Electrogeneration of highly viscous droplets on demand

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Many emerging applications require printing of highly-viscous droplets on demand while existing printing technologies fall short to eject them from the nozzle of print heads. To address this challenge, a new electroprinting principle has been developed replacing the nozzle with a wire-in-a-tube drop generator[1].

The novel wire-in-a-tube drop generator allows users to make a single drop on the wire. Applying electric field to detach and guide the drop to a target, one guarantees that neither long viscous filaments nor Taylor cones have formed. The dynamics of droplet formation has been studied using a high speed-motion camera. Image and video analysis are conducted using Fiji and LabVIEW respectively.

We demonstrate that a highly-viscous ($> 10^5$ cp) Ba-Ce-Fe-based sol can be printed on demand in a form of micro-droplets. The wire diameter controls the drop size while characteristic time of droplet formation is controlled by the sol viscosity and surface tension. This time has been measured for the wires of different diameters and the obtained dependence has been explained by a non-linear model of film dynamics within lubrication approximation.

References:

1. Andrukh, T.; Rubin, B.; Kornev, K. G., Wire-in-a-nozzle as a new droplet-on-demand electrogenerator. *Langmuir* **2011,** *27* (6), 3206-10.