Invited submissions

SDEWES2018.0137

Maximum Net Power Density Conditions in Reverse Electrodialysis Stacks

M. Ciofalo*[1], M. La Cerva[1], M. Di Liberto[1], L. Gurreri[2], A. Cipollina[2], G. Micale[2]

[1]University of Palermo, Italy; [2]Università degli Studi di Palermo, Italy (*michele.ciofalo@unipa.it)

Abstract

Reverse Electrodialysis (RED) harvests electrical energy from a salinity gradient. The maximum obtainable net power density (NPD) depends on many physical and geometric variables. Some have a monotonic (beneficial or detrimental) influence on NPD, and can be regarded as "scenario" variables chosen by criteria other than NPD maximization. Others, namely the thicknesses H^{CONC}, H^{DIL} and the velocities U^{CONC}, U^{DIL} in the concentrate and diluate channels, have contrasting effects, so that the NPD maximum is obtained for some intermediate values of these parameters. A 1-D model of a RED stack was coupled here with an optimization algorithm to determine the conditions of maximum NPD in the space of the variables H^{CONC}, H^{DIL},U^{CONC}, U^{DIL} for different combinations of the "scenario" variables. The model accounts for entrance effects, property variation, concentration polarization, axial concentration changes, osmotic, electro-osmotic and diffusive fluxes, and can deal with complex channel geometries using Ohmic resistances, friction factors and mass transfer coefficients computed by 3-D simulations.