

Abstract Submitted
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Geometry-driven charge accumulation in electrokinetic flows through laminates B.S. TILLEY, B. VERNESCU, J.D. PLUMMER, Worcester Polytechnic Institute — In the remediation of charged species from contaminated saturated soils, electric fields are applied to move the charge from the bulk toward the electrodes. Debye-layers occur at the soil/fluid interface which allows for advective transport of charge through electroosmosis, along with transport due to electrodiffusion (electrophoresis). However, depending on the valence of the species, these effects may act in concert to remove charge or may compete. We model the soil as an array of purely dielectric laminates with nonuniform thickness whose spatial variation in the streamwise direction occurs on a much longer length scale than the spacing between laminates (i.e. pore spacing). We derive an asymptotic model that incorporates lubrication pressures, dispersive effects in the electric field correction, and species equations for ion concentrations in the liquid. Electroneutrality is not assumed in the fluid region. In the case of monovalent species, we find that spatial variations in the pore structure can lead to accumulation of charge where both the fringe electric field converges and the advective transport of charge is weak. Comparisons with results found in experiments are discussed.

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