

SYNTHESIS AND ELECTROCHEMICAL HYDROGENATION OF $\text{TbCo}_{4.5}\text{Sb}_{0.1}\text{Li}_{0.4}$ *Stetskiv I. A.*, Kordan V. M., Tarasiuk I. I., Pavlyuk V. V.

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Hydrogen storage alloys based on intermetallic compounds and solid-solution alloys are important for a few electrochemical uses, especially in the energy storage area. Practically, when hydrogen enters the lattice of most transition metals, interstitial metal hydride (MH) is formed. The most frequent electrochemical application for MH (commonly the mischmetal-based AB_5 -type alloy) is the negative electrode material for nickel metal hydride (Ni-MH) batteries. Substitution of rare earth element by antimony and lithium is proposed in order to improve the absorption properties.

Sample alloys were prepared by arc melting of stoichiometric amounts of high-purity (≥ 99.9 wt%) metals: Tb, Co, Sb, Li. The ingots were homogenized in quartz ampoules under vacuum in a resistance furnace MP-60 at 400 °C for 1 month. X-ray powder diffraction data for materials before and after hydrogenation were obtained on DRON-2.0M diffractometer (Fe $K\alpha$ -radiation). The efficiency of the electrochemical hydrogenation was investigated in a two-electrode Swagelok-type cell. Electrochemical synthesis of hydrides was carried out using MTech G410-2 galvanostat. The charge and discharge processes were carried out in galvanostatic mode at 1.0 mA/cm². X-ray analysis showed that the prepared Sb- and Li-doped $\text{TbCo}_{4.5}\text{Sb}_{0.1}\text{Li}_{0.4}$ sample was almost single phase and retained the original structure. The crystal structure of TbCo_5 compound belongs to the CaCu_5 structure type (space group $P6/mmm$, Pearson symbol $hP6$). The cell parameters of our phase before hydrogenation were $a = 4.9148(4)$, $c = 3.9884(6)$ Å, $V = 83.43(1)$ Å³ and increased slightly after hydrogenation. On the diffraction pattern of the alloy after hydrogenation peak profiles were a little broad, which indicates some amorphization of anode material. We observed the formation of $\text{TbCo}_{4.5}\text{Sb}_{0.1}\text{Li}_{0.4}\text{H}_{0.23}$ hydride solid solution (see Fig.). The investigated phase demonstrated the corrosion stability in the electrolyte solution (6 M KOH): after 50 charge-discharge cycles we found no reflexes of new phases on diffraction patterns; discharge capacity noticeably changed after the 30-th cycle.

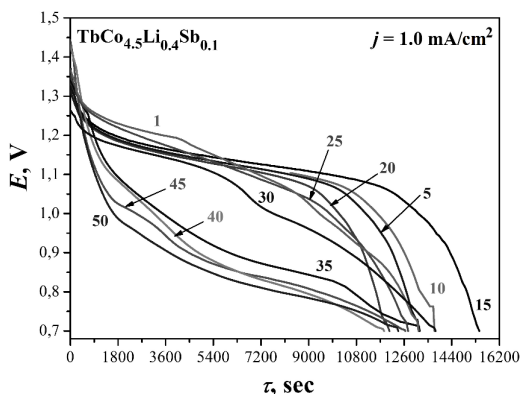


Fig. Selected discharge curves for Ni-MH battery with electrode on the basis of $\text{TbCo}_{4.5}\text{Sb}_{0.1}\text{Li}_{0.4}$

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