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Abstract

The present paper is devoted to the properties of sulfonated cation-exchange membranes obtained by radiation chemical grafting polymerization of styrene with divinylbenzene on a polyethylene film. The mechanical and transport properties (conductivity, diffusion permeability, and transport numbers) of the membranes obtained with various amounts of a cross-linking agent (0-3.5%) and degrees of polystyrene grafting (23-32%) were investigated in comparison with commercially available membranes, *i.e.* Nafion® 117 and Neosepta® CMX. Tensile strength values around 15-20 MPa were obtained, and they increased with increasing cross-linker amounts. The conductivity of membranes containing no cross-linking agent reached $8.4 \cdot 10^{-2}$ $\Omega^{-1}cm^{-1}$ at 25°C and high relative humidity. As the amount of the cross-linking agent increased, the water uptake in membranes and their conductivity at high relative humidity decreased, whereas the activation energy of conductivity increased. At low humidity (RH=30%), the water uptake and conductivity increased with increasing amounts of the cross-linking agent. The membranes based on cross-linked polystyrene had low diffusion permeability, while the associated cation transport numbers were higher than those with commercial Nafion® 117 membrane. The calculated theoretical power of reverse electrodialysis batteries based on the best membranes was 10 % higher than that of the battery based on the Neosepta® CMX membrane.

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