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Doped tin dioxide aerogels as alternative catalyst supports for Proton Exchange Membrane Fuel Cells

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Catalyst supports for Polymer Electrolyte Fuel Cells (PEFC) are currently made up of carbon blacks. This material is however not thermodynamically stable in fuel cell operating conditions and loss of performance is observed with time, especially at the cathode side. To improve PEFC durability and make this technology a credible alternative to conventional power sources, carbon free cathodes were prepared. With a remarkable morphology, aerogels have already proven their ability to efficiently support catalysts for PEMFC application [1, 2]. In this study doped tin dioxide aerogels are proposed as alternative supports presumably stable in PEMFC operating conditions.

Antimony, niobium or tantalum doped tin dioxide aerogels were synthetized using sol-gel route in acidic media from alkoxide precursors. These materials have shown particularly adapted physico-chemical properties [3]. Platinum was deposited on doped SnO_2 aerogels following two methods. Method A was based on the impregnation of a platinum salt further reduced in a reducing atmosphere or under UV irradiation. The influence of a post heat treatment was studied. Method EG is a conventional polyol method using ethylene glycol. Electrocatalysts structures and morphologies were investigated by X-ray diffraction and transmission electron spectroscopy. Active Electrochemical Surface Areas (ECSA) and catalytic activities for oxygen reduction reaction (ORR) were measured on Rotating Disk Electrode (RDE). Heat treatments have shown direct influence on Pt structure and crystallinity. Highest ECSA was recorded after method A (45 m^2. mg_{Pt}^{-1}) while highest ORR mass activity was measured after method EG (40 mA. mg_{Pt}^{-1}). This value is even higher

than that of the chosen carbon based electrocatalyst reference, TEC10E40E, measured in the same conditions (23.4 mA. mg_{Pt}^{-1}).

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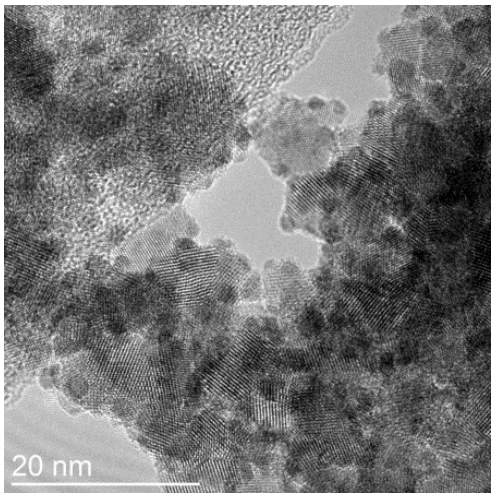


Figure 1. TEM image of a Pt/Sb-doped SnO_2 aerogel obtained from method A

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