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Dissimilar viscosity induced sample pre-concentration in elecrokinetic nanofluidic channels DEAN WINK, ELIJAH SHELTON, SUMITA PENNATHUR, University of California Santa Barbara, BRIAN STOREY, Franklin W. Olin College of Engineering — Nanofluidic analysis systems boast many advantages: portability, small sample handling, short processing times, and potential for integration with mobile electronics. However, such systems face the challenge of detecting increasingly small volumes of sample at low concentrations. In this work, we demonstrate a unique pre-concentration technique in electrokinetic nanofluidic systems based on a viscosity mismatch between two fluids. In nanofluidic electrokinetic systems, finite electric double layers (EDL) lead to non-uniform electric potentials and transverse concentration distributions. Therefore, when the EDL is comparable in size to the channel height, negatively charged ions are repelled from negatively charged walls and preferentially populate the channel centerline. Furthermore, an axial piecewise viscosity distribution induces internal pressure gradients within the channel. These force the ions to move at a different average velocities based on the pressure gradient being favorable or adverse, leading to focusing. To experimentally probe this phenomenon, we electrokinetically inject solutions of borate buffer with and without glycerol (to change the viscosity) and use a fluorescent tracer dye to visualize the flow. We perform the injections in cross-geometry channels of 20 micron, 1 micron, and 250 nanometer depths. We measure fluorescence at 5, 10 and 15 mm distances from junction. Enhancement is characterized by comparing intensities to control measurements for systems with uniform viscosity.

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