MATERIALS FOR HYDROGEN ENERGY

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Hydrogen energy requires developing materials of sufficiently high purity which would exhibit necessary structure and specified service properties. Hydrogen storage, transport and conversion to produce clean energy are impossible without developing efficient technologies for making such materials.

Developing efficient fuel cells (FC) of a wide nomenclature, which are main components of hydrogen equipment, requires structural materials having necessary properties. Pure manganese, yttrium, scandium, strontium, lanthanum, cerium, vanadium, neodymium and some other oxides are used as a cathode material for FCs [3].

In some FCs, platinum and palladium are used as catalysts for hydrogen oxidation [2, 5].

This group of pure matters may be significantly widened after performing extensive research. Experiments have already proved the perspectives of developing solid-state high-temperature FCs with a ceramic electrolyte and a composite anode based on nuclear pure zirconium which require decreasing grains down to nanosize [1,3,6].

Cerium, samarium, yttrium, scandium, strontium, nickel oxides were tested as alloying elements improving physical properties of composites.

Production of these matters is based on nuclear-pure technologies consisting in the processes of fine purification of the matters by sorption and extraction methods using current efficient technique.

This paper gives a review on such technologies which worked and found practical applications in industry.

Developing the high-performance FCs is impossible without using such precious metals as platinum and palladium but their deficiency and high specific consumption make the products significantly expensive and hinder their wide applications [2].

Therefore the technologies where the use of these precious metals is significantly decreased and their substitutes demonstrate not worse results are rather promising.

The work, which is performed in Ukraine, on using molybdenum and tungsten carbides instead of platinum and palladium [2], and on developing multifunctional catalysts accelerating reactions with lower Pt and Pd consumption is of scientific interest.

The present report gives an overview of current technologies for producing molybdenum and tungsten oxides of high purity suitable for preparing carbides, and gold as a support for catalysts.

Iron alloys with nickel, chromium and cobalt were studied as invar compounds that match ceramics for full cells but no one is produced in Ukraine [4].

The deposit of nickel-copper sulfide ores was discovered in Ukraine, Dnepropetrovsk region, and its mining makes it possible to produce nickel, cobalt and copper, the technological scheme of this process is discussed in the report.

In spite of the variety of materials for hydrogen energy, silicon remains the main semiconductor to convert available solar energy into electricity required for the electrochemical production of inexpensive hydrogen which combustion in FE will be a pollution-free process. The main hindrance against wider practical hydrogen applications is its relatively high specific consumption per kilovatt of energy and a high price of its production. The search for an optimum technology to produce inexpensive silicon of "solar" purity is continued in Ukraine, researchers are working over the possible technological schemes for its production.

References

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