DEVELOPING AN ELECTROCATOLYTIC Ni-V COATING AS CATHOD MATERIAL FOR THE ELECTROCHEMICAL PRODUCTION OF HYDROGEN WITH AN ALUMO-DEPOLARIZING CYCLE

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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 produced hydrogen, is relevant for modern hydrogen energy. Materials that have vanadium in their composition can have such properties.

The co-deposition of nickel with vanadium was investigated in the work. As a result of the research, it was found that the formation of high-quality nickel-vanadium alloy coating (Fig.) is possible from a nickel sulphate electrolyte with addition of 0.1–0.3 g/dm^3 (in terms of metal) vanadate-ion VO^{3-}. The content of vanadium in the coating is (0.2–0.45) %.The process was carried out at a current density of 2–5 A/dm^2, at a temperature of 25–30 °C, pH = 4.5–5.5.

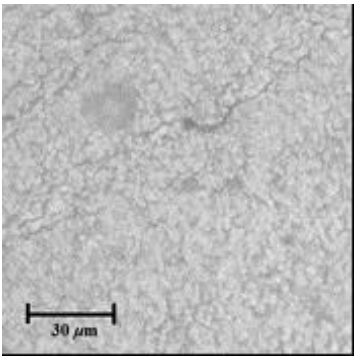

Fig. Nickel-vanadium coating surface

The catalytic activity study of the coating that was obtained using nickel-vanadium alloy in relation to the reaction of hydrogen reduction at the cathode was performed in solution of 2.5 M NaOH + 0.02 M NaCl. By increasing the vanadium content in the coating from 0.2 to 0.45 % the hydrogen evolution overvoltage is reduced by 70–100 mV. Compared to electrodes, which are used in industrial water-alkali electrolysis, the overvoltage of hydrogen reduction on a nickel-vanadium-coated electrode is on average less by 150–200 mV (Table).

Table. Kinetic parameters of the HER on the cathodes made of various materials

Material of electrode	-a, V	-b, V	-lg j_0
St.20 with Ni-V coating	0.47	0.1	4.73
St.20 with Ni coating	0.67	0.14	6.24
St.20	0.62	0.12	5.4

Electrodes with coating, obtained by nickel-vanadium alloy can be recommended as a cathode material for the electrochemical production of hydrogen with an alumina depolarizing cycle. Hydrogen evolution overvoltage reduce also reduces the energy consumption for this process.