Title	Electroplated Ni-Cu nanocrystalline alloys and their electrocatalytic activity for hydrogen generation using alkaline solutions
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Abstract

Hydrogen can be significantly considered the sustainable fuel for the energy storage and conversion. In this work, we synthesize nanocrystalline Ni-Cu alloys across the range of compositions and show that Ni-Cu alloys are indeed more active than pure nickel for hydrogen evolution reactions. The electroplated Ni-Cu alloy were characterized by scanning electron microscopy (SEM), energy dispersive X-ray spectroscopy (EDX), X-ray diffraction, XRD, and energy dispersive X-ray, EDX. The HER was studied at electroplated Ni-Cu alloys in 1.0 M KOH solution at 298 K. The electroplated Ni-Cu alloys were investigated by cyclic voltammetry (CV), electrochemical impedance spectroscopy (EIS) and polarization measurements to determine their electrocatalytic activity for the HER. The use of the appropriate concentrations of the addition agent simultaneously with the ultrasound waves during sample preparation was found to produce nanocrystalline Ni-Cu alloys. XRD patterns show that the Ni-Cu alloys possess the face centered cubic structure. The incorporation of Cu into the Ni alloys causes surface modification, which catalyzes the hydrogen evolution reaction (HER). The electroplated Ni-Cu alloy with 49 at% Cu contents shows the highest rate of hydrogen evolution. The increase of the Cu content more than 50 at% was accompanied by a decrease in the rate of HER.