

Accepted Manuscript

Encapsulation of $\text{La}_{1.5}\text{Mg}_{0.5}\text{Ni}_7$ nanocrystalline hydrogen storage alloy with Ni coatings and its electrochemical characterization

Martyna Dymek, Marek Nowak, Mieczysław Jurczyk, Henryk Bala



PII: S0925-8388(18)31100-9

DOI: [10.1016/j.jallcom.2018.03.230](https://doi.org/10.1016/j.jallcom.2018.03.230)

Reference: JALCOM 45460

To appear in: *Journal of Alloys and Compounds*

Received Date: 6 January 2018

Revised Date: 16 March 2018

Accepted Date: 17 March 2018

Please cite this article as: M. Dymek, M. Nowak, M. Jurczyk, H. Bala, Encapsulation of $\text{La}_{1.5}\text{Mg}_{0.5}\text{Ni}_7$ nanocrystalline hydrogen storage alloy with Ni coatings and its electrochemical characterization, *Journal of Alloys and Compounds* (2018), doi: 10.1016/j.jallcom.2018.03.230.

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

Encapsulation of $\text{La}_{1.5}\text{Mg}_{0.5}\text{Ni}_7$ nanocrystalline hydrogen storage alloy with Ni coatings and its electrochemical characterization

Martyna Dymek^{a*}, Marek Nowak^b, Mieczysław Jurczyk^b and Henryk Bala^a

^a *Czestochowa University of Technology, Department of Chemistry, al. Armii Krajowej 19, 42-200 Czestochowa, Poland*

^b *Poznan University of Technology, Institute of Materials Science and Engineering, Jana Pawla II no 24, 61-138 Poznan, Poland*

* *Corresponding author*

E-mail addresses: mdymek@wip.pcz.pl, marek.nowak@put.poznan.pl, mieczyslaw.jurczyk@put.poznan.pl, hbala@wip.pcz.pl

Abstract

Nanocrystalline $\text{La}_{1.5}\text{Mg}_{0.5}\text{Ni}_7$ alloy has been synthesized by mechanical alloying and heat treatment (850°C) and a 20 - 50 μm fraction of its particles has been encapsulated with three kinds of Ni-based coatings: (i) electroless Ni-P, 1 μm thick, (ii) magnetron sputtered Ni, 0.087 μm thick and (iii) magnetron sputtered Ni, 0.29 μm thick. The electrochemical charge/discharge multicycling of powder composite electrodes has been carried out in view of material potential usefulness for Ni/MH_x batteries. The nanocrystalline $\text{La}_{1.5}\text{Mg}_{0.5}\text{Ni}_7$ alloy exhibits four times lower capacity fade as compared to a microcrystalline LaNi_5 reference compound. Modification of $\text{La}_{1.5}\text{Mg}_{0.5}\text{Ni}_7$ particle surface with comparatively thick layer of electroless Ni-P coating deteriorates electrode corrosion behavior and worsens kinetics of hydrogen electrosorption due to unsatisfactory adhesion of the coating to the Mg-containing substrate. Corrosion protection of the $\text{La}_{1.5}\text{Mg}_{0.5}\text{Ni}_7$ nanomaterial by magnetron sputtered Ni films depends on average film thickness. Relatively thick (0.29 μm) sputtered Ni film limits corrosion degradation and stabilizes exchange current density of $\text{H}_2\text{O}/\text{H}_2$ system. Particle modification by Ni encapsulation does not affect the hydrogen diffusivity. Effective diffusion coefficient of hydrogen for $\text{La}_{1.5}\text{Mg}_{0.5}\text{Ni}_7$ nanocrystalline material, irrespectively of surface modification, is close to $2 \cdot 10^{-10} \text{ cm}^2 \text{ s}^{-1}$.

Download English Version:

<https://daneshyari.com/en/article/7992075>

Download Persian Version:

<https://daneshyari.com/article/7992075>

[Daneshyari.com](https://daneshyari.com)