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Reaching the limiting current regime by linear sweep voltammetry in ion-exchange membrane systems

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ABSTRACT

The transient current overshot and the evolution of the ionic concentrations and the electric potential to the limiting current regime by linear sweep voltammetry have been numerically investigated in ion-exchange membrane systems. The system under study is constituted by a cation-exchange membrane and two diffusion boundary layers on both sides of the membrane, which include the electric double layers at the interfaces, ionic transport of a binary electrolyte being described by the Nernst-Planck and Poisson equations. The time evolution of the electric current through the system in response to an electric potential increasing linearly with time, has been numerically simulated for different sweep rates of the perturbing signal by using the network simulation method. The effect of the sweep rate on the current-voltage curves has been analysed and discussed for systems with different values of the thickness of the diffusion boundary layers and the membrane resistance. The dependence of the peak current and the peak potential with the sweep rate has been