Ordered Mesoporous Carbon Synthesized via Self-Assembly in Aqueous Phase as Support for ORR Pt Electrocatalyst

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ABSTRACT

Carbon-supported Pt or Pt-alloys are generally used as cathode electrocatalysts in Direct Oxidation Fuel Cells (DOFCs) in order to promote an enhancement of the oxygen reduction reaction (ORR) kinetics. Ordered Mesoporous Carbon (OMC) has received great attention to be used as support for fuel cell electrocatalysts due to its relatively large pores and high surface area, which allows a high concentration of catalytic active sites, facilitating the mass transport process. In this work, OMC has been synthesized via self-assembly in aqueous phase using a mixture of resorcinol/formaldehyde as carbon precursor. Afterwards, Pt/OMC electrocatalysts have been obtained by deposition of metal nanoparticles using the polyol reduction process. The materials have been characterized by BET, XRD and TEM analysis. The catalytic activity for the ORR of the Pt/OMC electrocatalysts has been evaluated by linear scan voltammetry under potenciodynamic conditions in acid media. The results have been compared with those obtained from a Pt/C (C=Vulcan) electrocatalysts synthesized by the same method. The effect of the home-developed OMC on the Pt structure and how the metal-support interaction influences its catalytic activity for the ORR has been evaluated. Structural characterization has revealed a BET surface area of OMC of nearly ~530 $m^2 g^{-1}$, while TEM studies of Pt/OMC have indicated a Pt particle size around 2.5 nm. The results have shown that the type of carbon support has a positive effect on the Pt particle size and that the specific activity of the Pt/OMC electrocatalysts is comparable to that of Pt/C.

Keywords: Ordered Mesoporous Carbon, Oxygen Reduction Reaction, Pt nanoparticles.

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