Catalytic effect of nanostructure SiC and Ni on Mg-based hydrogen storage materials prepared by reactive mechanical alloying method

Zulkarnain Jalil[1], Adi Rahwanto[1], Erfan Handoko[2] Bambang Soegijono[3]

[1] *Department of Physics, Syiah Kuala University, Banda Aceh 23111, Indonesia. E-mail: zjalil@unsyiah.ac.id*

[1] *Department of Physics, State University of Jakarta, Jakarta 13220, Indonesia.*

[1] *Institute of Materials, University of Indonesia, Salemba, Jakarta 10430, Indonesia.*

Among the metal hydrides, magnesium has the theoretically highest weight capacity for hydrogen storage (7.6 wt.%), lightweight and a reasonably low cost [1]. However, high working temperature, slow reaction kinetics and difficult activation limit the practical application of Mg-based hydrides. Many efforts have been done to improve sorption properties and reaction kinetics such as element substitution (metal or metal oxides) as catalyst in nanometer scale and modification of ball milling technique as well [2-4]. Recently, the reactive ball milling under hydrogen atmosphere was also successfully introduced to prepare hydrogen storage materials [5].

In this work we success to synthesis and investigate the catalytic effect of SiC and Ni (in nanostructure scale) on MgH_2 using reactive mechanical alloying method in 10 bar H_2. At first step, using SiC catalyst the sorption properties can be improved. The most promising step by using nano-catalysts of SiC and Ni (MgH_2-5wt%SiC-5wt%Ni) which absorp 5.7 wt% hydrogen and at the same time decrease the desorption temperature to 250°C. Compared to T onset of pure MgH_2 -which desorp at 380^{o} C.

Keyword: Magnesium, hydrogen storage, reactive mechanical alloying, catalyst, silicon carbide.

1. Schlapbach and Zuettel, Hydrogen storage materials for mobile applications, *Nature*, Vol **414**, 15 November 2001.
2. L. Wang, Y. Wang, H. Yuan, Development of Mg-based hydrogen storage alloy, *Journal of Material Science and Technology*, Vol. **17** No. 6, (2001).
3. H. Yuan, Y. An, G. Xu, C. Chen, Hydriding behavior of magnesium-based hydrogen storage alloy modified by mechanical ball-milling, *Mater. Chem. Phys*., **83** (2004).
4. A.Ranjbar, Z.P. Guo, X.B. Yu, D.Wexler, A. Calka, C.J. Kim, H.K. Liu, Hydrogen storage properties of MgH2–SiC composites, *Materials Chemistry and Physics*, Vol. **114**, (2009).
5. F.C. Gennari, F.J. Castro, G. Urretavizcaya, *Hydrogen desorption behavior from magnesium hydrides synthesized by reactive mechanical alloying*, Journal of Alloys and Compounds, **321**, (2001).