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Kaluža, Luděk
2015

SYNTHESIS OF PT/C FUEL CELL ELECTROCATALYSTS: RESIDUAL CONTENT OF CHLORINE AND ACTIVITY IN OXYGEN REDUCTION

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Hydrogen and fuel cells represent a possible solution of modern transportation. Carbon-supported Pt is conventional catalyst in proton-exchange membrane fuel cells (PEMFC). Deposition of Pt over the support is usually based on i) impregnation of the support with a Pt containing solution followed by reduction[1] or on ii) precipitation of Pt out of the support surface and then mixing it with the support. Aqueous solution of H_2PtCl_6 is mostly used as Pt source. However, H_2PtCl_6 is expected to leave a certain amount of residual Cl species on the catalyst surface.[2] This residual chlorine is believed to decrease the catalytic activity in PEMFC[2], since Cl^- is well-known poison to Pt catalysts and it increases the propensity of PEMFC to corrosion. The aim of this work was to compare Pt/C prepared by impregnation of C followed by reduction and dechlorination (by NaOH(aq)[3] or NH_3(g)) with Pt/C prepared by precipitation of Pt (by microwave-assisted polyol method) followed by washing and controlled mixing with C, in terms of residual Cl content, electrochemically active surface area (ESA) and activity towards the oxygen reduction reaction (ORR). It was found that the medium-surface-area C, selected in our previous work[3] for the present experiments, resulted in catalysts with improved durability, but somewhat lower surface area and Pt dispersion (for the impregnated catalysts), in comparison to conventional reference catalysts based on high-surface-area C. The microwave-assisted polyol method featured smaller Pt nanoparticles, lower content of residual Cl and higher activities than those prepared by impregnation. On the other hand, the impregnated catalysts showed better durability of the Pt particles. Mass-specific ORR activities of the prepared Pt/Cs were of a similar size as that of the reference catalyst. The novel Pt/C catalysts are thus suitable for high-performance, durable membrane–electrode assemblies (MEAs) for PEMFCs.

Acknowledgement. The research leading to these results has received funding from the European Union's Seventh Framework Programme for the Fuel Cells and Hydrogen Joint Technology Initiative under Grant Agreement 303466 IMMEDIATE. L.K. and D.K. also acknowledge the co-financing of the Ministry of Education, Youth and Sports of the Czech Republic (grant no. 7HX13003).

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