Sb or Nb doped tin dioxide aerogels based PEFC cathode

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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 PEFC application [1, 2]. In this study doped tin dioxide aerogels are proposed as alternative support presumably stable in PEFC operating conditions.

Antimony and niobium 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 catalyst supported on doped SnO_2 aerogels was prepared by two methods. Method A was based on the impregnation of a platinum salt followed by a reduction under UV and a heat treatment in oxidative or reducing atmosphere. 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). Method A leads to the formation of particularly well dispersed Pt nanoparticles on aerogel surface (Figure 1), whereas filament form was observed after the use of Method EG. 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}). Half-cell and MEA singlecell test measurements will also be presented to complete the characterization panel.

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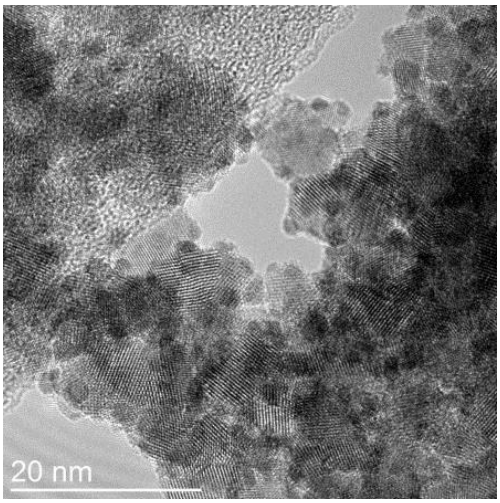

Figure 1. TEM image of a Pt/Sb doped (10 at%) SnO_2 aerogel from method A

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