

**HYDROGENATION OF THE COMPOSITE ALLOY BASED ON THE TiFe PHASE DOPED BY Co, Y AND Sn**

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Composites and multicomponent phases based on the TiFe intermetallic compound are attractive for hydrogen storage. Their advantages are low material cost, high cyclic stability during hydrogenation-dehydrogenation, thermal stability and thermodynamic parameters. The aim of our work is to synthesize a composite alloy, determine its phase and chemical composition, characterize the crystal structures of the identified phases, and investigate the hydrogen sorption properties of the sample.

An alloy with the nominal composition TiFe doped by 10 at. % Co, 10 at. % Y and 5 at. % Sn was synthesized by arc melting. It was remelted several times to improve homogeneity. X-ray phase analysis (Proto AXRD Benchtop diffractometer, Cu  $K\alpha$ -radiation, Ni-filter) and scanning electron microscopy showed that the sample consisted of two phases: solid solution based on the TiFe (CsCl structure type,  $Pm\bar{3}m$  space group) and minor amounts of  $Y_5FeSn_3$  ( $Hf_5CuSn_3$  structure type,  $P6_3/mcm$  space group). Energy dispersive X-ray spectroscopy (Tescan VEGA3 LMU scanning electron microscope, EDX-analyser with X-Max<sup>N20</sup> detector) confirmed the chemical composition of these phases as  $Ti_{49.6}Fe_{36.7}Co_{13.5}Y_{0.1}Sn_{0.1}$  and  $Y_{53.1}Ti_{16.4}Fe_{6.4}Co_{1.5}Sn_{32.6}$ , respectively. Hydrogenation was carried out at 10 bars for 24 h after activation at 723 K for 1 h. Results of investigations showed that the composite alloy exhibits reversible hydrogenation without destroying the crystal structure of the solid solution. The chemical composition of the main phase after hydrogenation did not change significantly ( $Ti_{49.5}Fe_{36.9}Co_{13.1}Y_{0.3}Sn_{0.2}$ ).

Scanning electron microscopy of the initial alloy and the hydrogenated polycrystalline powder (Figure) reveals the formation of cracks and partial grain fragmentation induced by hydrogenation. X-ray powder diffraction analysis shows significant peak broadening accompanied by the appearance of an amorphous halo, indicating increased structural disorder and partial amorphization of the material.

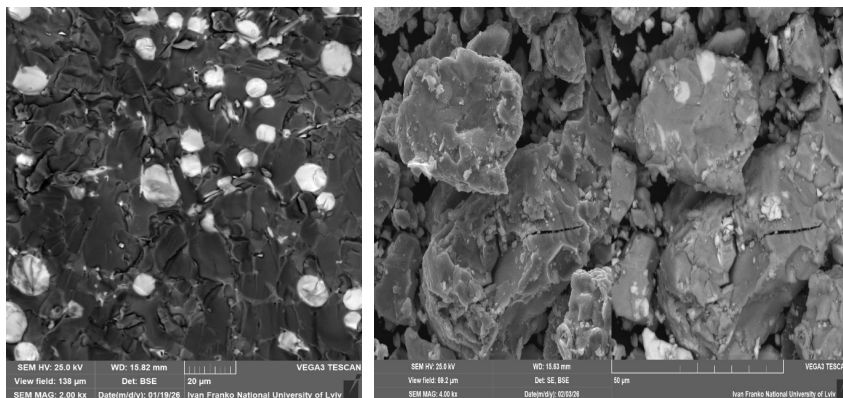


Fig. SEM-images of as-cast alloy (left) at 2000 x magnification and composite hydride (right) at 4000 x magnification

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