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The settling velocity and shape distortion of drops in a uniform electric field G.M. HOMSY, XIUMEI XU, Department of Mechanical and Environmental Engineering, University of California-Santa Barbara — We theoretically and experimentally investigate the settling velocity and deformation of a dielectric liquid drop in a second dielectric liquid subject to a uniform electric field, E. Both shape distortion and charge convection, when coupled with the asymmetric velocity profiles, will produce a net drag and a shift in the settling speed. Perturbation methods for small shape distortion and small charge convection are used to solve the problem. Corrections to the settling velocity from both contributions are combined linearly at the lowest order, and show a dependence on the drop size. The shape distortion due to charge convection is given up to second order, with the result that the distortion is asymmetric. Experiments are performed to measure the settling velocity and deformation of PhenylMethylsiloxane-DiMethylsiloxane (PMM) drops in castor oil. The experimental results are in qualitative agreement with the theory: the symmetric and asymmetric deformations and the change in settling velocity are all proportional to E^2, as predicted, and the settling speed shows the correct trends with drop size. Quantitative agreement is lacking, presumably due to the imprecision of the fluid properties, but the theory can fit all the data with reasonable choices for these properties.

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