



Anion exchange membranes and binders based on polystyrene-*block*-poly(ethylene-*ran*-butylene)-*block*-polystyrene copolymer for alkaline water electrolysis

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Received 17 April 2018; Accepted 31 October 2018

ABSTRACT

The preparation of hydroxide ion-conductive membranes and catalyst binders starting from polystyrene-*block*-poly(ethylene-*ran*-butylene)-*block*-polystyrene (PSEBS) is described. Highly chloromethylated (CM) and soluble polymer was obtained by the reaction of PSEBS with dimethoxymethane (formaldehyde precursor), ZnCl₂ (catalyst), and phosphorus trichloride (chlorinating agent). The prepared CM polymer was used for casting of membranes and preparation of binders of catalytic particles. The membranes and binders were converted into quaternized form (PSEBS-CM-trimethylamine (TMA)) by immersion into an ethanolic solution of TMA. Ionic conductivity of PSEBS-CM-TMA was 56.1 mS cm⁻¹ at 30°C and 79.2 mS cm⁻¹ at 70°C, respectively. A laboratory water electrolyzer using a PSEBS-CM-TMA membrane and an anode with PSEBS-CM-TMA binder was operated permanently for 1 month without considerable deterioration of its performance. The anodes containing PSEBS-CM-TMA binder and NiCo₂O₄ catalyst greatly outperformed those containing the same amount of NiCo₂O₄ fixed to the anode by polytetrafluoroethylene.

Keywords: Polystyrene block copolymer; Alkaline water electrolysis; Anion exchange membrane; Anion exchange catalyst binder

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