

Abstract Submitted
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Electromigration dispersion in the presence of a zeta-potential¹

ZHEN CHEN, SANDIP GHOSAL, Northwestern University — Electromigration dispersion is observed in zone electrophoresis when the concentration of sample ions is comparable to that of the background ions, so that the local electrical conductivity is significantly altered in the sample zone. It was shown (S. Ghosal and Z. Chen Bull. Math. Biol. 2010, vol. 72, pg. 2047) that under certain simplifying assumptions, the concentration profile is described by Burgers' equation. Here we consider a more general situation where the walls of the separation channel may have a non-zero zeta potential and is therefore able to sustain an electro-osmotic bulk flow. The main result is a one dimensional nonlinear advection diffusion equation for the area averaged concentration that accounts for the Taylor-Aris dispersion resulting from the variation in the electro-osmotic slip velocity along the wall. It is shown that in a certain range of parameters, the electro-osmotic flow can actually reduce the total dispersion by delaying the formation of a concentration shock. However, if the electro-osmotic flow is sufficiently high, the total dispersion is increased because of the Taylor-Aris contribution.

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