Influence of Platinum Loading on the Electrochemical Behaviour of Low Temperature DMFCs

A. Di Blasi, V. Baglio, P. Cretì, E. Modica, V. Antonucci, A. S. Arico'

CNR-ITAE Institute, via Salita S. Lucia sopra Contesse 98126 Messina, Italy

The most promising application of DMFCs presently concerns with the field of portable power sources. In this regard, increasing interest is devoted towards the miniaturization of these fuel cells devices in order to replace the current Li-ion batteries. Unfortunately, DMFC operation at low temperatures requires a high noble metal loading to enhance the kinetics of the methanol electro-oxidation reaction. In order to reduce ohmic drop and mass transport problems deriving by the use of thick electrodes, the present catalysts are usually unsupported Pt and Pt-Ru alloys. Furthermore, a high Pt loading is also necessary at the cathode to reduce the poisoning constraints due to the methanol cross-over.

In this work, an 85% Pt-Ru (1:1 a/o) alloy supported on Vulcan XC-72 was in-house prepared by using a sulfite complex route. An advantage of the high metal loading carbon supported anode approach relies on its large surface area, while it allows to maintain a low electrode thickness. Also a 60% Pt/Vulcan XC-72 was prepared using the same procedure and used as cathode catalyst.
The influence of noble metal loading on the performance of a DMFC operating at low temperatures (30-60°C) was investigated by steady-state polarization measurements. In-situ adsorbed methanolic residues stripping voltammetry was carried out to get information on electrode activity and catalyst utilization.

A maximum power density of about 75 mW cm^{-2} was recorded at 60°C and ambient pressure using 5 mg cm^{-2} Pt loading for both anode and cathode electrodes. By increasing the Pt loading up to 10 mg cm^{-2} no significant enhancement of performance was recorded. A decrease of the catalyst utilization was observed in the latter case, as confirmed by the adsorbed methanol stripping analysis.

Acknowledgements

The authors gratefully acknowledge the financial support of the European Commission through the Morepower Project SES6-CT-2003-502652.