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Deformation and transport of particle laden droplets in micro devices SAI NUDURUPATI, PUSHPENDRA SINGH, New Jersey Institute of Technology, NADINE AUBRY, Carnegie Mellon University — Transporting droplets in microfluidic devices can be achieved efficiently by applying a non-uniform electric field. While this approach has been successfully used in the past to transport rigid particles, we show here that it can be applied to droplets, particularly those which carry particles on their surface. A droplet not only experiences a net force which transports it, but also an electric stress on its surface which deforms it and can even break it into one or more droplets if the applied electric is sufficiently strong. In this work, we use both experiments and direct numerical simulations (DNS) to study the problem of deformation and transport of a dielectric drop in a non-uniform electric field. The electric field is generated by placing electrodes at the bottom of the microfluidic device. Experiments show that the distribution of particles on the surface of a drop becomes non-uniform when an external electric field is applied. The DNS technique is based on a finite element scheme in which the droplet and its surrounding fluid are moved using the fundamental equations of motion. The interface is tracked by the level set method and the electric forces are computed using the Maxwell stress tensor.

Nadine Aubry
Carnegie Mellon University

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