Abstract Submitted
for the MAR05 Meeting of
The American Physical Society

Electrophoresis of a Bead-rod Chain through a Narrow Slit: A Brownian Dynamics Study SATISH KUMAR, AJAY PANWAR, University of Minnesota, SEUNG HA KIM, KYUNG HYUN AHN, SEUNG JONG LEE, Seoul National University — We use two-dimensional Brownian dynamics simulations to study the electrophoresis of a bead-rod chain through a narrow slit. A constant electric field is assumed to act inside and outside the slit, and the total charge on the chain is distributed equally among all beads. We study the dependence of the polymer transit velocity on the chain length, slit dimensions (width-to-length ratio), and electric field strength. We find that for sufficiently narrow slits, the transit velocity increases non-linearly with the applied field for low field strengths, whereas it increases linearly for high field strengths. In the low-field-strength region and for sufficiently narrow slits, the transit velocity decreases rapidly for small chain lengths and then decreases slowly beyond a critical chain length. With increasing width of the slit, the decrease in velocity is observed to be more continuous, and becomes independent of chain length for large slits. These results show the sensitivity of the transit velocity vs. chain length relationship to the slit dimensions and electric field strength, and could be useful for microfluidic separations.

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Date submitted: 19 Nov 2004 Electronic form version 1.4