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Stretching DNA molecules via combined electrospraying and evaporation LU ZHANG, SIDDHARTH MAHESHWARI, YINGXI ZHU, HSUEH-CHIA CHANG, University of Notre Dame — The high elastic moduli of coiled DNAs stipulate that, without anchoring, they can be stretched hydrodynamically only if a high shear-rate gradient can be imposed longitudinally. We demonstrate that DNAs can be stretched by a combination of two micro-stagnation flows: Electrospraying of the DNA solution produces micro-drops that are impacted onto a positively charged surface and the drops then recede by evaporation on the same surface. The opposite surface charge helps retain the stretched conformation. Varying the spraying conditions alters the drop dimension and charge and consequently the evaporation rate as well as the impact force, leading to a variety of stain patterns with different stretching mechanisms and stretching ratio. A multi-ring DNA stain pattern, with stretched DNAs connecting the rings, is also observed when the DNAs aggregate at the contact-line and cause a stick-slip receding process with periodic depinning of the contact line. The effect of each stretching parameter and the role of electrospraying, drop impact and evaporation as individual stretching mechanisms are studied through high-speed confocal scanning microscopy.

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