

Abstract Submitted  
for the DFD09 Meeting of  
The American Physical Society

**Deformation and Rotation of a Drop in a Uniform Electric Field<sup>1</sup>**

PAUL SALIPANTE, JAMES HANNA, PETIA VLAHOVSKA, Thayer School of Engineering, Dartmouth College — Drop deformation in uniform electric fields is a classic problem. The pioneering work of G.I. Taylor demonstrated that for weakly conducting media, the drop fluid undergoes a toroidal flow and the drop adopts a prolate or oblate spheroidal shape, the flow and shape being axisymmetrically aligned with the applied field. However, recent studies have revealed a nonaxisymmetric rotational mode for drops of lower conductivity than the surrounding medium, similar to the rotation of solid dielectric particles observed by Quincke in the 19th century. We will present an experimental and theoretical study of this phenomenon in DC fields. The critical electric field, drop inclination angle, and rate of rotation are measured. For small, high viscosity drops, the threshold field strength is well approximated by the Quincke rotation criterion. Reducing the viscosity ratio shifts the onset for rotation to stronger fields. The drop inclination angle increases with field strength. The rotation rate is approximately given by the inverse Maxwell-Wagner polarization time. We also observe a hysteresis in the tilt angle for low-viscosity drops. The effects of AC fields and surfactants are also explored.

<sup>1</sup>Supported in part by ACS-PRF grant 48415-G9.

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Date submitted: 05 Aug 2009

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