POLY (VINYL) ALCOHOL ION EXCHANGE MEMBRANES FOR LOW TEMPERATURE ALKALINE FUEL CELLS

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Polyvinyl alcohol (PVA) is a white powdery substance in a crystalline character, which has wide industrial uses due to its high tensile strength, flexibility, high thermal and chemical stability, solubility and film forming ability. Polyvinyl alcohol is described with two numbers (PVA X-Y). First number (X) is the viscosity of 4% aqueous solution at 20°C as an indicator of the relative molar weight. The second number (Y) is the degree of hydrolysis (saponification).

Thin microporous PVA membranes were prepared by a solution casting method and a partial dissolution process. Poly (vinyl alcohol) (Aldrich, 99+% hydrolyzed, M.W. 89 000 – 98 000) was used as received. For our membranes was used 4 wt% PVA solution. The appropriate weight of PVA was poured with water into the sealed flask. The resulting solution was stirred continuously until a solution mixture took on a homogenous viscous appearance at 90°C for 120 min.

Later a glutaraldehyde (GA) crosslinker and H₂SO₄ catalyst were added to the above solution, which was after sonication poured into Petri dish. The solution was placed for 24 hours at room temperature for initiating polymerization, subsequently the polymerization process continued for 24 hours at 50°C. Thickness of dried membranes was between 0,12 – 0,18 mm.

Long-live stability of the solid membranes was tested in H₂O and 5,6M KOH electrolyte. For measurements of ionic conductivity of membranes was developed special 4-electrodes cell. In cell were used two platinum electrodes and two referent Hg/HgO electrodes. Measurements were carried out on Autolab PGSTAT 10 instruments. For each of the measured membrane was measured cyclic voltametry and impedance spectroscopy. For comparison of ionic conductivity of membranes was also measured a commercial membrane Fumatech FAS.

Results of measurements show that our membranes exhibits higher relative ionic conductivity than commercial products. Measured membranes have ionic conductivity between 0,918·10⁻²–1,27·10⁻² S·cm⁻¹. Fumatech FAS membrane has ionic conductivity 0,312·10⁻² S·cm⁻¹.

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References