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Embedding sulfonated lithium ion-sieves into polyelectrolyte membrane to construct efficient proton conduction pathways

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Abstract

In this study, acidified lithium ion-sieves (HMOs) containing unique inner ionic channels suitable for the transfer of H^+ are selected as proton-conductive fillers to prepare hybrid membranes for the first time. By using facile distillation-precipitation polymerization process, two types of sulfonated HMOs (SHMOs) are prepared: L-SHMOs, which are modified by sulfonate polyelectrolyte layer, and B-SHMOs, which are sulfonate polyelectrolyte brushes. The results demonstrate that these fillers improve the thermal and mechanical stabilities of chitosan (CS) control membranes. The incorporation of pristine HMOs enhances the water uptakes and proton conduction abilities of hybrid membranes at suitable loading. By comparison, SHMOs-filled membranes possess higher proton conductivities than those of HMO-filled membranes, owing to the additional proton hopping sites of $–SO_3H$ and acid-base pairs ($–SO_3^{-}\cdots{}^{+}{}_3HN–$). Moreover, B-SHMO-filled membranes exhibit superior proton conductivities over L-SHMO-filled ones, demonstrating that the