Quincke rotation of particle laden drops

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The physics of leaky-dielectric particle-free droplets are well developed with theories and models for droplet rheology and dynamics, like electrohydrodynamic flows [1-3] and the "Quincke rotation" phenomenon [4, 5]. The main mechanism behind Quincke rotation is the instability of the droplet dipole, which is aligned opposite to the electric field direction. Above a critical electric field strength, the droplet dipole is displaced and the resulting torque induces physical rotation on the droplet.

Here we report the results of Quincke rotation of particle laden silicone oil droplets. The experimental investigations were based on the following scientific hypotheses: (i) because the particle laden droplets can be considered as a two phase system, i.e. bulk liquid has different properties than a particle shell, the critical strength of electric field needed for Quincke rotation and deformation of such Pickering droplet can be different than that of a pure droplet; (ii) deformations of a Pickering droplet at higher strengths of electric fields may influence the nature of Quincke rotation, i.e. can be different that that described for rotation of a sphere (the Quincke theory does not account for deformations); (iii) frequency of Quincke rotation depends on dielectric properties of particles comprising the particle laden droplet.

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