Influence of the TiO_2 Additives on Hydrogen Sorption/Desorption Properties of Mg-Based Composites

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Practical use of magnesium and its alloys in hydrogen storage systems is limited by slow kinetics and elevated temperatures (>300 °C) of hydrogen absorption/desorption. A lot of recent studies were devoted to the enhancement of these parameters, including preparation of magnesium by reactive ball milling in hydrogen medium (RBM) and modification by different additions, e.g. oxides, intermetallic compounds, graphite etc [1]. In our previous work we have studied the properties of Mg-based composite materials with $Ti_4Fe_2O_x$ suboxide as catalytic additive [2]. Substantially improvement of hydrogen absorption-desorption properties were demonstrated also for the Mg–$Zr_4Fe_2O_x$ composites prepared by RBM [3]. Our further studies were devoted to the combination of graphite and IMC additives in the same Mg-based composite materials. This report will be devoted to the influence of Ti and TiO_2 oxide in different dispersive states on the hydrogenation properties of Mg-based composites.

Mg-based hydride composites were prepared by reactive ball milling of Mg and Ti or TiO_2 additive (with and without graphite) under 1 MPa H pressure. It has been shown that composites have H storage capacity of 1.8-2 wt.% at room temperature and 5.5-7.0 wt.% at 200-300 °C. Hydrogen desorption from the hydrides was studied by means of thermodesorption spectroscopy (TDS) with linear heating of specimens (2 K/min) in dynamic vacuum from room temperature to 620–670 K. Thermal desorption from the selected hydrides was also studied by *in situ* XRD. Powder XRD patterns were measured during heating (2 K/min heating in 1 bar argon from 25 to 650 °C) using Bruker C2 Discover powder diffractometer at the X-ray Crystallo-graphic Center, University of Maryland, USA. The observed TDS curves demonstrated onset temperature for hydrogen release. Compared to convenient $MgH_{\sim 2}$ hydride, much lower temperatures of hydrogen desorption peaks were observed for the synthesized composites. The comparison of the hydrogenation/dehydrogenation properties will be discussed for the Mg-based composites with the Ti and TiO_2 additives in different dispersive state. The cycling stability will be compared for the composite materials with and without carbon additives.

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