

SOL-GEL SYNTHESIS AND CHARACTERIZATION OF PROTON CONDUCTIVE MEMBRANES

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Nowadays many types of hybrid organic-inorganic materials are developed because of their wide application, in particular as proton conductive membranes in fuel cells. The objective of our study was to prepare organic-inorganic materials with proton conductive properties using sol-gel method of synthesis. Acrylic monomers: acrylonitrile (AN), acrylamide (AAM) and 3-sulpho-propylacrylate potassium salt (SPAK) were chosen to create polymer matrix in the process of UV-curing. Inorganic counterpart was formed as a result of sol-gel process of TEOS-based sol-gel system (SGS) during photo-initiated polymerization *in situ*. The ratio between monomers was SPAK:AAM:AN = 25,3:58,5:16,2 (wt. %); SG content in feed composition was varied from 10 till 40 wt. %.

The composition and chemical structure of synthesized films were investigated by ATR-FTIR spectroscopy.

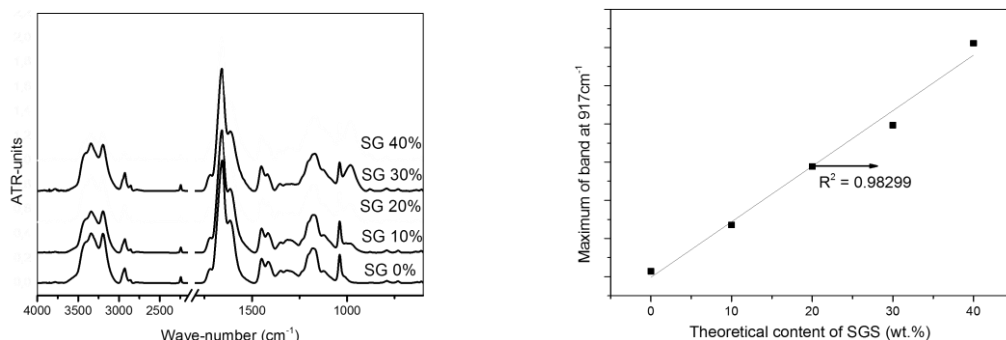


Fig. 1. FTIR spectra of membranes with different content of SGS

FTIR spectra reveal the presence of inorganic ingredient in the samples: Si-O bonds of siloxane network give the absorption peak at 980 cm^{-1} (stretching vibration of $\nu(\text{Si-O})$). In addition, the relative intensity of the bands rises with increasing amounts of SGS in polymer matrix. The existence of Si-O-Si peak (the band at 917 cm^{-1}) proves the occurrence of hydrolysis and condensation reactions of TEOS and suggest the formation of crosslinked silica network structure in the membranes. Thus, the cross-linked hybrid organic-inorganic membranes were fabricated as desired.

Proton conductivity of synthesized membranes (due to the presence of sulpho groups) was measured by impedance spectroscopy. Nyquist plot for the sample of organic-inorganic membrane with 20 wt. % of SGS, added into feed composition, is presented in Fig. 2. Proton conductivity of obtained membranes, calculated from the data of impedance spectroscopy, was 10^{-3} – 10^{-4} Sm/cm .

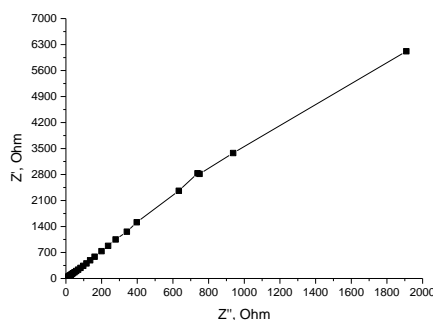


Fig. 2. Nyquist plot for the sample PMSG20

Acknowledgement. The authors are grateful to DAAD program for financial support (Research Grants for Doctoral Candidates and Young Academics and Scientists 2015/16, program ID 57130104) and Dr. Mikhail Malanin for assistance.