Abstract Submitted
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Dynamics of Brush-grafted Nanoparticles in Polymer Melts[1] RUSSELL COMPOSTO, CHIA-CHUN LIN, Univ of Pennsylvania, KOHJI OHNO, Kyoto University, MICHAEL HORE, Case Western Reserve University, JEFFREY METH, Central Research & Development, DuPont Co., NIGEL CLARKE, Univ of Sheffield, KAREN WINEY, Univ of Pennsylvania — Grafting a polymer brush to nanoparticles is an effective approach to achieve a good dispersion of nanoparticles in a polymer melt and the structure of this dispersion has been well studied. However, the interplay between the structure of the brush and nanoparticle diffusion is lacking. Here, we study the diffusion of poly (methyl methacrylate), or PMMA,-grafted iron oxide nanoparticles (core diameter=5nm) in PMMA melts. Different brush architectures are obtained by tuning brush molecular weight (16 and 21kg/mol), brush grafting density (0.17, 0.33 and 0.55 chains/nm2) and PMMA matrix molecular weight (4-70kg/mol). Preliminary results show that the diffusion of nanoparticles is slowed down relative to predictions of the classic Stokes-Einstein relation applied to a 5nm particle suggesting that the interpenetration between the brush and matrix influences nanoparticle mobility. Self-consistent field theory is performed to predict the structure of brush and matrix in the vicinity of the particle to quantify the effect of brush-matrix interpenetration. These experiments demonstrate that the structure of the brush could affect nanoparticle center of mass diffusion and the brush-nanoparticle interpenetration should be considered.

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