

5TH REGIONAL
SYMPOSIUM ON
ELECTROCHEMISTRY
SOUTH EAST EUROPE

PROGRAM
BOOK OF ABSTRACTS

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Shape Controlled, Carbon Supported Pt Anodic Catalysts for DFAFC

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Electrocatalytic activity of platinum-based electrocatalysts used in fuel cells has been well recognized. However, significant attention remains on the particle shape and size control of such nanomaterials. Catalytic activity can be enhanced by alloying Pt with another element (e.g. Ru and Sn) [1], or by supporting Pt on metal oxides [2], both of which involve a bifunctional effect. It is also possible to achieve better catalytic characteristics by exposing different Pt crystal facets, which alters chemical and electronic interactions (structural effect) [3].

In order to synthesize Pt nanoparticles of a pre-determined shape, water in oil microemulsion method was used [4], with a few modifications: carbon support (Vulcan XC-72R) was added into the microemulsion itself, just after the completion of the reduction reaction of H_2PtCl_6 with NaBH_4 as the reducing agent and this was crucial for further improvements of the catalyst cleaning procedures. Microemulsion consisted of [n-heptane] / [polyethyleneglycol-dodecyether (BRIJ30)] / [0,1M H_2PtCl_6 in 0, 15, 25 and 35% HCl], so four Pt catalyst were formed using different amounts of HCl in the water phase of the microemulsion. In comparison to previously reported applications of the microemulsion method [5], where electrochemical treatment of catalysts before its application was necessary, this alteration of cleaning steps made use of the “as prepared” catalysts possible.

Catalysts A (0% HCl), B (15% HCl), C (25% HCl) and D (35% HCl) were characterized by thermogravimetric analysis (TGA), X-ray diffraction (XRD) and transmission electron microscopy (TEM), as well as with electrochemical characterization methods (cyclic voltammetry in supporting electrolyte, CO stripping). Some of the obtained results are given in the following figures.

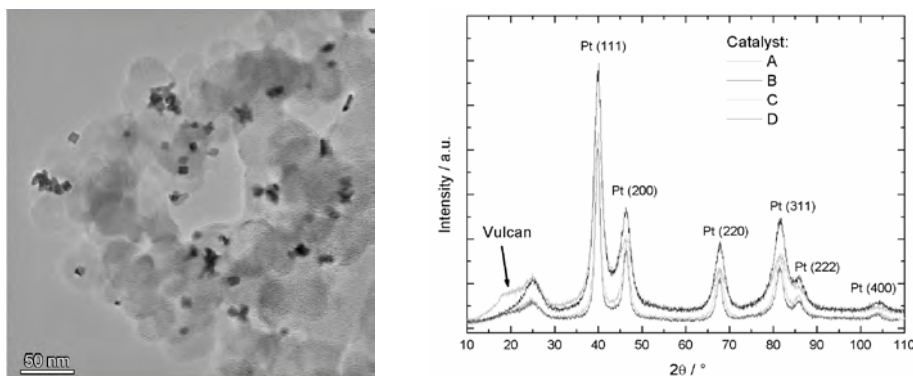


Fig. 1. Left: TEM image of catalyst D; right: XRD patterns of supported Pt catalysts

TEM images confirmed the presence of cubic Pt particles, and indicated their good dispersion on carbon support, while XRD patterns revealed the share of each plane orientation in all investigated catalysts. This acknowledged the influence of HCl in the microemulsion on the shape of Pt particles. Mean particle size was determined both by TEM and XRD investigations, which are in good accordance, and show that average diameters of these four catalysts vary from 3 to 8 nm.