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Enhancing Oxygen-Evolution Reaction in Alkaline Conditions with Anodized FeNi Alloy

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The efficient and durable catalysis of the oxygen-evolution reaction (OER) is crucial for the conversion of energy through the water-splitting process. The OER, which involves the oxidation of water, can provide electrons for reduction reactions of H_2O, CO_2, and N_2, leading to the production of valuable compounds. In this study, a FeNi alloy foam with a Ni:Fe ratio of 1:1 was anodized at 50 V in a two-electrode system in a KOH solution (1.0 M). The resulting material was characterized using various techniques including Raman spectroscopy, diffuse reflectance spectroscopy (DRS), X-ray diffraction (XRD), scanning electron microscopy (SEM), energy-dispersive X-ray spectrometry (EDX), transmission electron microscopy (TEM), and high-angle annular dark-field imaging (HAADF)-scanning transmission electron microscopy (STEM). This FeNi alloy foam was found to be an efficient and durable electrocatalyst for the OER in a KOH solution (1.0 M). The onset overpotential for the OER, based on extrapolation of the Tafel plot, was 225 mV, while the overpotentials for current densities of 10 and 30 mA/cm^2 were observed at 270 and 290 mV, respectively. Additionally, a low Tafel slope of 38.0 mV per decade was observed for the OER. To investigate the mechanism of the OER, in situ surface-enhanced Raman spectroscopy was employed to detect high-valent Fe and Ni species formed on the electrode surface.

Keywords: Artificial Photosynthesis, Nickel, Iron, Oxygen-evolution Reaction

References

[1] Cushing, L. J.; Li, S.; Steiger, B. B.; Casey, J. A. *Nature Energy,* ***2023***, *8 (1), 52-61.*

[2] Hota, P.; Das, A.; Maiti, D. K. *International Journal of Hydrogen Energy,* ***2023***, *48* (2), 523-541.

[3] Zhang, B.; Luo, H.; Ai, B.; Gou, Q.; Deng, J.; Wang, J.; Zheng, Y.; Xiao, J.; Li, M. *Small,* ***2023***, *19* (3), *2205431.*

[4] Corrigan, D. A. *Journal of The Electrochemical Society,* ***1987***, *134* (2), 377.

[5] Zhang, Q.; Hu, Y.; Wu, H.; Zhao, X.; Wang, M.; Wang, S.; Feng, R.; Chen, Q.; Song, F.; Chen, M. *ACS Nano,* ***2023***, *17*, 1485–1494.