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# Pore-filling polymer electrolyte membrane based on poly (arylene ether ketone) for enhanced dimensional stability and reduced methanol permeability

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ABSTRACT

We synthesized sulfonated poly (arylene ether ketone) (SPAEK) with an 80% degree of sulfonation (DS) from 4,4-bis(4-hydroxyphenyl) valeic acid and 4,4-difluorobenzophenone. A series of pore-filling membranes were prepared by filling SPAEK into the plasma-treated porous poly (arylene ether ketone) membrane (PAEK) with various pore sizes and porosity. The porous PAEK membrane were obtained by removing the phase separated polylatide (PLA) blocks from the self-arranged PAEK-b-PLA copolymer membranes. The results from synthesis of SPAEK and porous PAEK was characterized using $^{1}$H NMR and FTIR, and the morphology of the SPAEK-filled porous PAEK membrane was investigated using SEM and EDX-SEM. The essential properties of pore-filled membranes (e.g., ionic exchange capacity (IEC), proton conductivity, thermal and mechanical stability, and methanol permeability), were examined and collated to those of pristine SPAEK and commercial Nafion 117 membranes. The pore-filled membranes prepared in this study showed enhanced thermal and dimensional stability and reduced methanol permeability compared with the pristine SPAEK and Nafion 117 membranes. The pore-filled membrane with a pore diameter of 50 nm