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Dynamics in Nanoparticle Liquids PETER MIRAU, AFRL/RXBN, Air Force Research Lab, Bio-Nano Branch, Wright-Patterson AFB, OH 45433, MICHAEL JESPERSEN, RICHARD VAIA, AFRL/RXBN, ROBERT RODRIGUEZ, EMMANUEL GIANNELIS, Materials Science & Engineering, Cornell University, Ithaca, NY 14853 — Nanoscale Ionic Materials (NIMS) are organic-inorganic hybrids in which a nanometer-sized core is functionalized with a covalently attached corona and an ionically tethered canopy. NIMS can be engineered to be liquids at ambient temperature in the absence of solvent and are of interest for a variety of applications. We have used NMR relaxation and pulse-field gradient NMR to measure the dynamics of NIMS made from a 20 nm silica core modified with propyl sulfonic acid groups and amino-terminated ethylene oxide/propylene oxide block copolymers. Carbon NMR studies show that the block copolymer canopy is quite mobile both in the bulk and the nanoparticle liquid. The carbon spin-lattice relaxation times as a function of temperature are fit to a model with rapid librational motions and slower reorientation of the copolymer. Neither the correlation times for reorientation of the block copolymer nor the self-diffusion coefficient are influenced by the presence of the silica nanoparticle core. These data suggest that the liquid-like behavior in NIMS is due to rapid exchange of the block copolymer canopy between the ionically modified nanoparticles.

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