Carbon paper coated with Metal-free C-N electrocatalyst for Oxygen Reduction Reaction in Proton Exchange Membrane Fuel Cell

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Polyaniline (PANI) nanofibers were synthesized on carbon paper by electrochemical method, then heat-treated at temperatures of 800°C, 900°C, 1000°C and 1100°C to obtain a gas diffusion electrode (GDE). Fourier Transform infrared spectroscopy (FTIR), Scanning electron microscope (SEM), Transmission electron microscopy (TEM), X-ray diffraction (XRD) and X-ray photoelectron spectroscopy (XPS) were used to characterize the catalysts. The metal-free C-N catalyst with a reticular structure was coated on carbon paper. The ORR (oxygen reduction reaction) activity of metal-free C-N catalysts was evaluated by cyclic voltammetry (CV) and rotating disk electrode (RDE) in HClO₄. The results showed that the catalysts heat-treated at 1000°C had the best ORR activity and better stability compared with the commercial Pt-based catalysts in acidic medium. The result of XPS showed that the activity of metal-free C-N catalysts was related to the pyridinic-type nitrogen. Finally, the advantages and disadvantages of these catalysts were discussed for further investigation.

Keywords: Proton exchange membrane fuel cell (PEMFC), Metal-free catalyst, Electropolymerization, Oxygen reduction reaction

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