

## Effect of surface modification on hydrogen storage properties of Mg-based alloys

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With the regain of interest for fuel cells as an alternative power source for electrical vehicles, the research for developing better hydrogen storage materials has been renewed with a special interest for light weight hydrides such as Mg-based alloys. Indeed, with its high capacity and its low cost, magnesium may be considered as a potential hydrogen storage material however its practical application remains limited by its low hydriding and dehydriding rates at low temperature due to the formation of a very stable hydride. As largely reported in the literature, mixing magnesium with catalytic transition elements such as Ni, V, Ti, Co, could lead to a strong improvement of the hydride performances.

Enhancement of the hydriding/dehydriding properties of Mg based alloys was recently obtained in our group by preparing Mg-Ni alloys in a nanocrystalline or amorphous state using mechanochemistry. Optimization of the ball milling conditions (such as the ball to powder weight ratio and the milling time) leads to the preparation of amorphous Mg-Ni alloys. The advantages of nanocrystalline materials are partly due to their high specific surface area, emphasizing the great importance of the surface towards the hydrogen absorption/desorption process.

There are several ways to tune the hydride forming alloy surface. Mechanochemistry may be described as a physical means while, in this paper attention is focused on the modification of the alloy surface by a chemical approach. Highly divided particles of elemental Cu, Ni, Pt, Pd or of their alloys, which are well known hydrogen catalysts, were deposited onto Mg-Ni alloys using the polyol process. The polyol process consists in the reduction of a metallic salt in a liquid polyol, allowing the preparation at low temperature of monodisperse particles in a submicrometer range as well as colloidal particles [1]. The great advantages of using surface modification through solution chemistry reside 1) in the fact that we can control the particle size and 2) in the ability to uniformly disperse very small amounts (less than 0.5 % by weight) of catalysts.

Figure 1 shows Pd particles of 200 nm deposited onto MgNi alloy particles. This coating led to a strong increase in hydrogen release with a desorption capacity as high as 2.5 hydrogen weight percent below 200 °C.

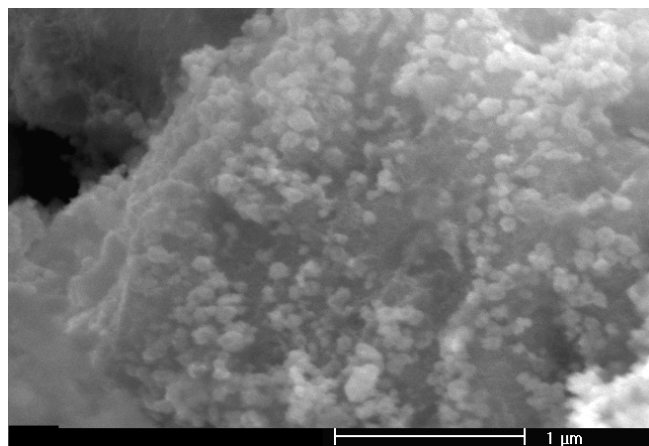


Figure 1 : SEM micrograph of MgNi alloy covered with Pd particles deposited by the polyol process.

In summary, in this work we will show how one can enhance the Mg-based alloys hydrogen absorption-desorption properties by modifying and monitoring the alloy surface nature and characteristics. Insights on the kinetics of the hydrogen absorption/desorption will be deduced from pressure composition temperature measurements.

[1] F. Bonet, V. Delmas, S. Grugeon, R. Herrera Urbina, P-Y Silvert, and K. Tekaiia-Elhissen, *Nanostructured Materials*, Vol. 11, 8, 1277, 1999.