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Programmed assembly of colloidal arrays using shaped microvortices AVANISH MISHRA, Department of Mechanical Engineering, Purdue University, West Lafayette, ALOKE KUMAR, Department of Mechanical Engineering, University of Alberta, Edmonton, STEVEN WERELEY, Department of Mechanical Engineering, Purdue University, West Lafayette — Ability to program colloidal assemblies in desired spatial patterns and orientation remains a significant roadblock to the development of micro- and nanoparticle-based devices. In this work, by shaping electrothermal microvortices, we demonstrate a high-throughput assembly of particles in complex shapes. The microscale electrothermal vortices are generated by optical heating of an electrode layer in the presence of an AC electric field. Entrained in the electrothermal flow particles rapidly and reversibly assemble into the shapes of projected optical patterns. These microvortices can be dynamically reconfigured by changing the optical patterns, thus allowing us to alter the topology of particle clusters. Additionally, driven by an interplay of Stokes drag and dipole-dipole repulsion, the number of particles and inter-particle spacing in an array can also be dynamically tuned by changing the flow velocity. Using a net electrophoretic force in an asymmetrical AC electric field, we demonstrate permanent deposition of patterned particles. In this presentation, we plan to discuss the mathematical background on shaping the electrothermal flow, its implementations in forming colloidal arrays, and their applications.

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