Proton conductive membranes for DMFC

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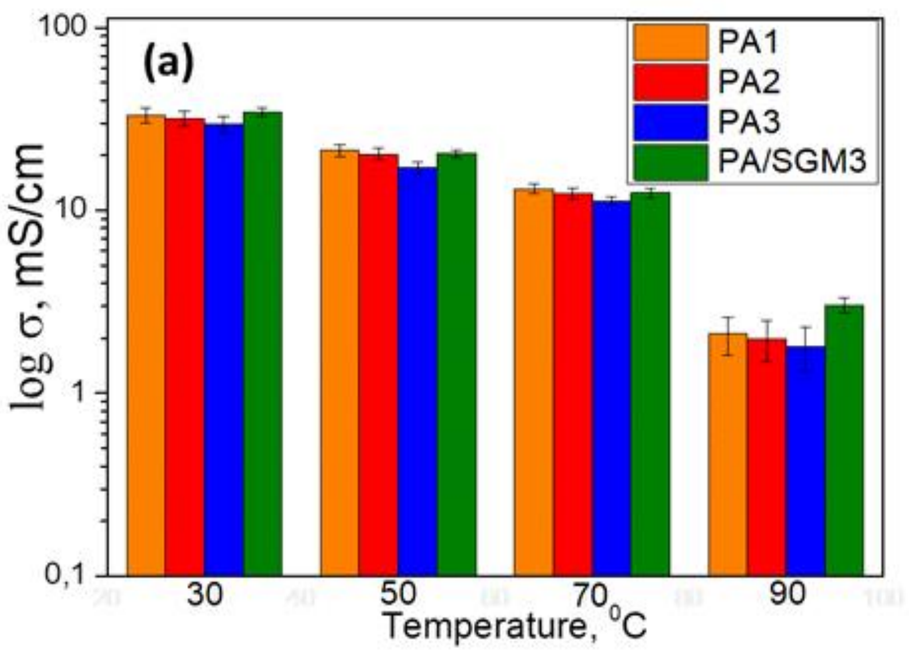
Direct methanol fuel cells (DMFCs) have recently gained much attention as perspective energy sources [1]. However, they have some shortcomings such as methanol crossover through membrane. Perfluorosulfonate ionomer membranes Nafion are currently used as PEMs in DMFCs. They have a serious methanol crossover problem.

We propose hybrid organic/inorganic cross-linked materials based on monomers acrylonitrile (AN), acrylic acid (AA), ethyleneglycole dimethacrylate (EGDMA), sodium styrene sulfonate (SSS) and sol-gel system of tetraethoxysilane (TEOS) and 3-methacyloxypropyltrimethoxysilane (MAPTMS) synthesized by UV-polymerization and sol-gel process *in situ*. Monomer ratio in feed composition was as follows: AN:AA:EGDMA:SSS = 44:20:20:14 wt. %. The amount of the added SGS was 3-5 wt. %.

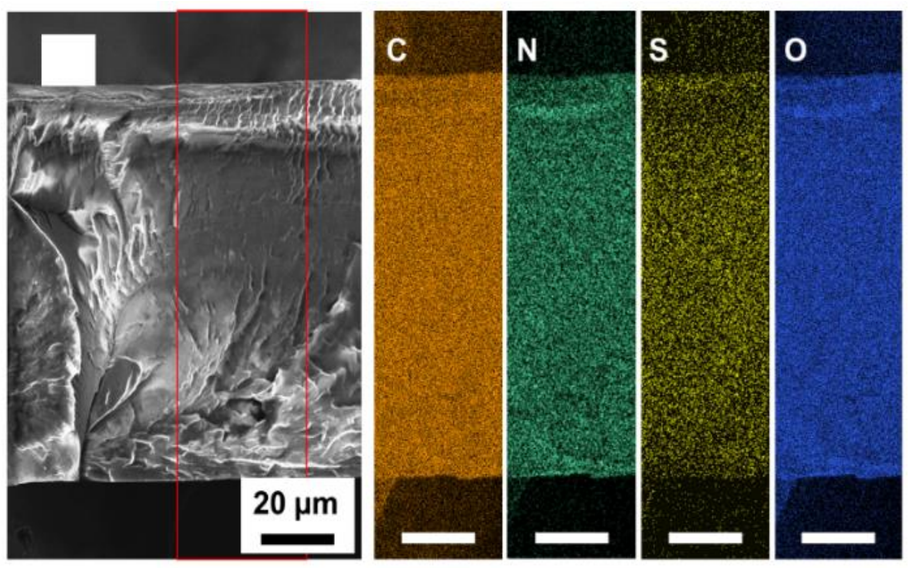


Dependence of proton conductivity of polyacrylate and polyacrylate/silica sulfo-containing membranes on temperature

The measured by impedance spectrometry proton conductivities of the prepared membranes at ambient temperature are high – 2.58 - 2.85 mSm/cm.

The values of methanol uptake of the cross-linked composite membranes are within 9.5 - 8.3 wt. %, what is much lower than that of Nafion membrane.

Hence, the introduction of sol-gel precursor into monomer mixture leads to formation organic/inorganic network and greatly reduces methanol permeability of the membrane.



EDX elemental distribution maps of C, N, S, and O across the NAS-622 membrane thickness. The scale bar on the elemental EDX maps corresponds to 20 µm

The proposed poly(AN-*co*-AA-*co*-EGDMA-*co*-SSS-*co*-MAPTMS)/SiO_2 may be considered as a potential candidate for DMFC application.

Kim D. J., Jo M. J., Nam S. Y. A review of polymer-nanocomposite electrolyte membranes for fuel cell application // J Ind Eng Chem.-2015.-21.-P. 36-52.