Electrocatalytic behavior of Ni-(Nb,Ta,Mo)-B amorphous alloys for hydrogen evolution

Lyuben Mihailov, Ivailo Tsvetanov, Tony Spassov

Faculty of Chemistry, University of Sofia, 1164 Sofia, Bulgaria.
E-mail: superlyubo@abv.bg

Ni-(Nb,Ta,Mo)-B amorphous alloys were synthesized by rapid quenching from the melt, using a planar flow technique. Their thermal stability and crystallization behavior were studied by differential scanning calorimetry and x-ray diffraction. The electrocatalytic activity of the as-quenched amorphous alloys with respect to the hydrogen evolution reaction (HER) in alkaline water electrolysis was studied in relation to the alloy composition. The kinetic parameters of the HER were evaluated by cyclic voltammetry and impedance spectroscopy techniques in 6M KOH at room temperature. The as-quenched alloys revealed good stability relative to that of crystalline Ni. The electrocatalytic activity of the amorphous alloys was found to depend on the alloy composition. It was obtained that molybdenum and niobium containing amorphous alloys showed an increased electrocatalytic activity in the HER compared to pure Ni. This is due to an improved intrinsic activity of the material, explained with the change of the electron density in the d-shell upon alloying Ni with Mo and Nb.