Abstract Submitted
for the DFD06 Meeting of
The American Physical Society

Flow of DNA solutions in planar 90 degree micro-bends SHELLY GULATI, SUSAN MULLER, DORIAN LIEPMANN, University of California, Berkeley — The characterization of flows containing macromolecules is critical for the optimal design of microfluidic systems for biochemical analyses. The effects on lambda-DNA transport in microscale flows are significant because the flow behavior may be influenced by molecular interactions, both viscous and elastic forces dominate inertial forces at this length scale, and the macromolecular length scale L approaches the device length scale D. Our previous studies of flow of semi-dilute DNA solutions in micro-contractions (L/D $\sim$ 0.17) indicate strongly elastic behavior through the observation of vortex enhancement with increasing Re and Weissenberg (Wi) numbers; here Wi is the ratio of the polymer relaxation time to the characteristic flow time scale. In the present work, the viscoelastic flow of semi-dilute DNA solutions in planar 90 degree micro-bends (L/D $\sim$ 0.09), another canonical microfluidic structure, is investigated; macromolecular flows in this geometry on a macro or microscale have been previously unexplored. The onset of a new flow instability occurs at Wi $\sim$ 1. A recirculation region is present in the interior corner of the bend and is enhanced with increasing Re ($6 \times 10^{-7} < \text{Re} < 3 \times 10^{-4}$) and Wi ($1 < \text{Wi} < 190$); this vortex is absent in Newtonian flows.

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Date submitted: 04 Aug 2006 Electronic form version 1.4