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How do Macromolecules Diffuse Through Pathways imposed by Nanoparticles? RUSSELL COMPOSTO, KAREN WINEY, University of Pennsylvania, NIGEL CLARKE, Durham University, SANGAH GAM, University of Pennsylvania, JEFF METH, DuPont Co. — Macromolecular motion slows down in crowded biological and engineered systems. Polymer nanocomposites (PNC) containing nanotubes and nanospheres are ideal systems for probing the underlying mechanisms of diffusion in a crowded system. Here, we review the current experimental studies of tracer diffusion in PNC. For silica nanospheres (12nm and 28nm), the normalized diffusion coefficients fall on a master curve when plotted against the interparticle separation divided by the probe size. The entropic barrier model accounts for the reduced diffusion by the loss of chain entropy due to the constrictive bottlenecks between nanoparticles. A new flux-based model depicts confined chains as diffusing along narrow pathways arranged by the NPs. This model captures experimental results while accounting for the distribution of particle separations inherent to real PNC.

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