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Transient Current and Fluid Transport in Electrolyte Displacement by Electro-osmotic Flow HSIEN-HUNG WEI, SZU-WEI TANG, CHIEN-HSIANG CHANG, National Cheng Kung University — In this work, the displacement between two different conductivity solutions by an electro-osmotic flow in a uniformly charged channel is revisited theoretically in the large Peclet number limit. A conductivity mismatch can induce an additional pressure flow due to unequal electro-osmotic slip velocities in the solutions. And yet, we argue that the notion of uniform displacement can still be valid *locally* in the vicinity of the moving concentration front. We derive a coupled set of equations for the electric current and the displacement distance and obtain an analytical solution for these equations. We find that the displacement can exhibit distinct features, depending on the range of the conductivity ratio. This is demonstrated by examining three limiting scenarios: (i) when the solution conductivities are nearly matched, (ii) the displacement by a very high conductivity solution, and (iii) the use of a very low conductivity solution in advancing the displacement. Our findings provide some insights into the zeta potential measurement using the current monitoring method and sample stacking by electro-osmotic flow with conductivity gradient. Effects of dispersion are also discussed.

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