NOVEL FABRICATION OF
ACTIVE HYDROGEN STORAGE ALLOY
BASED ON COMBUSTION SYNTHESIS

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Hydrogen storage alloys are industrially produced based on ingot metallurgy (see Fig.1). This melting method has serious problems, because it causes evaporation loss of metal, poisoning an ingot product by air and moisture and, as a result, it needs a time-consuming, activation treatment. In one chemical company, the operator repeats the melting of the ingot over five times, to produce Mg$_2$Ni with 99.9\% of purity, by adding magnesium. To obtain its hydride, the hydriding and dehydriding procedure is also repeated over ten times. Even after such time- and energy-consuming process, complete activation of the product is impossible.

The solution of this problem is to directly produce it based on Hydriding Combustion Synthesis$^{1-7}$ (see Fig.2), in which a well-mixed powder of metals as a raw material is thermally treated, without melting, at pressurized hydrogen atmosphere by a controlled, stepwise heat pattern. This method offers many benefits: maximizing hydrogen storage capacity, accelerating reaction rate, shortening processing time, simplifying the process, minimizing energy input and realizing highest cost performance.

This novel method is applicable to any intermetallic hydride, in particular, most attractive for producing a magnesium-based alloy from accurate control of the composition without evaporation loss of magnesium.

Some successful examples are:
1) the production of Mg-Ni alloy, which shows good reactivity without any activation treatment and records worldwide the largest capacity of hydrogen storage over 7.0 mass\% (see Fig.3).
2) Based on this method, Mg$_2$FeH$_6$ and Mg$_2$CoH$_5$, having 5.5 mass\% and 4.5 mass\% in storage capacity, were obtainable$^{10}$ (see Figs.4&5).

References
3) L.Li, T. Akiyama and J. Yagi, Intermetallics, 7(1999), 201.