PROTON CONDUCTIVITY OF SULFO-CONTAINING POLYMERIC AND ORGANIC-INORGANIC MATERIALS

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Fuel cell technology requires the development of new efficient proton conductive membranes. The developed materials must be competitive in cost and synthesized from available raw materials. Therefore, polymeric and organic-inorganic proton conductive membranes are objects of intensive research in recent years.

UV polymerization technology has a great potential for the synthesis of polymeric and organic-inorganic materials, as it has several significant advantages over other synthesis methods, namely, high process speed, low energy consumption, and the absence of solvents, which corresponds to the principles of *green chemistry*.

We have synthesized a series of polymeric membranes containing sulfo groups: poly(2-acrylamido-2-propanesulfonic acid-co-acrylamide-co-acrylonitrile), poly(potassium 3-sulfopropylacrylate-co-acrylamide-co-acrylonitrile), poly(sodium 4-styrene sulfonate-co-acrylamide-co-acrylonitrile) by UV-initiated radical polymerization as well as the organic-inorganic membranes with the same polymeric matrices containing the inorganic nanoparticles formed in the simultaneous sol-gel process from TEOS-based sol-gel system (Table 1). N,N'-methylene-bis-acrylamide was used as a cross-linking agent.

Table 1. Compositions for membranes synthesis (wt. %)

Sample	SM	AAm	AN	MBA	SG
AMPS-SG0	25.0	57.8	16.2	1.0	-
AMPS-SG10	22.5	52.1	14.5	0.9	10
SPAK-SG0	25.0	57.8	16.2	1.0	-
SPAK-SG10	22.5	52.1	14.5	0.9	10
SSNa-SG0	25.0	57.8	16.2	1.0	-
SSNa-SG10	22.5	52.1	14.5	0.9	10

The main characteristic of membranes for fuel cells is their proton conductivity. To ensure a high level of conductivity the materials for the membranes must contain the functional ionic groups, the best one was found to be $–SO_3$. It was interesting to investigate how the changing of the sulfo-containing monomer in the polymer matrix affects the value of proton conductivity.

The results of the measuring of proton conductivity of the synthesized polymeric and organic-inorganic membranes at 30°C are shown in Fig. 1.

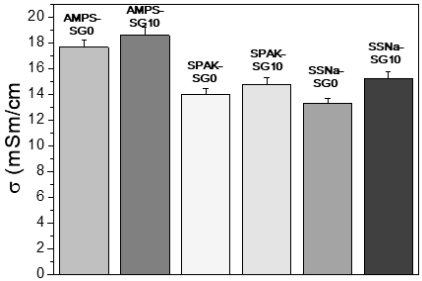

Fig. 1. Proton conductivity of the synthesized membranes

The values of proton conductivity of the obtained membranes are relatively high, reaching 18.63 ± 0.62 mSm/cm for the sample AMPS-SG10.