Palladium Nanoparticles Supported on Phosphorus-Doped Graphitic Carbon Nitride/Carbon Black Hybrids for Formic Acid Electro-Oxidation

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A novel hybrid supports consisting of phosphorus-doped graphitic carbon nitride and carbon black were prepared for loading Pd nanoparticles (NPs). The obtained Pd/C-PCN catalysts exhibited superior catalytic performance towards formic acid electro-oxidation (FAO). The anchoring effect of the graphite carbon nitride (g-C₃N₄) improved the dispersibility of Pd NPs. It is found that the Pd NPs with a reduced average diameter dispersed on g-C₃N₄ supports compared to that on carbon black. After doping with phosphorus, the prepared Pd/C-PCN-X catalysts has a further improvement in the activity and durability of FAO. Pd/C-PCN-0.2 shows the highest peak current density for FAO. Its peak current density reached 771 A/g, which is 2.15 times that of Pd/C (358 A/g). It also exhibited the best stability for FAO. The enhanced catalytic performances of this Pd/C-PCN-X catalysts can be attributed to high dispersion of Pd NPs and improved electronic structure of Pd NPs caused by P doping.

Keywords: carbon nitride; phosphorus-doped; palladium; formic acid oxidation; electrocatalysis

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