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EFFECT OF COOLING RATE ON HYDROGENATION PROPERTIES OF HYDROGEN STORAGE MATERIAL FOR AUTOMOTIVE APPLICATION

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ABSTRACT

In order to evaluate the effect of cooling rate on adsorption and desorption properties of $LaNi_5$, the raw material of Nickel and Lanthanum with 99.999% purity were melted in proportion to 68% and 32% in zirconia crucible under the vacuum induction conditions. These alloys were solidified in two crucibles,steel and graphitic. The results of hydrogen adsorption were showed that the alloy which solidified in steel crucibleafter 200 cycles were adsorbed 1.55 wt. % Hydrogen. Another alloy didn't have any adsorption. The results of XRD indicated the $LaNi_5$ phase in alloy structure which alloyed by casting. The SEM and EDS showed that the intermetallic matrix formed in alloy which solidified in steel crucible.

Keywords: cooling rate, intermetallic phase, hydrogen storage material.

INTRODUCTION

SOLID-H™ hydrogen storage containers are filled with metal powders that absorb and release hydrogen (metal hydrides). The most popular SOLID-H containers supply a few atmospheres of hydrogen gas pressure at room temperature. This is the safest method known for storing flammable hydrogen gas. If your hydrogen system develops a leak, SOLID-H immediately releases a small fraction of its stored hydrogen. The remainder will be released over a period of hours. If you want to know more about metal hydride chemistry,

Substitutions at the La and Ni sites have been widely used to modify the thermodynamic properties of LaNi and play a crucial role in the selection of the alloy for specific technological applications, since they affect the stability and the maximum hydrogen content. Substitution at nickel sites by s-p elements of group IIIA (such as Al) and group IVA (Si, Ge, Sn) are known to lower the pressure plateaux of the isotherms.

RESULTS AND CONCLUSIONS

The results of hydrogen adsorption were showed that the alloy which solidified in steel crucibleafter 200 cycles were adsorbed 1.55 wt. % Hydrogen (figure 1). Another alloy didn't have any adsorption. The results of XRD indicated the $LaNi_5$ phase in alloy structure which alloyed by casting. The SEM and EDS showed that the intermetallic matrix formed in alloy which solidified in steel crucible. In comparison to these results $LaNi_5$ phase didn’t form and the adsorption property wasn’t at the standard amount (figure 2 and figure 3).

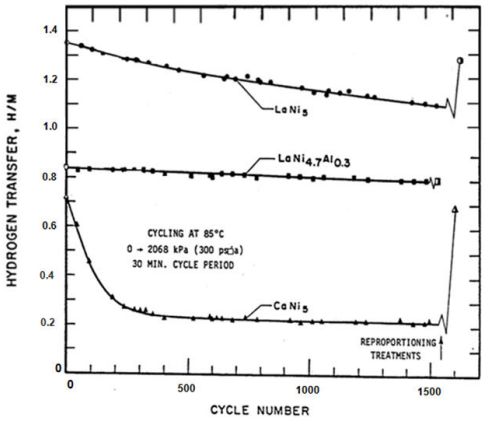
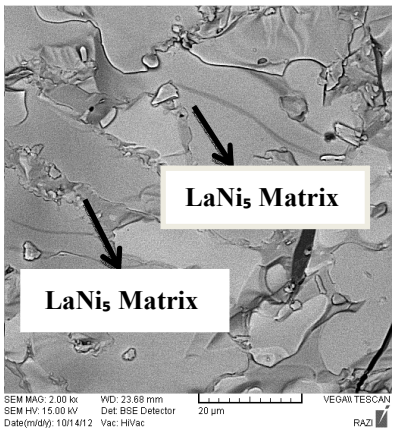


Fig. 1 - Effect of $85\,^{\circ}C$ pressure cycling on the (H-capacity)rev of the three AB_5 alloys

Table 1 - EDX result of LaNi alloys

Element	Nickel	Lanthanum
Solidified in Steel Crucible	66.26% atom	33.33% atom
Solidified in Graphit Crucible	40.39%atom	59.61%atom



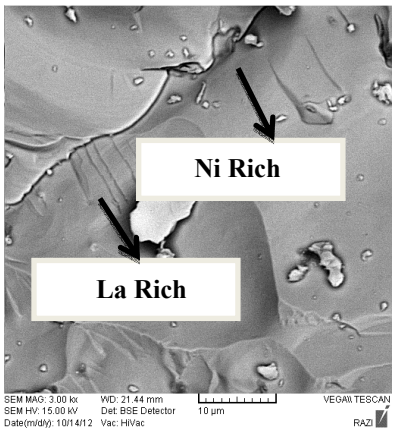


Fig. 2 - SEM, solidified in steel crucible Fig. 3 - SEM,Solidified in graphitic crucible

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