

Relaxation behaviors of nanoparticles in polymer composites: influence of local frictions by polymer chains*

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The dynamics of Au nanoparticles (AuNP) tethered with thiol-terminated polystyrene (PS) in the composites with poly(styrene-*b*-2-vinylpyridine) diblock copolymers (PS-PVP) have been studied by x-ray photon correlation spectroscopy and small-angle x-ray scattering. Relaxation behaviors of nanoparticles located selectively in PS domain due to enthalpic interaction, interestingly, are not uncorrelated with those of matrix polymer chains, i.e., their relaxation times are not dependent on the molecular weights of PS-PVP. They even relax faster in PS-PVP than in PS homopolymer, where the molecular weight of PS homopolymer is about the same as that of the PS brush of PS-PVP. On the other hand, the influence of morphological structures of PS-PVP, however, is significant: AuNP could move faster in the lamellae phase than those in the cylinder phase or in the PS homopolymer. This is because AuNP in the lamellae phase in our experiment likely was segregated to the middle of the PS domain and hence experienced less local friction.

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