Nanocomposites and nanomaterials

Investigation of proton conductivity of the hybrid organic-inorganic membranes synthesized via photo-initiated polymerization and in situ sol-gel process

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Membrane is one of the most important parts of fuel cell, because it makes possible for device to functionalize. The main critical requirement for membrane materials is proton conductivity. Hybrid membranes were synthesized via photo-initiated polymerization of acrylic monomers (acrylonitrile, acrylamide, 3-sulfo-propylacrylate potassium salt) and in situ sol-gel process of tetraethoxysilane-based system. The content of sol-gel system was varied.

The proton conductivities were measured in a temperature and humidity controlled chamber using a four-point probe (FuMaTech GmbH, Germany). The membrane conductivities were calculated using the following formula:

$$\sigma = \frac{l}{w \cdot d \cdot R} (S/cm),$$

where l is the distance between electrodes, w is the width, d is the thickness of the sample and R is the measured resistance. Table 1 shows the results of proton conductivity of created membranes measurements at different temperatures. The membrane containing 20 wt. % of SGS shows the most stable and promising results.

Table 1. The results of proton conductivity of the hybrid membranes measurements

SGS content / Temperature(°C)	30	40	50	60	70	80
0 wt.%	9.4	11.1	13.3	-	-	-
20 wt.%	15.2	15.0	13.7	13.0	12.1	5.0
30 wt.%	12.1	13.5	12.5	3.3	8.8	1.0

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