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Drop manipulation and surgery using electric fields LESLIE YEO, Monash University, RICHARD CRASTER, OMAR MATAR, Imperial College London — We study the dynamics of a slender drop sandwiched between two electrodes. A coupled system of evolution equations for the film thickness and interfacial charge density is derived using lubrication theory in the limit of large liquid conductivity. The contact line singularity is alleviated by postulating the existence of a wetting precursor film, which is stabilised by intermolecular forces. We examine the motion of the drop as a function of system parameters: the electrode separation, an electric capillary number and a spatio-temporally varying bottom electrode potential. The possibility of drop manipulation and surgery is demonstrated; this includes drop spreading, translation, splitting and recombination, using appropriate tuning of the properties of the bottom potential. For relatively small electrode separations and/or large electric capillary numbers, the drop assumes cone- like structures as it approaches the top electrode; the latter stages of this approach are found to be self-similar and a power-law exponent has been determined for this case. These results may have potential implications for drop manipulation schemes in various microfluidic applications.

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