TRANSPORT PROPERTIES OF POLY(2,6-DIMETHYL-1,4-PHENYLENOXIDE) MEMBRANES AT DIFFERENT DEGREES OF SULPHONATION

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A variety of functionalised polymeric materials have been studied during the last decade with respect to theirs possible utilisation as a solid polymer electrolyte in fuel cells. The typical representatives of these membranes are perfluorosulphonate polymers, such as Nafion. Regardless of its high proton conductivity, mechanical and chemical stability, Nafion also has serious disadvantages (high production costs, relatively high permeability to methanol, sensitivity to the water management).[1,2] In this study the new type of ion-exchange membrane based on the sulphonated poly(2,6-dimethyl-1,4-phenyleneoxide) (SPPO) has been prepared. This polymer is an attractive material for the preparation of membranes because it possesses excellent film- and membrane-forming properties as well as high thermal and chemical stability.[3]

Aim of this study was to determine influence of degree of sulphonation of SPPO on the kinetics of its swelling in the water vapour and mass transfer properties. Ion conductivity, ion exchange capacity and swelling in water vapour were followed for the individual membrane samples. These values were used to evaluate proton diffusion coefficient in the membrane using the theory of absolute mobility of ions.[4]

The transport properties of the SPPO membranes improve with the increasing degree of sulphonation up to the limit of 40 %, see Figure. Membrane sulphonated to more than 30 % posses transport properties comparable or even better than those of Nafion. However, at the same time, the mechanical and chemical stability of the polymer material deteriorates substantially for the sulphonation higher than 40 %. It follows from these results that optimal degree of SPPO sulphonation fall in the range 30 to 40 %.

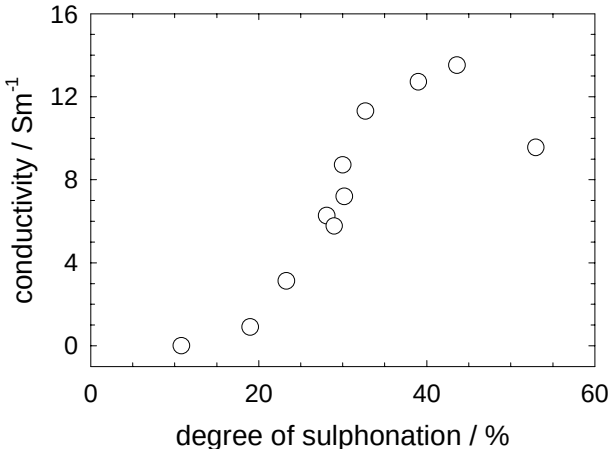

Fig.1. *Membrane conductivity vs. degree of sulphonation, temperature 20 °C, relative humidity 100 %*

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