6TH INTERNATIONAL CONFERENCE on MATERIALS ENGINEERING and METALLURGY
Iran.Tehran 28, 29 Oct. 2017
iMAT CONFERENCE 2017
تهران – ایران ۶ و ۷ آبان ماه ۱۳۹۶
ششمین کنفرانس بین المللی مهندسی مواد و متالورژی و یازدهمین کنفرانس مشترک انجمن مهندسی متالورژی و مواد ایران و انجمن علمی ریخته گری ایران

Production of Nano-crystalline $Mg(Gd)_2Ni$-based Powder Using High Energy Ball Milling and Subsequent Heat Treatment

Muhammad Mehdinia[1], Seyed Farshid Kashani-Bozorg[2], Amir Zali[3] and Negar Mehraein[4]
School of Metallurgy and Materials Engineering, University of Tehran, Tehran, Iran
mohamad.mehdinia@ut.ac.ir

Abstract

In the present work, high-energy milling technique using a planetary ball mill and subsequent annealing have been employed for the production of nano-crystalline powders based on Mg_2Ni intermetallic compound. X-ray diffraction and scanning electron microscopy were used for the characterization of the milled products. Formation of Mg_2Ni-based nanocrystallites occurred after 40 and 50h of milling using the initial binary and ternary powder mixtures with stoichiometric compositions of Mg_2Ni and $Mg_{1.8}Gd_{0.2}Ni$, respectively. The calculated average Mg_2Ni crystallite size was ~8 nm at the ball to powder weight ratio of 20:1 after 60 h of milling and showed decreasing with increasing the milling time. Subsequent annealing of the milled product at a low milling time of 20 h resulted in the formation of the dominant Mg_2Ni intermetallic compound.

Keywords*:* Mg_2Ni, Ball Milling, Nano-crystallites, Heat treatment, Gd.

Introduction

Mg_2Ni intermetallic compound is considered as a hydrogen absorbing material in nickel metal hydride (NiMH) rechargeable batteries. Crystallite size reduction and additions of elements with high tendency to hydriding are believed to have effective role in increasing hydrogen absorbing capacity. Magnesium and magnesium-based alloys were considered to be promising hydrogen storage materials for negative anode electrode in Ni–MH batteries because of the great abundance, light weight of Mg, and high hydrogen capacity of the hydrides, e.g. 7.6 wt.% for MgH_2, 3.6 wt.% for Mg_2NiH_4, 4.5 wt.% for Mg_2CoH_5 and 5.4 wt.% for Mg_2FeH_6 [1]. It was documented that Mg-

[1]- Master Student, Identification and Selection of Engineering Materials, School of Metallurgy and Materials Engineering, University of Tehran.

[2]- Associate Professor, School of Metallurgy and Materials Engineering, University of Tehran, fkashani@ut.ac.ir.

[3]- Master Student, Identification and Selection of Engineering Materials, School of Metallurgy and Materials Engineering, University of Tehran, amir.zali.az@ut.ac.ir

[4]- Master Student, Identification and Selection of Engineering Materials, School of Metallurgy and Materials Engineering, University of Tehran, n.mehraein@ut.ac.ir