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Polymer dynamics in PMMA-carbon nanocomposites RANA ASHKAR, University of Maryland-College Park/NIST, MANSOUR ABDULBAKI, University of Houston, CHRISTOPHER BERTRAND, MADHUSUDAN TYAGI, ANTONIO FARAONE, PAUL BUTLER, National Institute of Standards and Technology, RAMANAN KRISHNAMOORTI, University of Houston — Particle-polymer attractions in nanocomposites can lead to significant heterogeneities in the polymer dynamics and remarkably impact the material properties. While dynamical perturbations are expected to be limited to interfacial polymer segments, for nanoparticle concentrations above percolation, however, the interfacial regions overlap. The impact of interfacial-polymer network results in a complex relaxation behavior of the polymer, that is unanticipated from dilute nanoparticle dispersions in polymer matrices. Neutron spectroscopy on C60 and SWNT composites reveals that dynamical perturbations can extend to non-interfacial polymer segments and significantly influence their local mobility and their meso-scale cooperative relaxations. In this case of attractive polymer-particle interactions, a gradual decrease in the polymer mean-square displacement is observed with increasing nanoparticle loadings below the percolation threshold. However, once the nanoparticles are percolated – be it C60 or SWNT – the mean-square displacement seizes to change with increasing loading, indicating kinetic arrest of the polymer. Interestingly, upon percolation, the composites experience an order of magnitude slowdown in the structural relaxations relative to the pure matrix.

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