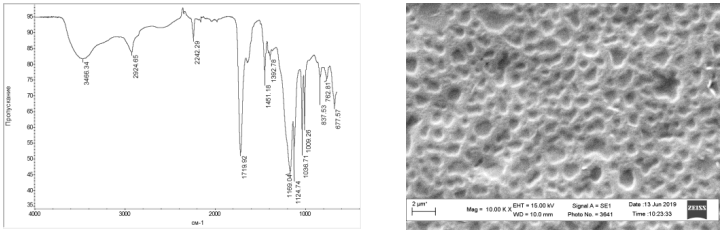
POLY(ACRYLATE)SILICA MEMBRANES FOR FUEL CELLS

Zhyhailo M. M., Demchyna O. I., Yevchuk I. Yu., Rymsha Kh. V., Zhuravetska I. M.
Department of Physical Chemistry of Fossil Fuels L.M. Lytvynenko Institute of Physico-Organic Chemistry and Coal Chemistry NAS of Ukraine, Lviv, Ukraine
zhyhailo.mariia@gmail.com

Hydrogen technology is considered as a great opportunity to reduce emissions and increase the value of "clean" energy. Fuel cells may be used for heating and electrification of buildings, as an alternative fuel for cars and trains, and so on. Compared to conventional systems of energy production, fuel cells are more efficient due to the electrochemical principle of operation. Therefore, the efforts of the researchers all over the world are directed to acceleration of the deployment of fuel cell technology. One of the challenges is the development of the effective proton conductive membrane (PEM) for fuel cell.

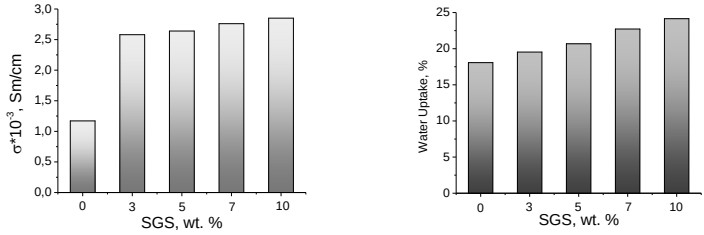
The series of cross-linked membranes were prepared by UV-initiated polymerization of acrylic monomers (acrylonitrile AN, acrylic acid AA, 4-vinylbenzene sulfonate NaSS, ethyleneglycole dimethacrylate EGDMA) in the presence of photoinitiator (IRGACURE 651, 2 wt. %) and 3-methacryloxypropyl trimethoxysilane (MAPTMS)-based sol-gel system, introduced into the polymerizing mixture before gelation. The formation of hybrid organic-inorganic structure involves intermolecular interactions, such as hydrogen bonding, electrostatic interactions, Van der Waals forces. The structure and morphology of the obtained materials were characterized by FTIR and SEM, respectively.



a) b)

Fig. 1. FTIR spectrum (a) and SEM image (b) of polyacrylate/silica membrane

Proton conductivity of the synthesized membranes measured at 30 °C as well as water uptake were found to depend on the content of inorganic component (Fig. 2).



a) b)

Fig. 2. Proton conductivity (a) and water uptake (b) *vs* SGS content

The values of proton conductivity of the obtained membranes are relatively high – up to $2.85 \cdot 10^{-3}$ Sm/cm for the sample S5 (10 wt % of SGS added). Water uptake increases with the increase in the content of inorganic component reaching 24.2 wt. % for the sample S5. The synthesized PEMs are good candidates for fuel cell application.