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GH. Barati Darband, M. Aliofkhazraei, A. Sabour Rouhaghdam, M.A. Kiani

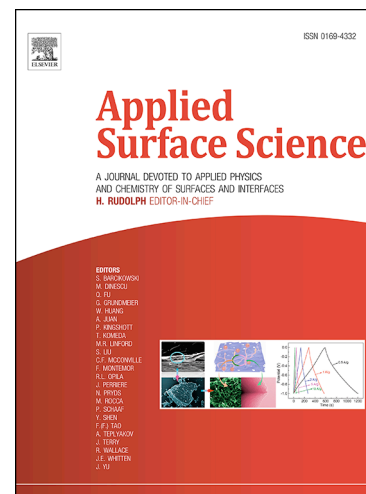
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Three-Dimensional Ni-Co Alloy Hierarchical Nanostructure as Efficient Non-noble-metal Electrocatalyst for Hydrogen Evolution Reaction

Gh. Barati Darband¹, M. Aliofkhazraei^{1*}, A. Sabour Rouhaghdam¹, M.A. Kiani²

1- Department of Materials Engineering, Tarbiat Modares University, Tehran, Iran, P.O. Box: 14115-143, Tehran, Iran

2- Chemistry & Chemical Engineering Research Center of Iran, P.O. Box 14335-186, Tehran Iran

*Corresponding author: Tel.: +98-912-6905626, Fax: +98-21-66960664, E-mail address: maliofkh@gmail.com, khazraei@modares.ac.ir

Abstract

Hydrogen is an ideal energy carrier with ultrahigh energy value that is believed to be the best candidate for replacement for fossil fuel. Thus, fabrication of novel materials and structures for this purpose is one of the important challenges of our times. In this study, Ni-Co nanocones as new structure was fabricated by electrodeposition method in the bath containing crystal modifier and electrocatalytic activity of these structures for HER was studied in 1.0 M KOH solution. Scanning electron microscope (SEM), X-ray diffraction (XRD) method and Atomic force microscopy (AFM) were used for physical characterization. Linear sweep voltammetry (LSV), electrochemical impedance spectroscopy (EIS) and Chronopotentiometry were used for electrocatalytic activity evaluations. Fabricated Ni-Co alloy nanocones exhibited an enhanced electrocatalytic activity for HER. Best electrocatalytic activity was obtained for alloy prepared at Ni/Co salts ratio of about 8, in which η_{10} = 107 mV, η_{20} =142 mV and η_{100} =198 mV. This remarkable activity is mainly attributed to the high surface area of the nanocones and also synergistic effect between Ni and Co while decreasing the bubble resistance as a result of fabrication of nanocones. Additionally, the Ni-Co alloy catalyst displayed good durability and affords long-term electrolysis without activity degradation. This study offers a facile fabrication method for in situ growth of 3-D

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