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Hydrodynamic flow in a microchannel due to nanocapillary membrane electro-osmotic flow JARROD SCHIFFBAUER, Physics Dept., West Virginia University, WILL BOOTH, Physics Dept, West Virginia University, KATHLEEN KELLY, Chemistry Dept. West Virginia University, BOYD EDWARDS, Physics Dept., West Virginia University, AARON TIMPERMAN, Chemistry Dept. West Virginia University — A model for hydrodynamic flow in a microchannel terminated by a nanocapillary membrane (NCM) is proposed in which the microchannel electric-double layer (EDL) is treated as a boundary-layer, providing a hydrodynamic slip-velocity at the channel wall, and the NCM electro-osmotic flow (EOF) is treated as fully-developed. Applied pressure gradients and the contribution of the microchannel EDL to both the net charge transport and the back-pressure on the NCM are neglected. The proposed coupling between the NCM EOF and microchannel hydrodynamic response is obtained by arguing that the steady-state Onsager symmetry between linear-response coefficients may be applied to the transient response of the microchannel. The resulting form of the Navier-Stokes equation in the microchannel possesses steady-state solutions that are compatible with parabolic and inverted-parabolic profiles observed in NCM sample concentration experiments.

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