Electrochemical performance of Ni-RE (RE = rare earth) as electrode material for hydrogen evolution reaction in alkaline medium (Conference Paper)

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Abstract

In this work, Ni-RE (RE = rare earth, La, Ce) materials were obtained by the solid state reaction using as Ni source: a) metal acetylacetonates and b) metal powders while rare earth element was added from acetylacetonates. These materials were synthesized for 3 h at different temperatures (800 °C or 900 °C, 1000 °C and 1200 °C) in order to evaluate their electrochemical performance on the Hydrogen Evolution Reaction (HER). The effects of the sintering temperature and the Ni source on the morphology, structure and particle size were evaluated and correlated with the displayed catalytic activity. The results showed that depending of the added rare earth element and Ni source the formed compounds varied from a mixture of oxides (NiO, CeO_2) and intermetallic compounds ($LaNiO_3$) at low annealing temperatures up to the formation of the NiO-CeO_2, NiO-$LaNiO_3$ and NiO-$La_4Ni_3O_{10}$ compounds at 1200 °C. From Scanning Electron Microscopy (SEM) results, it was observed that the agglomerates of Ni-RE electrode materials presented a more uniform shape (semispherical) and lower crystal sizes (0.2-2.0 μm) using acetylacetonate precursors than that obtained with Ni powders (5-50 μm). It was found that the individual organization of the nickel particles and their electrocatalytic activity is affected by diverse factors: a) the type of precursor used in the synthesis, b) the reaction temperature and c) the synergetic effect caused by the addition of the rare earth metal, which seems to be better for lanthanum than for cerium. The Tafel parameters of the stabilized Ni-RE electrodes revealed that the formation of Ni-La intermetallic compounds at low temperature favors the current densities on the HER. Thus a clear dependence of the electrocatalytic activity on the source of these Ni-RE materials was observed.

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