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Electrohydrodynamics-driven droplet dynamics in an oil-in-oil emulsion

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We study the process of drop break up as well as the non-equilibrium analog of collective behaviours such as crystal melting using tunable electrohydrodynamic interactions in an oil-in-oil emulsion of silicone oil drops in the "leaky dielectric, castor oil. The experiments were carried out in capacitors made of ITO where the lateral extent is much smaller than the vertical dimension.

First, we examine the dependence of the drop breakup on cell thickness in the presence of an external DC electric field. Above a thickness of 100 μ m , the threshold of drop breakup is characterized by an electric Capillary number Ca_E which is of order unity, while it is much larger in thinner cells. Moreover, for thick cells, there is a convective instability that enhances the flows and the drop breakup [1].

In the second set of experiments, the ITO bottom plate of the capacitor was selectively etched such that a hexagonal array of roughly circular ITO-free regions was obtained. In this study, we used an external AC electric field to trap drops in the hexagonal array [2]. Varying frequency and field amplitude, we tune the strength of EHD interactions [3] and observe shape deformations, translational and orientational dynamics across the resulting order-to-disorder transition [4].

1- S. Khajehpour Tadavani, J. R. Munroe, and A. Yethiraj. Electrohydrodynamic behavior of droplets in a micro fluidic oil-in-oil emulsion. Physics of Fluids. Submitted 2016.

2- A. Varshney, S. Gohil, S. Khajehpour Tadavani, A. Yethiraj, S. Bhattacharya, and S. Ghosh. Large scale arrays of tunable microlenses. Lab on a Chip, 14:13301335, 2014.

3- A. Varshney, S. Ghosh, S. Bhattacharya, and A. Yethiraj. Self organization of exotic oil-in-oil phases driven by tunable electrohydrodynamics. Scientifiec Reports, 2:1–6, 2012.

4- S. Khajehpour Tadavani and A. Yethiraj, Melting of a granular oil-droplet crystal under the influence of tunable hydrodynamic interactions, Submitted, 2017.

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