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Electrochemical synthesis of thin, dense, and conformal anion exchange membranes with quaternary ammonium groups

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Abstract:

We report for the first time the electrochemical synthesis in anodic and cathodic conditions of anion-conducting ionomer separators using two different precursors: N-(p-vinylbenzyl) N,N,N-trimethylammonium chloride (VBTMA) and (N-allyl N-benzyl N,N-dimethyl)ammonium iodide (ABDMA). The ionomer structure and microstructure are investigated by NMR and FTIR spectroscopies and Scanning Electron Microscopy. The quaternary ammonium groups are grafted in side chains (VBTMA) or are near the main chain (ABDMA). The anion conductivity is in the order of 1 mS/cm with quaternary ammonium groups in side chains and lower when the ammonium groups are near the main chain, where they probably reduce the anion mobility by steric hindrance. Such thin-film anion exchange membranes are a valuable asset for the realization of microfuel cells and solid-state water electrolyzers.

Keywords: electrodeposition; ionomers; anion conductivity; alkaline fuel cells; water electrolyzers

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