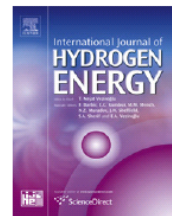




Available at www.sciencedirect.com



journal homepage: www.elsevier.com/locate/he



The composites of magnesium hydride and iron-titanium intermetallic

Robert A. Varin^{a,*}, Zbigniew Zaranski^b, Tomasz Czujko^{b,c}, Marek Polanski^b,
Zbigniew S. Wronski^{a,c}

^aDepartment of Mechanical and Mechatronics Engineering, University of Waterloo, Waterloo, ON N2L 3G1, Canada

^bDepartment of Advanced Materials and Technologies, Military University of Technology, Kaliskiego 2, 00-908 Warsaw, Poland

^cCanmetEnergy, Hydrogen, Fuel Cells & Transportation Energy, Natural Resources Canada, Ottawa, ON K1A 1M1, Canada

ARTICLE INFO

Article history:

Received 25 June 2010

Accepted 29 June 2010

Available online 6 August 2010

Keywords:

Solid state hydrogen storage

Desorption temperature and kinetics

Nano-nickel additives

Hydrogen storage materials

Composite hydrides MgH₂ and FeTi

Ball milling

ABSTRACT

Hydride-intermetallic composites MgH₂ + X wt.% FeTi (X = 10, 30, 50) were synthesized by Controlled Mechanical Milling (CMM) in a magneto-mill. Their thermal behavior was investigated by Differential Scanning Calorimetry (DSC) and Temperature Programmed Desorption (TPD). It is found that the DSC hydrogen desorption peak temperature as well as the activation energy of hydrogen desorption of the MgH₂ constituent in composites decreases linearly with increasing volume fraction of FeTi with a coefficient of fit $R^2 = 0.98$. A doping of the MgH₂ + FeTi composites with 5 wt.% of nanometric-size nickel (n-Ni) produced by Vale Inco Ltd. further reduces the DSC hydrogen desorption peak temperature of MgH₂ to the temperature range below 300 °C for the MgH₂ + 10 and 30 wt.% FeTi composites. The most effective reduction of the DSC hydrogen desorption peak temperature of the MgH₂ constituent by as much as 60 °C due to the catalytic effect of n-Ni is observed for the MgH₂ + 10 wt.% FeTi + 5 wt.% n-Ni composite. At this composition the composite also has hydrogen capacity slightly higher than 5 wt.%.

© 2010 Professor T. Nejat Veziroglu. Published by Elsevier Ltd. All rights reserved.