Abstract Submitted
for the DFD12 Meeting of
The American Physical Society

Preventing droplet deformation during dielectrophoretic centering of a compound emulsion droplet[1] GREG RANDALL, BRENT BLUE, General Atomics — Compound droplets, or droplets-within-droplets, are traditionally key components in applications ranging from drug delivery to the food industry. Presently, millimeter-sized compound droplets are precursors for shell targets in inertial fusion energy work. However, a key constraint in target fabrication is a uniform shell wall thickness, which in turn requires a centered core droplet in the compound droplet precursor. Previously, Bei et al. (2009, 2010) have shown that compound droplets could be centered in a static fluid using an electric field of 0.7 kV/cm at 20 MHz. Randall et al. (2012) developed a process to center the core of a moving compound droplet, though the ∼kV/cm field induced small ($< 5\%$) but undesirable droplet stretching. This work shows that by using macromolecular emulsifiers to strengthen the droplet's interfaces, (proteins, tunable peptides, or biotinylated streptavidin) droplet stretching can be greatly inhibited. Proof-of-principle experiments are performed in either a stagnant density-matched aquarium or a vertical channel of buoyancy-driven droplets in a ∼kV/cm electric field. A scaling analysis is given from a fluid mechanics and interfacial rheology perspective and we discuss the effective interfacial charge from an emulsifier and its impact on centering.

[1]Work funded by General Atomics Internal R&D.

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Date submitted: 03 Aug 2012 Electronic form version 1.4