diffusive motion when quenching to lower temperature. When polymer chains are longer than the entanglement length, things are more complicated. At low temperature, similar hyper-diffusive motion are observed. At high temperature, i.e. 70 K higher than Tg, the dynamics changed from overdamped behavior to underdamped oscillatory behavior, indicating that entanglement strongly affects the particle motion.

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