Nitrogen and Phosphorus Self-Doped Carbon Supported Palladium as Highly Efficient Electrocatalysts for Formic Acid Oxidation

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Exploring new Pd-based catalysts with both high activity and CO resistance for formic acid oxidation remains of great importance of direct formic acid fuel cell (DFAFC) technology. Here, a nitrogen and phosphorus self-doped carbon have been facilely synthesized by a direct pyrolysis of aminophosphonic acid resin (APAR) which was employed as the N, P and C sources. The synthesized N, P self-doped carbon at different temperatures (NPC-T, T=850, 900, 950, 1000 °C) were used as supports for the preparation of Pd/NPC-T electrocatalysts by microwave-assisted glycol reduction method. All prepared catalysts show better catalytic performance than commercial Pd/C counterparts towards formic acid electro-oxidation (FAEO). Among them, Pd/NPC-900 demonstrates optimal electrocatalytic activity with an enhancing factor of 1.98 than commercial Pd/C catalyst. Moreover, the Pd/NPC-T catalysts present excellent stability, highly tolerant to CO poisoning and faster charge-transfer kinetics of FAEO. The superior catalytic performance of the Pd/NPC-T catalysts are attributed to the doping of nitrogen

and phosphorus, which modified the electronic structure of Pd particles and accelerated the removal of CO intermediates.

Keywords: N, P self-doped carbon; Pd electrocatalyst; Formic acid oxidation; Microwave-assisted reduction

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