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Ni-Cr alloys for effectively enhancing hydrogen evolution processes in phosphate-buffered neutral electrolytes

Abstract

Significant efforts have been made to develop highly active non-noble metal-based, affordable metallic and stable electro-catalysts for hydrogen evolution reaction (HER). Strong acid and bases are now used in HER operations to achieve large-scale, sustained H2 fuel production. However, few studies have utilized phosphate-buffered neutral electrolytes (PBS) in the field of neutral electrolyte technology. In this work, a certain alloys with a Ni-Cr basis have been produced as favorable components for the HER under neutral conditions.

Additionally, the current investigations are emphasizing on the concentration of buffer phosphate species in the HER activity of various materials. By employing polarization and electrochemical impedance spectroscopy (EIS) in neutral solutions, the electro-catalytic activity of new alloys on HER was evaluated. According to the preliminary findings, the examined Ni-Cr-based alloys show superior HER catalytic activity in neutral electrolytes.

Additionally, the Ni-Cr alloy matrix with Fe and Mo added enhances HER electrocatalytic efficiency while lowering interfacial charge transfer resistance. Due to its low overpotential of 297 mV @ 10 mA cm2 and Tafel slope of 94 mV dec1 in 1.0 M PBS media, the Ni-Cr-Mo -Fe alloy exhibits an efficient HER, suggesting that the Ni-Cr-Mo-Fe electrode will be

a
potential noble metal-free electro-catalyst for HER. The Ni-Cr-Mo-Fe cathode is a readily
available and affordable material for the production of HER in neutral medium.

Publishing Date: 26/9/2022