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Abstract

The use of eutectic solvents for electrodeposition of Ni-Mo alloy coatings as electrocatalytically active materials for the hydrogen evolution reaction in alkaline solutions

The doctoral dissertation presents the possibility of obtaining electrochemically active Ni-Mo coatings in the reaction of hydrogen evolution by electrolysis from alkaline solutions. Ni-Mo coatings were prepared by electrodeposition from non-aqueous baths composed of eutectic solvent ChCl:PG and metal salts: $NiCl_2 \cdot 6H_2O$ and $(NH_4)_6Mo_7O_{24} \cdot 4H_2O$. The electrocatalytic properties of the coatings in 1 $mol \cdot dm^{-3}$ KOH solution were investigated using electrochemical techniques such as cyclic voltammetry, potentiodynamic polarization, electrochemical impedance spectroscopy, chronopotentiometry. It characterized surface morphology, topography, structure, phase and surface composition.

The Ni-Mo alloy coatings had better catalytic activity in HER than the reference nickel coating, also when tested under variable potential. The mechanism of hydrogen evolution was referred to as Volmer-Heyrovsky. The produced coatings were characterized by a fairly low excess of hydrogen evolution compared to the literature data. The materials generally had a homogeneous morphology. In the alloy shells, there was an intergranular phase with stoichiometry similar to $Ni_{0.80}Mo_{0.20}$. The indicated compound formed a gradient deep into the coating. In the raw state, the surface of the selected Ni-Mo coating was composed mainly of metallic nickel, while molybdenum predominated in oxidized forms. The fabricated materials had properties that predisposed them to be used in the processes of hydrogen evolution from alkaline solutions.