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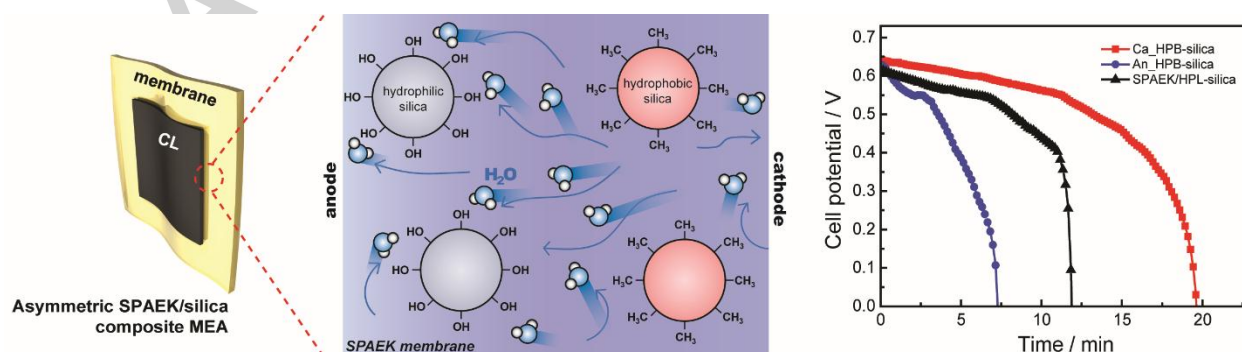
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Abstract

We prepared an asymmetric composite membrane in which surface modified silica nanoparticles were added to sulfonated poly(arylene ether ketone) (SPAEK). The asymmetric structure, hydrophilic silica to the anode side and hydrophobic silica to the cathode side in the polymer matrix, enhanced the water back diffusion from the cathode to anode within the membrane, which results in an increase of proton conductivity, particularly under low humidity conditions. The improved water back diffusion is attributed to the different water retention character and surface energy gradient of surface modified silica that accelerates water transport. The asymmetric composite membrane exhibited high and stable electrochemical performance of a fuel cell. Analysis of drain water and electrochemical characterization supports the structural effect of the asymmetric composite membrane for efficient water management.

Graphical abstract



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