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On electronkinetically driven flows in swelling clays B.S. TILLEY, Olin College, B. VERNESCU, J.D. PLUMMER, WPI — Clays are formed in parallel layers of minerals, called lamellae, which have negative surface charge due to imperfections in the crystal lattice. The space between the lamellae, the galley, is filled with a liquid in which cations are drawn to the charged platelet surfaces, resulting in a double-layer. The aspect ratio of the galley thickness to its length is small. Spatial variations on the lamella shape depend on the mechanical stresses being applied to the clay, the local flow rate, and the local cation and anion concentrations. We have developed a model in the small tortuosity limit for the bulk flow in the clays which takes into account local charge distributions, local displacements, and applied electric fields. Lubrication theory is applied to an individual galley/lamella system to describe the charge concentration and flow and electric fields and local displacements in the lamella. These fields then provide jumps in shear and tangential stresses within the lamellae, whose net force balance is found through homogenization over the size of the sample. Numerical simulations of the model are presented and are compared to experiments.

Burt Tilley
Olin College

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