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Coupled Translational and Rotational Glassy Dynamics in Hard Dicolloid Suspensions RUI ZHANG, KENNETH SCHWEIZER — Naive mode coupling theory (NMCT) and the nonlinear Langevin equation (NLE) theory of activated glassy dynamics have been generalized to treat the coupled center-of-mass translation and rotational motions of hard linear objects of variable aspect ratio. Two types of ideal nonergodicity transitions are predicted corresponding to localization of only translation (plastic glass for small aspect ratios) or simultaneous arrest of translation and rotation (double glass). The NMCT kinetic arrest transition signals a crossover to activated dynamics controlled by entropic barriers. Specifically, a two-dimensional dynamical free energy surface (function of translational displacement and rotational angle) is constructed which quantifies effective forces in the NLE theory. For all aspect ratios the most efficient activated process corresponding to the trajectory of lowest entropic barrier is associated with a system-specific translation-rotation cooperative motion. Mean alpha relaxation times as a function of dicolloid aspect ratio and volume fraction are computed using multidimensional Kramers theory.

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