論　文　要　旨
Thesis Abstract

(yyyy/mm/dd)　2019 年 01 月 10 日

※報告番号	乙第 87 号	氏　名 (Name)	Kamil Goc

主論文題名　（Title）

Hydrogen storage properties of magnesium hydride nanocomposites with graphite and transition metals

内容の要旨　（Abstract）

Recently, metal hydrides are widely considered and studied as materials for use as the hydrogen storage materials in mobile and on-boards applications. One of the most interesting is the magnesium hydride, because of high storage capacity (~7.5 wt. %, or 110 g/L), low cost and availability. However, its applications are limited by poor reaction kinetics and high decomposition temperature. Several methods, such as nanostructuring, alloying or addition of catalyst are often used to improve MgH2 performance.

This dissertation is focused on designing and development of a new method of introducing catalytic elements by forming a thin layer of catalyst on the surface of magnesium hydride particles using technology of magnetron sputtering on powdery substrates. Thin films of nickel, niobium and vanadium were successfully deposited on the as-purchased and the ball milled magnesium hydride powders. SEM observations and EDS elements mapping show metallic layers of 80-320 nm thickness formed on hydride particles. It was proven by measurements with Sievert's method that such surface modification increases the H2 dissociation/recombination speed and effectively enhances hydrogenation/dehydrogenation reaction rate. The DSC study performed shows a reduction of the activation energy and a decrease of the decomposition temperature.

In order to improve the heat transfer during hydrogen charging/discharging, special anisotropic composites of magnesium hydride and graphite, with thermal conductivity enhanced through their anisotropy, were prepared. Interaction of graphite flakes with the applied strong electric field gives rise to an induced polarization which results in a torque acting on the graphite particles and causes their reorientation and alignment. Samples of magnesium hydride with graphite suspended in a special high temperature proof resin were prepared in this way. A study of their thermal conductivity compared with hydrogenation/dehydrogeneration kinetic measurements shows that alignment enhances heat transfer in such composite materials making them prospective candidates for applications.

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