Abstract Submitted for the MAR17 Meeting of The American Physical Society

Direct visualization of nanoparticle dynamics at liquid interfaces¹ YIGE GAO, PAUL KIM, DAVID HOAGLAND, TOM RUSSELL, University of Massachusetts Amherst — Ionic liquids, because of their negligible vapor pressures and moderate viscosities, are suitable media to investigate the dynamics of different types of dispersed nanoparticles by scanning electron microscopy. No liquid cell is necessary. Here, Brownian motions of nanoparticles partially wetted at the vacuum-liquid interface are visualized by low voltage SEM under conditions that allow single particle tracking for tens-of-minutes or longer. Conductive, nonconductive, semiconductive, and core-shell conductive-nonconductive nanoparticles have all been studied, and their interactions with each other in one- and two-component layers, as manifested in particle trajectories, differ significantly. For example, Aucoated silica nanoparticles aggregate above a threshold current, whereas aggregated silica-coated Au nanoparticles disaggregate at the same conditions. The impacts of surface concentration of nanoparticle dynamics were observed for one-component and two-component layers, with both global and localized motions visualized for single particles even in dense environments. As the surface concentration increases, the diffusion coefficient drops, and when the concentration reaches a critical threshold, the nanoparticles are essentially frozen.

¹Financial support from NSF DMR-1619651 is acknowledged

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Date submitted: 09 Nov 2016

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