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**Tracking particles in ionic liquid thin films with in-situ scanning electron microscopy**[1] PAUL KIM, ALEXANDER RIBBE, THOMAS RUSSELL, DAVID HOAGLAND, Department of Polymer Science and Engineering, University of Massachusetts Amherst — Ionic liquids (ILs) have unique solvent properties, including close to zero vapor pressure and high conductivity, which combine to make IL-solvated "soft matter" systems suitable and safe for scanning electron microscopy (SEM) and other high vacuum techniques. To illustrate the capability for SEM, the diffusional dynamics of polymer-coated silica nanoparticles in ultra-thin IL films were studied via direct visualization and multiple-particle tracking. Selecting appropriate viewing conditions to avoid charging and beam damage artifacts (neither trivial concerns), individual particles could be followed at one frame per second for over one minute. In films thick compared to particle diameter, random Brownian motion followed the Stokes-Einstein equation. Unexpected particle pairing, both dynamic and static, was observed in films thin compared to particle diameter, suggesting a complicated interplay of capillary forces and hydrodynamic interactions; the latter are extremely long ranged in 2D fluids. This study positively demonstrates a new method to visualize in situ the nanoscale dynamics of solvated systems.

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