Abstract Submitted
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Polymer Diffusion in Nanocomposites having attractive particle-polymer interactions[1] CHIA-CHUN LIN, SANGAH GAM, Department of Materials Science and Engineering, University of Pennsylvania, JEFFREY S. METH, DuPont Nanocomposite Technologies, Central Research & Development, E.I. DuPont de Nemours & Co., Inc, NIGEL CLARKE, Department of Physics and Astronomy, The University of Sheffield, KAREN I. WINEY, RUSSELL J. COMPOSTO, Department of Materials Science and Engineering, University of Pennsylvania — The addition of fillers into polymeric materials has drawn tremendous attention because of the remarkable mechanical and functional properties exhibited by these composites. Previously, we studied diffusion in a weakly interacting system and found that the reduced diffusion coefficient (D/D_0) scaled with the confinement parameter, defined as the inter-particle distance relative to the tracer size. Using elastic recoil detection, tracer diffusion of deuterated poly(methacrylate) is studied in a poly(methyl methacrylate) matrix containing silica nanoparticles with number average diameters of 12.8 and 28.8 nm. Because the silica contains surface hydroxyl groups, PMMA nanocomposites are a model system for studying diffusion in strongly attractive polymer-nanoparticle systems. In contrast to the weakly interacting system, the reduced diffusion coefficient in the matrix with smaller nanoparticles is less than that with larger nanoparticles and this difference increases as the confinement parameter decreases (i.e., more crowded system). The reduced diffusion coefficient is also analyzed in terms of the surface to volume ratio of the nanoparticles.

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