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Impregnation Reduction Method for the Preparation of Platinum-Nickel/Carbon Black Alloy Nanoparticles as Faor Electrocatalyst

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Abstract : In order to enhance the efficiency and stability of an electrocatalyst for formic acid electro-oxidation reaction (FAOR), we developed a method to create Pt/Ni nanoparticles with carbon black. These nanoparticles were prepared using a simple impregnation reduction technique. During the observation, it was found that the nanoparticles had a spherical shape. Additionally, the average particle size remained consistent, falling within the range of about 4 nm. This approach aimed to obtain a loaded Pt-based electrocatalyst that would exhibit improved performance and stability when used in FAOR applications. By utilizing the impregnation reduction method and incorporating Ni nanoparticles along with Pt, we sought to enhance the catalytic properties of the material. By incorporating Ni atoms into the Pt structure, the electronic properties of Pt are modified, resulting in a delay in the chemisorption of harmful CO intermediate species. This modification also promotes the dehydrogenation pathway of the formic acid oxidation reaction (FAOR). Through electrochemical analysis, it has been observed that the Pt3Ni-C catalyst exhibits enhanced performance in FAOR compared to traditional Pt catalysts. This means that the addition of Ni atoms improves the efficiency and effectiveness of the Pt3Ni-C catalyst in facilitating the FAOR process. Overall, the utilization of these alloy nanoparticles as electrocatalysts represents a significant advancement in fuel cell technology.

Keywords : electrocatalyst, impregnation reduction method, formic acid electro-oxidation reaction, fuel cells
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