Polymer Diffusion in Nanocomposites with Nanorods: Bridging the Gap between Nanosphere and Nanotube fillers JIHOOH CHOI, University of Pennsylvania, NIGEL CLARKE, University of Sheffield, KAREN I. WINEY, RUSSELL J. COMPOSTO, University of Pennsylvania — The tracer diffusion of deuterated polystyrene (dPS; 168-3200 kg/mol) is measured in polystyrene (650 kg/mol) nanocomposites containing phenyl-capped nanorods with a similar aspect ratio (AR = 9) but different sizes, NR-short (TiO$_2$; $l=43.1$ nm and $d=4.6$ nm) and NR-long (SiO$_2$-[Ni(N$_2$H$_4$)$_3$]Cl$_2$; $l=371$ nm and $d=43$ nm). For NR-long where $l>2R_g$, the diffusion coefficient initially decreases as nanorod volume fraction increases but then begins to increase for near the percolation threshold. In this system, $R<R_g$ and the diffusion behavior is consistent with previous studies of carbon nanotubes (i.e., $l>2R_g$). However, for NR-short (i.e., $l<2R_g$), diffusion shows a monotonic slowing down as the volume fraction increases despite the small values of $R/R_g$. This behavior is similar to the slowing down observed for isotropic nanoparticles. These experiments demonstrate that not only radius but also length of the nanoparticle plays a key role in diffusion. Moreover, these results indicate that a comprehensive model for polymer dynamics should include the geometry of the nanoparticle relative to $R_g$. 

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