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A Systematic Study of Single-stranded DNA Electrophoresis in Photopolymerized Crosslinked Polyacrylamide Gels ROGER LO, VICTOR UGAZ, Texas A&M University — In this paper, we present a systematic investigation of mobility, diffusion, and dispersion in crosslinked polyacrylamide gels through parallel use of an automated DNA sequencer and a microfabricated electrophoresis device with integrated on-chip electrodes, heaters, and temperature sensors. DNA separations are conducted using the same sample, gel formulations, and operating conditions in both platforms. The microfabricated electrophoresis chip make it possible to collect a complete set of diffusion and dispersion data within about one hour, while it takes several days to finish the same work using a traditional sequencer under the same experimental conditions. By comparing data collected from these two platforms, we can isolate key parameters governing separation performance in both systems. These experimental results are compared with reptation theory to extract information on the gel structure and also predict achievable separation resolution under various operating conditions. We also investigate the effects of gel composition and polymerization chemistry and find that these photopolymerized crosslinked polyacrylamide gels provide good separation resolution at relatively low electric field strengths (10-20 V/cm). This makes it possible to customize the microfabricated electrophoresis chip for microdevice-based applications according to desired separation performance.

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