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Separation of DNA in nanoscale devices with alternating channel depth. HENRY LAU, ELIZABETH STRYCHALSKI, HAROLD CRAIGHEAD, LYNDEN ARCHER, Cornell University — The size-dependent separation of DNA using nanofabricated devices consisting of alternating deep and shallow regions have been the subject of numerous experimental and theoretical works. Recent Brownian dynamics simulations suggest that the separation of rigid-rod DNA can be effected at high electric fields without a loss of resolution (PRL, 2007, 98, 098106). To study the dynamics of DNA separation at high fields, electrophoresis experiments were carried out using DNA fragments up to 753 bp in size. As the transport mechanism of DNA fragments in gels has been shown to be a strong function of topology (Electrophoresis, 2004, 25, 1772), electrophoresis of branched rigid-rod DNA molecules was performed to investigate the effects of analyte architecture on mobility in nanofabricated devices. By comparing the mobility of branched and linear DNA molecules of identical total molecular weight, we exclude the influence of size and charge and focus on the effects of branch size and location, and overall analyte topology. Our results help to elucidate the electrophoretic migration mechanism of DNA molecules with complex architecture in sieving media with precisely-controlled internal structures.

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