ABSTRACT

Increasing energy problems associated with the depletion of natural energy sources and mainly fossil fuels such as coal and oil are causing increasing interest in alternative energy sources. Nickel-metal hydride (NiMH) cells are increasingly being used. Nickel metal hydride batteries have become popular due to their advantages, which include long life, no memory effect, low internal resistance and high capacity. In addition, they are environmentally friendly materials with no harmful elements in their composition, which is extremely important nowadays. Of the various battery technologies, nickel – metal hydride cells have been continuously developing for decades. Used batteries are an important source of secondary raw materials. They contain large amounts of valuable metals – rare earth elements, lithium, manganese, copper, nickel, cobalt. The recovery of these metals from waste is key to increasing resource efficiency and reducing primary production.

Currently, the most common composition in commercial nickel-hydride batteries is the LaNi5 alloy. With the increasing demand for energy, new compounds are being developed that can be used as electrode materials. One of these is AB – type electrode materials.

The subject of this work is electrode materials based on La-Ti-Ni, La-Zr-Ni, Gd-Ti-Ni, Gd-Zr-Ni systems. Their phase analysis was performed using electron microscopy with EDS analysis and X – ray powder diffractometry.

The materials obtained were tested in 3-electrode systems (Swagelok type) by performing voltammetry and cyclic chronopotentiometry analysis, and 2 – electrode systems with the aim of determining their hydrogen absorption capacity and corrosion resistance. Some of the resulting alloys were subjected to hydrogen sorption/desorption tests, which made it possible to determine the alloys' ability to physically absorb hydrogen.

The newly synthesised alloys for hydrogen storage on rare earth gas: lithium and gadolinium doped with zirconium and titanium were characterised by high stability of cell operation and good corrosion resistance. The introduction of a third component has a number of beneficial effects, which include increased durability and resistance to charge/discharge cycles, reduced material costs and increased chemical stability of electrode materials.

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