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Transient behavior of an optically induced electrothermal micro-vortex: Modelling and PIV analysis KSHITIZ GUPTA, ZHENGWEI CHEN, Purdue University, STUART WILLIAMS, University of Louisville, STEVE WERELEY, Purdue University — Optical, electrical and hybrid micro-manipulation techniques such as optical tweezers, dielectrophoresis and rapid electrokinetic patterning (REP) have proven to be of great importance in studying synthetic and biological particles. In this work, we study the flow field around a dynamically changing optically activated REP micro-vortex using computational modelling and particle image velocimetry (PIV). In-situ reconfigurable REP traps have potential to enhance our real-time micro-manipulation capabilities. A colloidal suspension of 1μm polystyrene beads (0.1 mM aq. KCl) sandwiched between two parallel-plate indium tin-oxide coated glass electrodes was subjected to an AC electric field (3.6 Vrms, 500 kHz). A laser (980 nm) spot was focused at the liquid-electrode interface and was scanned back and forth in a line at varying rates, to create the vortex. The resulting flow velocity was measured by a time-resolved PIV analysis. A model was created with COMSOL Multiphysics to visualize flow in dynamic REP vortices. Both the analysis methods show that fluid velocity oscillated with the laser spot however, with increasing scanning rate the mean as well as the deviation in velocity decreased. At scanning rates above 15 Hz, the oscillations in fluid velocity were indiscernible.

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