Abstract Submitted
for the DFD07 Meeting of
The American Physical Society

Dispersion in microfluidic separation systems in presence of wall interactions and axial inhomogeneites SUBHRA DATTA, SANDIP GHOSAL, Northwestern University — The dispersion of a solute which undergoes adsorption and desorption on the walls of a straight microchannel of axially varying cross-section is studied, motivated by capillary electrophoresis and chromatographic applications. An asymptotic approach based on the long time limit is adopted, which leads to the formulation of a model that requires the solution of only one-dimensional partial differential equations. As a check of accuracy of the asymptotic results, the full three-dimensional equations governing the transport and adsorption-desorption of the solute in a rectangular microchannel are solved numerically under axially variable and axially invariant electroosmotic flow fields and the results are compared to those from the asymptotically reduced model. The asymptotically reduced model gives accurate predictions for both slow and fast adsorption-desorption processes, unlike results from the theory of band broadening in chromatographic processes, which, incidentally emerge as a special case of the model.

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Date submitted: 17 Jul 2007 Electronic form version 1.4