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NOVEL CROSSLINKERS FOR HIGH PERFORMANCE POLY-AMPS-BASED PROTON EXCHANGE MEMBRANES FOR FUEL CELLS

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Polymer electrolyte fuel cells (PEFC) gained a lot of interest in recent years as a potential solution for an eco-friendly energy. Proton exchange membranes (PEM) are one of the main components of PEFCs and require mechanical and chemical stability to ensure high proton conductivity and effective separation of anode and cathode under challenging conditions. Best commercial membranes made from sulfonated fluoropolymers, such as Nafion®, are rather expensive. To improve fuel cell performance at a lower cost, 2-acrylamido-2-methylpropane sulfonic acid (AMPS) was investigated recently.[1] Since polyAMPS (PAMPS) excessively swells or even dissolves in water, we investigated several commercial crosslinkers and new multifunctional monomers (Fig. 1) to decrease swelling by crosslinking.

AMPS, crosslinker and photoinitiator were dissolved in water and N-methyl-2-pyrrolidone (NMP), respectively. To facilitate conductivity measurements and handling of crosslinked PAMPS formulations after UV-initiated radical polymerization, they were constrained within a porous membrane using a procedure described by Zhou et al.[2] We tested several commercial crosslinkers and according to these results we developed new crosslinkers with enhanced hydrolytical stability and conductivity. In contrast to the commercial crosslinkers, where conductivity increased with increasing amount of crosslinker, our new acrylamide based crosslinkers needed only very low concentrations. They could achieve more than 2.5 times the conductivity of Nafion with only 5 wt% crosslinker.

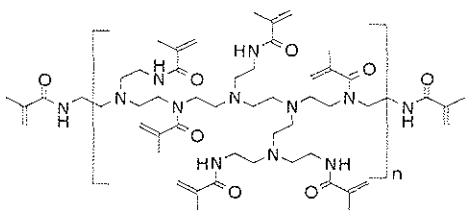

Fig. 1: Novel methacrylamide based crosslinker for PEFC's

We used this novel crosslinkers to integrate them into asymmetric membranes with interpenetrating proton-conducting morphology for enhanced methanol barrier properties.[3] First results of their performance compared to Nafion will be presented.

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