ELECTROCHEMICAL HYDROGENATION OF COMPOSITE BASED ON THE Tb_2Ni_7:*x*Mg WITH PEROVSKITE CERAMICS

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R_2M_7 (R = rare-earth metal, M = elements of iron triade) intermetallic compounds are attractive magnetic and hydrogen sorption materials. Alloys with this composition often consist of several phases: hexagonal Ce_2Ni_7-type, rhombohedral Gd_2Co_7-type and $CaCu_5$-type phases. These phases form solid solutions up to 6–7 at. % Mg. Solid solutions with a complex mechanism of substitution are formed, where both terbium and nickel are partially substituted by Mg. The hydrogen sorption properties are inherent to these solid solutions.

Alloy with the nominal composition $Tb_{22}Ni_{73}Mg_5$ was synthesized by arc melting, then remelted several times for better homogenization. Results of X-ray phase analysis and scanning electron microscopy showed that three phases with similar crystal structures were present in the sample. The main phase was α-Tb_2Ni_7:*x*Mg (space group $P6_3/mmc$), minor content of β-Tb_2Ni_7:*x*Mg (space group R-3m) and $TbNi_5$:*x*Mg (space group $P6/mmm$) phases was also observed. Energy dispersive X-ray spectroscopy (Tescan VEGA3 LMU scanning electron microscope, EDX-analyzer with X-Max^{N}20 detector) confirmed the formation of these phases. Ceramic phase with $GdFeO_3$-type structure (space group $Pnma$) was synthesized by solid-state reaction from carbonates and oxides. The $Tb_{22}Ni_{73}Mg_5$ alloy and oxide phase (5 wt. %) were mixed and thoroughly ground for 2 hours for the composite preparation.

Homogeneous elemental distribution for intermetallic solution based on the Tb_2Ni_7:*x*Mg and perovskite phase (without oxygen) is shown in Fig. Electrochemical hydrogenation of the studied composite was carried out in Swagelok-type battery prototype. Specific discharge capacities for battery prototypes with $Tb_{22}Ni_{73}Mg_5$ and composite based on the $Tb_{22}Ni_{73}Mg_5$ with 5 wt. % of perovskite ceramics as electrodes are 177 and 184 mA·h/g, respectively.

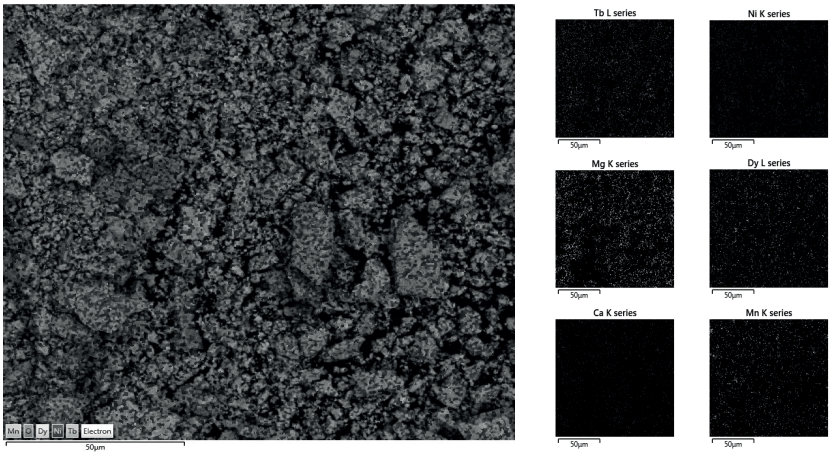

Figure. Elemental mapping of electrode material from Tb_2Ni_7:*x*Mg alloy and perovskite ceramics

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