



Development and characterisation of aromatic polymer materials for membranes in direct methanol fuel cells

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The advantages and disadvantages of the fuel cell technology were discussed in this dissertation. The essential position of the membrane development was illustrated. For direct methanol fuel cell (dmfc) application new polymer materials are needed, because the standard material NAFION® has too high costs and high permeability for methanol.

For cost reduced membranes aromatic, chemical and thermal stable, commercial available polymers on basis of Polyphenylsulfon (PPSU) and Polyphenyensulfid (PPS) were selected for modification. They were modified by using heterogeneous and homogeneous methods to introduce sulfonic acid groups for proton conductivity. Ion-Exchange-Capacities (IEC) between 0,8 and 3,8 mmol/g were reached. Membranes were formed from these materials and from sulfonated Polyetherketon (PEK) in a thickness of 25-100 µm. They were characterised by different analytical methods such as permeability measurement, impedance spectroscopy and fuel cell tests. Methanol selectivity was measured with temperature depending permeation of vapour and pervaporation at 55 °C. A decrease in permeability and selectivity of the membranes for methanol against water with factor 5 to 10 were reached. This is much better than NAFION® without an selectivity. The proton conductivity was measured with 55 mS/cm at 80 °C. With special post-treatment of the membranes such as crosslinking a decrease in capability in the fuel cell.

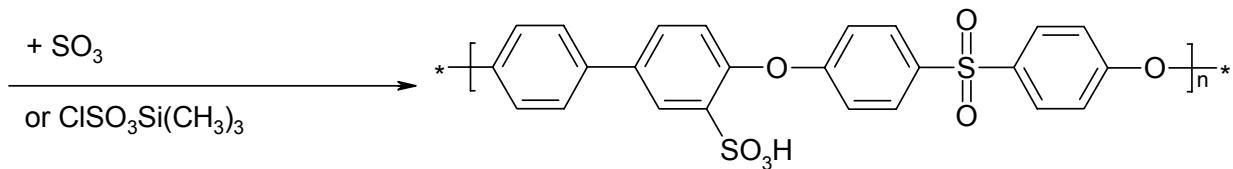


Figure: Sulfonation of Polyphenylsulfon with different reagents

An alternative method of membrane preparation leads to an asymmetric structure, which allows the combination of high mechanical stability and high proton conductance. The manufacturing of the membrane-electrode-assembly is optimised to increase the accessibility of the catalyst for the reactants in the three-dimensional-interface.