Electronic Supplementary Material (ESI) for Soft Matter

Movie Description: Retraction inhibition of a Silicone oil droplet through corona discharge

This video shows the dynamics of an impacted dielectric droplet over a non-wetting substrate in the presence of a strong corona discharge.

In the first part of the movie, the corona discharge is applied between a high voltage corona emitter electrode and a grounded stainless steel substrate with a non-wetting coating. The corona voltage is $V=16\ kV$ and the corona current collected by the substrate is $18\ \mu A$. A Silicone oil droplet is impacted on a substrate while the corona discharge accelerates the ionic cloud towards the air/liquid droplet interface. A strong interfacial pressure is generated due to the interaction of the interfacial surface charge density and the imposed electric field. The normal electric pressure squeezes the droplet towards the substrate. The normal squeezing electric force eliminates the retraction which occurs immediately after the impact process at the normal conditions (absence of corona discharge). Moreover, since the corona discharge is strong, the continuous electric pressure assisted expansion of the droplet followed by the initial expansion of droplet due to the kinetic energy of the impact.
After 44 seconds of the corona exposure, the electric field is removed. As it can be observed at ~t=45 (in the absence of corona discharge), the deposited surface charge migrates to the ground substrate while the interface is not supplied by the surface charge thus the surface charge accumulation and the electric pressure tends to zero and the expanded droplet retracts significantly.