Nanocomposites and nanomaterials

Synthesis of hybrid organic-inorganic composites

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Proton conductive membranes for the use in fuel cells must meet a number of requirements for effective fuel cell performance: in addition to a high proton conductivity, they must have a good electrochemical and thermal stability, a good mechanical strength, a low fuel crossover. Hybrid organic-inorganic membranes are widely investigated as proton conductive materials for fuel cell application alternative to the current state-of-the-art material Nafion [1].

We have synthesized organic-inorganic membranes on the base of acrylic monomers and sol-gel system TEOS – C_2H_5OH – H_2O using UV-initiated polymerization. Acrylic monomers used were acrylamide, acrylonitrile and 3-sulphopropylacrylate potassium salt or sodium styrene sulfonate. Cross-linker *N*,*N*′-methylenebisacrylamide was used to form cross-linked structure of copolymer.

Organic-inorganic composites with different content of inorganic phase were obtained in the form of thin films. SEM investigations of the film morphology have indicated homogeneous structure of the obtained materials. The study of sorption characteristics of synthesized hybrid organic-inorganic membranes has indicated their ability to water retention that is necessary to ensure ionconducting properties of the membranes. Diffusion coefficients of water vapour into membrane structure have been calculated to be 10^{-7} - 10^{-8} cm^2/s. The composite membranes demonstrated high proton conductivity – 10^{-3} - 10^{-2} S/cm at the temperature 80ºC.

Therefore, the synthesized organic-inorganic materials may be considered as promising ones for fuel cell application.

1. *Mauritz K*. *A*. Organic-inorganic hybrid materials: Perfluorinated ionomers as sol-gel polymerization templates for inorganic alkoxides // *Mater. Sci*. *Eng*. – 1998. - ***C*** **6, N** 2. - P. 121-133.