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Synergistic Effect of Graphene Oxide on Fe/ZIF-67 for the Electrocatalytic Reaction of Oxygen Evolution

Mustafa Farajzadeh,[a] Fatemeh Rahnemaye Rahsepar [a]*

[a] *School of Chemistry, College of Science, University of Tehran, Tehran 1417614411, Iran*

[*] *E-mail: frahsepar@ut.ac.ir*

Nowadays, fossil fuels alone will not be enough to meet ever-increasing energy demands to develop sustainable energy. Therefore, a clean pathway to produce sustainable energy carriers has been introduced through electrochemical water splitting containing hydrogen and oxygen evolution reactions (HER and OER) [1]. OER is generally considered to be the rate-limiting step of water splitting, and so the development of inexpensive, low-cost, and efficient OER electrocatalysts is essential [2]. Herein, we propose easily prepared bimetallic zeolitic imidazolate framework-67 (Fe/ZIF-67) on graphene oxide (GO) to investigate the synergistic effect of GO in OER process. The prepared electrocatalyst was characterized using X-ray diffraction (XRD), field emission scanning electron microscopy (FE-SEM) coupling Energy-dispersive X-ray spectroscopy (EDS) and Fourier transform infrared spectroscopy (FT-IR). According to the characterization methods the Fe/ZIF-67 nanoparticles were uniformly dispersed on graphene, which provides many more active sites to achieve the better performance of OER. Therefore, Fe/ZIF-67/GO composites compared with ZIF-67 and Fe/ZIF-67 displays low overpotential of 354 and 397 mV at the current density of 5 and 10 mA cm^{-2}, respectively, with a small Tafel slope of 110 mV dec^{-1} in alkaline media. The excellent OER performance is mainly owed to its unique nanoarchitecture and the synergistic effects: not only uniformly dispersed Fe/ZIF-67 nanoparticles on graphene guarantee large specific area and abundant active sites, but also the porous nanostructure benefits electrolyte penetration. This work provides a deep understanding of how to boost catalytic efficiency using GO in the structure of electrocatalysts.

Keywords: Water splitting, Oxygen evolution reaction, Graphene oxide, Zeolite-imidazole framework

References

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