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A hexatic-to-disorder transition in colloidal crystals near electrodes: Rapid annealing of polycrystalline domains CARI DUTCHER, TAYLOR WOEHL, NICHOLAS TALKEN, WILLIAM RISTENPART, Dept. Chemical Engineering & Materials Science, University of California, Davis — Colloids are known to form planar, hexagonal closed packed (HCP) crystals near electrodes in response to electrohydrodynamic (EHD) flow. Previous work has established that the EHD velocity increases as the applied AC frequency decreases. Here we report the existence of an order-to-disorder transition at sufficiently low frequencies, despite the increase in the attractive EHD driving force. At large frequencies ($\sim$500 Hz), spherical micron-scale particles form HCP crystals; as the frequency is decreased below $\sim$250 Hz, however, the crystalline structure transitions to randomly closed packed (RCP). The transition is reversible and second order with respect to frequency, and independent measurements of the EHD aggregation rate confirm that the EHD driving force is indeed higher at the lower frequencies. We present evidence that the transition is instead caused by an increased particle diffusivity due to increased particle height over the electrode at lower frequencies, and we demonstrate that the HCP-RCP transition facilitates rapid annealing of polycrystalline domains.

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