ENERGY-SAVING ELECTRODE MATERIALS FOR THE ELECTROCHEMICAL PRODUCTION OF HYDROGEN

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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. Aluminum alloys and materials that have vanadium in their composition are promising for implementation for solving this problem.

Carbon-free steels of the 12Cr1MoV type, containing vanadium and molybdenum carbides and nickel-vanadium coating obtained via electrocatalytic process were studied as cathode materials in this work. Overvoltage of hydrogen evolution reaction is lower by 150 – 200 mV on such materials than on the steel electrodes. The vanadium content in the coating is 0,2 – 0,45%.

The AMg type aluminum alloys for oxygen-free electrochemical hydrogen production from alkali-chloride solutions were investigated as cathode materials application. Electrolyzers without separating elements (membranes, diaphragms) can be successfully used for this process. Hydrogen releasing was observed on both cathode and anode electrodes. Hydrogen evolution on the anode is caused by an intense corrosion prosses with hydrogen depolarization. Electrolysis voltage does not exceed 0,8–1V. Based on studies electrodes made with steel 12Cr1MoV and with nickel-vanadium alloy coating can be recommended as a cathode material for the hydrogen electrochemical production with anode process depolarization by the AMg aluminum alloy.

Simplified technological process for the oxygen-free electrochemical hydrogen production with an aluminum depolarizing cycle was proposed. It can be used for hydrogen production with low productivity (up to 10 m^3/ $dm^2 \cdot h$) that can be applied in energetics for heat production and chemical industry as well as for domestic purposes. The cost of hydrogen produced via the new technology process is comparable to the cost of natural gas and has great potential and perspectives for its production.

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