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Electrohydrodynamic Displacement of Polarizable Liquid Interfaces in an Alternating Current Electric Field ZACHARY GAGNON, Johns Hopkins University — In this work, we investigate Maxwell-Wagner polarization at electrically polarizable liquid interfaces. An AC electric field is applied across a liquid electrical interface created between two co-flowing microfluidic fluid streams with different electrical properties. When potentials as low as 2 volts are applied, we observe a frequency dependent interfacial displacement that is dependent on the relative differences in the electrical conductivity and dielectric constant between the two liquids. At low frequency this deflection is dependent on electrical conductivity, and only depends on dielectric constant at high frequency. At intermediate frequencies, we observe a crossover that is independent of applied voltage, sensitive to both fluid electrical properties, and where no displacement is observed. An analytical polarization model is presented that predicts the liquid interfacial crossover frequency, the dependence of interfacial displacement on liquid electrical conductivity and dielectric constant, and accurately scales the interface displacement measurements. The results show that liquid interfaces are capable of polarizing under AC electric fields and being precisely deflected in a direction and magnitude that is dependent on the applied electric field frequency.

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