

The Effect of Physicochemical Pretreatment of Supported Pt Nanoparticles for the ORR. A Novel Carbon from Natural Source.

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ABSTRACT

Materials used as nanoparticles supports play an important role in the performance, efficiency and stability of catalysts applied in polymer fuel cells. Carbon supports have been employed for their excellent properties like good electronic conduction, high surface area, relative crystallinity and resistance to acids and alkalis moderate. The surface modification of carbon by physicochemical treatment (functionalization) has a favorable effect on the performance and stability of the catalyst to improve the metal-support interaction through anchoring sites which in turn favor the distribution of the metal particles on the carbon matrix. The shape and particle size are influenced by the properties of the support and these characteristics are directly related (together with the diffusion of gases and ionomer interaction conductor) with the catalytic activity towards the reactions of interest. Pre-treated Carbon Vulcan with nitric acid is the most used support for nanoparticles in polymer fuel cell. However its origin derived from the combustion of waste oil (non-renewable energy source) makes it unattractive for future applications by issues of environmental pollution, furthermore the sulfur content and other impurities can degrade and decrease the lifetime of the metal catalysts. In this study we present the research for a new type of carbon obtained by a simple process from natural sources. This carbon was treated by different physicochemical methods and then Pt nanoparticles were synthesized and supported by chemical reduction with NaBH₄ on the different pre-treated carbons. This work plan is performed with the main target to evaluate the potential use of natural carbon as a novel support material and to analyze the effect of different treatments on the catalytic activity of nanoparticles towards the ORR. The study is complemented by physical characterization techniques like TEM, SEM, EDAX, Raman, FTIR and electrochemical techniques by RDE in acid medium. All the results are compared with Pt/Vulcan Carbon pre-treated.

Keywords: Novel natural carbon; Oxygen reduction reaction; Physicochemical pretreatment to carbon.

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