Abstract Submitted
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Ion transport through a charged cylindrical membrane pore contacting stagnant diffusion layers MATHIAS B. ANDERSEN, Stanford University, P.M. BIESHEUVEL, Wageningen University and Wetsus, MARTIN Z. BAZANT, MIT, ALI MANI, Stanford University — Fundamental understanding of the ion transport in membrane systems by diffusion, electromigration and advection is important in widespread processes such as de-ionization by reverse osmosis and electrodialysis and electro-osmotic micropumps. Here we revisit the classical analysis of a single cylindrical pore, see e.g. Gross and Osterle [J Chem Phys **49**, 228 (1968)]. We extend the analysis by including the well-established concept of contacting stagnant diffusion layers on either side of the pore; thus, the pore is not in direct equilibrium with the reservoirs. Inside the pore the ions are assumed to be in quasi-equilibrium in the radial direction with the surface charge on the pore wall and we obtain a 1D model by area-averaging. We demonstrate that in some extreme limits this model reduces to simpler models studied in the literature; see e.g. Yaroshchuk [J Membrane Sci **396**, 43 (2012)]. Using our model we present predictions of important transport effects such as variation of transport numbers inside the membrane, onset of limiting current, and transient dynamics described by the method of characteristics.

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