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High resolution imaging of the dynamics of nanoparticles in/on liquids PAUL KIM, ALEXANDER RIBBE, THOMAS RUSSELL, DAVID HOAGLAND, Univ of Mass - Amherst — Electron microscopy for the study of nanoscale structure and dynamics in solvated soft materials has only recently been proposed, and since this technique requires high vacuum, significant challenges must be confronted. Specimens can be encapsulated in vacuum-sealed devices for TEM but this approach is not without difficulties, including beam damage, cumbersome specimen handling, and propensity for wall artifacts. Here, we report an alternative SEM approach, obviating need for a liquid cell by exploiting the nonvolatility of ionic liquids, which is illustrated by visualizations of nanoscale dynamics for two solvated systems, dispersed nanospheres and nanorods in/on thin, free-standing IL films. The translational and rotational Brownian of these nanoparticles were quantitatively tracked. In ultra-thin films, a striking and unanticipated dynamical pairing of the nanospheres was observed, manifesting a balance of capillary and hydrodynamic interactions. Concentrated nanorods were seen to assemble into finite stacks that could be tracked over their entire lifetimes. Broadly applicable to solvated soft nanoscopic materials, the new imaging protocol offers a breakthrough in the study of their structure and dynamics.

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