

STUDY OF NI–V ALLOY COATING ELECTRODEPOSITION FROM SULFATE ELECTROLYTE

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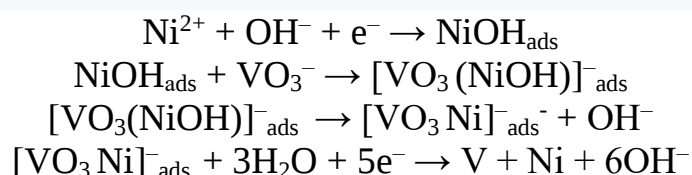
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The study of existing energy-saving materials and obtaining the new ones, which can be used to reduce the cost of the hydrogen production, are among important research topics in recent years. Such materials should possess catalytic activity against the hydrogen evolution reaction that can be achieved by incorporating vanadium to their composition. It is known that vanadium in the metallic state is not separately electrodeposited from aqueous solutions but can be co-deposited with metals of the iron group, forming alloys. This phenomenon is called induced co-deposition.

For formation of nickel-vanadium alloy coating a nickel sulphate electrolyte with addition of vanadium in vanadate ion VO_3^- form was used.

Induced co-deposition can be explained by the mechanism with the formation of a cluster intermetallic compound with a Ni-V bond.



The stage of electron attachment is delayed rate limiting that is confirmed by the linear dependence of the overvoltage on the current density in the electrochemical kinetics coordinates. The formation of the $[\text{VO}_3(\text{Ni})]_{\text{ads}}$ particle leads to a rearrangement and a sharp weakening of the vanadium-oxygen binding energy, which makes the whole particle unstable promoting the electrolytic discharge at the cathode according to the last reaction. The final stage of the process of vanadium and nickel reduction is the crystallization of both metals from adatoms. All refractory metals in aqueous solution in the form of anions in the oxidation state from +4 to +6 (W, V, Ti, Mo, etc.) can form cluster compounds with a metal-metal bond.

Electrodes with nickel-vanadium coating can be recommended as a cathode material for the electrochemical production of hydrogen. Hydrogen evolution overvoltage decrease also reduces the energy consumption for this process.

References:

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