Droplet motion driven by electro-elasto-capillary effects

JAYMEEN SHAH, XIN YANG, YING SUN, Drexel University — The motion of droplets on natural and synthetic fibers underlines many technological applications including flexible displays, insulation, and smart filters. However, there is a lack of fundamental understanding of the coupled electrical, elastic, and capillary forces on droplets in fiber networks. In the present study, the motion of a water droplet suspended between two electrically insulated fibers of different Young’s modulus, lengths and diameters are examined under electric fields. The results on rigid fibers reveal a critical voltage, under which the droplet remain stationary. Above this critical voltage, droplet self-propulsion is observed as a result of the interplay of electro, elasto and capillary forces on the droplet. The effects of the inter-fiber distance and Young’s modulus on droplet motion are also discussed. The controllable motion of droplets can be used to manipulate or transport liquid at small scales.

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