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Hierarchical assembly of anisotropic particles in AC electric fields. ISAAC TORRES DIAZ, BRADLEY RUPP, XIAOQING HUA, YUGUANG YANG, MICHAEL A. BEVAN, Johns Hopkins University — Hierarchical microstructures composed of colloids are of great interest for technological applications and advanced materials such as metamaterials and microfluidic devices. The dynamics of spherical colloidal particles has been analyzed previously for several systems, and has led to the control of the formation of perfect crystals using AC electric fields. However, spherical particles do not have a dependence on its orientation as anisotropic particles. Recently, researchers reported experiments showing the capabilities of anisotropic particles to assemble in different configurations, yet a detailed understanding of the mechanism and control is lacking. This work shows both theoretical and experimental results of the control of a colloidal system composed of anisotropic colloidal particles with a tri-axial ellipsoidal shape subjected to a non-uniform electric field close to a planar wall. We show that particles pack into different structures and orientations as a function of the applied electric field amplitude and frequency by taking into account dipole-field, dipole-dipole, and colloidal interactions. This analysis provides a theoretical framework for the equilibrium and non-equilibrium structures that can be formed via field mediated interaction, which are validated by experimental microscopy results, and can ultimately be used to engineer the hierarchical assembly of anisotropic particles.

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