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Electrical characteristics in reverse electrodialysis using nanoporous membranes[1] SOURAYON CHANDA, PEICHUN AMY TSAI, University of Alberta — We experimentally and numerically investigate the effects of concentration difference and flow velocity on sustainable electricity generation and associated fluid dynamics using a single reverse electrodialysis (RED) cell. By exploiting the charge-selective nature of nanoporous interfaces, electrical energy is generated by reverse electrodialysis harnessing chemical Gibbs energy via a salinity gradient. Experimentally, a RED cell was designed with two reservoirs, which are separated by a nanoporous, cation-selective membrane. We injected deionized water through one reservoir, whereas a solution of high salt concentration through the other. The gradient of salt concentration primarily drives the flow in the charged nano-pores, due to the interplay between charge selectivity, diffusion processes, and electro-migration. The current-voltage characteristics of the single RED cell shows a linear current-voltage relationship, similar to an electrochemical cell. The membrane resistance is increased with increasing salt concentration difference and external flow rate. The present experimental work was further analyzed numerically to better understand the detailed electrical and flow fields under different concentration gradients and external flows.

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