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The ac electrokinetic elongation mechanism of DNA. CHRISTOPH WALTI, University of Leeds, ANDRE GERMISHUIZEN, University of Cambridge, PAUL TOSCH, University of Leeds, CLEMENS KAMINSKI, University of Cambridge, GILES DAVIES, University of Leeds — The manipulation of molecules in a controlled manner is a crucial prerequisite for the emerging field of molecular nanotechnology. AC electrokinetics provide a powerful tool for both positioning and manipulation of molecules, as well as for inducing conformational changes in DNA. We performed three-dimensional imaging measurements of fluorescently labelled DNA strands tethered to gold microelectrodes and subjected to strong ac electric fields. The observed elongation patterns are compared with previously determined fluid flow patterns and with the electric field lines obtained from numerical simulations. We demonstrate that the major contribution to the elongation of the DNA molecules stems from the ac electrokinetic torque, supplemented by a small bias force provided by the electric-field-induced fluid flow. Further, we show that the observed restricted elongation owing to the geometry of the electrode results from a sign change in the bias force.

Christoph Walti
University of Leeds

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