Swelling of composite sulfonated polyetheretherketone (SPEEK)/ ZrO_2 membranes in electrolytes

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The interest of the research, during the last 20 years, was addressed to the improvement of existing polymer electrolyte membranes for fuel cells and the development of new ones [1] due to the need to develop alternative energy systems. Problems related to CO_2 emissions and climate changes are accelerating the new technology development. For this reason, the focus of research is changing to direct methods reversing CO_2 emissions. Availability of local alternative energy sources (wind, solar) makes it possible to discuss the electrochemical CO_2 transformation to useful chemicals – methanol, acetic acid, carbohydrates, etc.
Sulfonated polyetheretherketone (SPEEK) was synthesized from polyetheretherketone (PEEK, obtained from *Sigma Aldrich*) [2-3]. Degree of sulfonation = 0.70. Polymer membranes prepared by using a solvent cast method. Polymer solutions were poured into Petri dishes and dried for 48 h at 80 °C.
Water uptake and swelling degree were determined for each of the prepared membranes. Dry membranes weighted and measured length and thickness. After that, membranes immersed in deionised water for 24 h, weighted and measured again. Alternatively, membranes immersed in a 1M $KHCO_3$ solution. Metrohm Autolab potenciostat/galvanostat PGSTAT204 was used for impedance/ conductivity measurements, and measuring parameters were as follows: frequency range was 50 kHz to 100 Hz; 10 frequencies per decade; signal amplitude 10 mV. Potassium content after ion-exchange obtained using XRF element analysis (Bruker S8 Tiger).

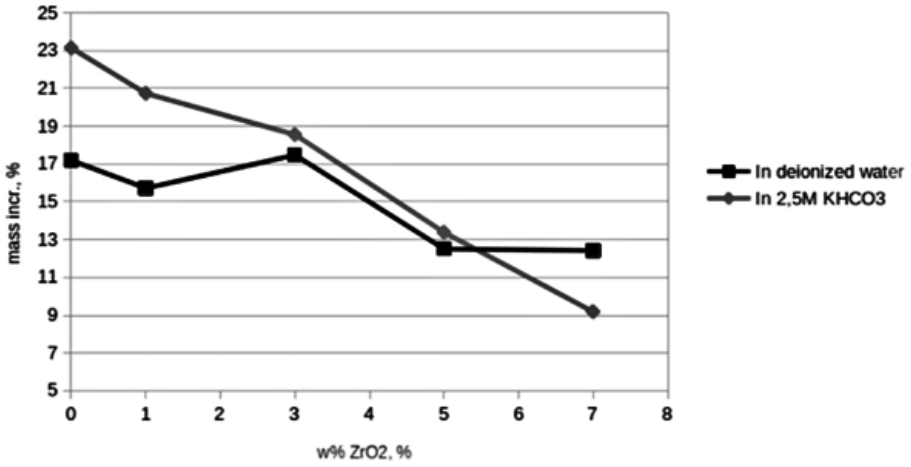

Figure 1 Thickness and mass changes for ZrO_2/ SPEEK composite membranes with a different ZrO_2 content in deionized water and 2.5M $KHCO_3$

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