Influence of the Synthesis Parameters in CNT Doped with Nitrogen Towards the Electroreduction of Oxygen

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ABSTRACT

One of challenges in the commercialization of fuel cells is the high cost and scarcity of platinum based catalysts. In addition, there is also the slow kinetics problem in the oxygen reduction reaction (ORR). Therefore, alternative electrocatalysts are needed. Systems based on doped carbon nanostructures (without the use of active metals) have been proposed as a good option to solve both of the drawbacks before mentioned. In the present study, nitrogen doped carbon nanotubes (N-CNTs) were by a chemical vapor deposition method. Pyridine was used as carbon and nitrogen precursor and ferrocene as a metal catalyst for the nanotubes growth. Different synthesis conditions such as temperature of the reactor, carrier gas flow, concentration of the reactants, and vaporizer temperature were studied. The purpose of this variation of parameters was to found the optimal conditions in which the material achieves the best catalytic activity. The electrocatalytic performance was evaluated towards the ORR by linear sweep voltammetry measurements. A catalyst-coated rotating disk electrode at different rotation rates in 0.5 M H_2SO_4 solution was performed. The results show that the reactor temperature and gas flow significantly influence the characteristics of the materials and hence the electrocatalytic activity for ORR. The factors that determine the high electrocatalytic activity of the N-CNTs are discussed.

Keywords: Nanotubes; Carbon; Synthesis.