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Nonmonotonic size dependence of the electrophoretic mobility of stiff and slightly flexible rods in random arrays of obstacles MYKYTA V. CHUBYNSKY, GARY W. SLATER, Department of Physics, University of Ottawa, Canada — Using 2D Brownian Dynamics simulations, we study the motion of stiff charged rods in a uniform electric field in arrays of randomly placed obstacles (modeling, e.g., a gel, an entangled polymer solution, or a microfabricated nanopillar array). A long infinitely stiff rod in a strong field can be trapped for a very long time that depends exponentially on both the field strength and the rod length. However, for moderate fields and not too long rods such trapping is rare and the corresponding rate decreases significantly if the rods are slightly flexible or the obstacles are slightly mobile. For this reason, the mobility of untrapped rods is a physically meaningful quantity. This mobility depends nonmonotonically on the rod length, as longer rods orient more along the field and thus collide less with the obstacles. We develop a theory that describes the scaling of the rod orientation and the position of the mobility minimum with all relevant parameters and agrees with our simulation data.

Mykyta V. Chubynsky
University of Ottawa

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