Nanoporous, Nanocomposite, Low-Cost Membranes for Low-Power Direct methanol Fuel Cells

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Direct methanol fuel cell (DMFC) is a relatively newborn of the great fuel cell family. However, the pace development of this system is such that it might not be unrealistic to expect it soon to hit the market.

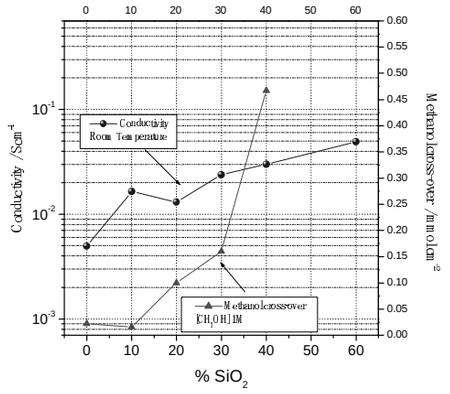
The most striking advantage of DMFC over the other systems is its functioning simplicity which makes possible the power source miniaturization and the potential use in portable electronics.

In order to consent large scale production of DMFC addressing to some key issues is unavoidable:
1) lower methanol permeation through the membrane (crossover);
2) less expensive membranes than Nafion;
3) better anode kinetics to reduce both catalyst costs and methanol crossover.

In this presentation we report on new, low-cost polydivinilidenfloride-based (PVdF), nanoporous, nanocomposite protonic membranes and their use in low-power, low-temperature DMFC.

The membranes were synthesised out of PVdF and different ceramic oxide commercial powders, and, subsequently, loaded with H_2SO_4 aqueous solutions at different concentrations. The ionic conductivity of the samples was measured in a temperature range up to 80°C in different environmental humidity levels. The methanol crossover was evaluated in static and dynamic conditions. Finally, membranes performances were evaluated by an home-made 1 cm^2 DMFC cell under typical low-power operating conditions.

Conductivity vs time and Methanol cross-over of PVDF-CTFE 20% membrane having different content of SiO_2



References

1) J. Nordlund and G. Lindbergh
J. Electrochem. Soc. 149, (9) A1107-A1113(2002)

Polarization curves for the cell:
Air / ***Membrane*** / metanol solution
Membrane: PVdF + 10% SiO_2,
Room Temperature