Optoelectrofluidic Control of Colloidal Assembly in an Optically Induced Electric Field

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Possible Mechanisms of Optoelectrofluidic Colloidal Assembly (OCA)

Figure S1. Illustration for possible mechanisms of optoelectrofluidic colloidal assembly (OCA). In the low AC frequency regime, the AC electroosmotic (ACEO) flow due to a light-activated nonuniform electric field became more dominant than the optically induced dielectrophoresis (DEP). At a specific AC frequency, colloidal particles were concentrated and trapped due to the ACEO flow converging in to the light pattern. The region, where the ACEO flows were converged, became a stagnation point, at which the ACEO flow velocity is almost negligible. Therefore, other mechanisms such as induced-charge electroosmosis (ICEO) along the particle surface, Faradaically coupled electroosmosis (FCEO), and electrostatic dipole forces between the particles ($F_{\text{dipole}}$) became more significant. Based on these frequency-dependent mechanisms acting on the particle movement in concert, the distance ($d$) to diameter ($2r$) ratio could be modulated. The detailed principles are described in the Theory section.