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Computational modeling of electrokinetic transport in random networks of micro-pores and nano-pores SHIMA ALIZADEH[1], ALI MANI, Stanford University — A reduced order model has been developed to study the nonlinear electrokinetic behaviors emerging in the transport of ionic species through micro-scale and nano-scale porous media. In this approach a porous structure is modeled as a network of long and thin pores. By assuming transport equilibrium in the thin dimensions for each pore, a 1D transport equation is developed in the longitudinal direction covering a wide range of conditions including extreme limits of thick and thin electric double layers. This 1D model includes transport via diffusion, electromigration and wide range of advection mechanisms including pressure driven flow, electroosmosis, and diffusion osmosis. The area-averaged equations governing the axial transport from different pores are coupled at the pore intersections using the proper conservation laws. Moreover, an asymptotic treatment has been included in order to remove singularities in the limit of small concentration. The proposed method provides an efficient framework for insightful simulations of porous electrokinetic systems with applications in water desalination and energy storage.

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