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_2Ni 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.

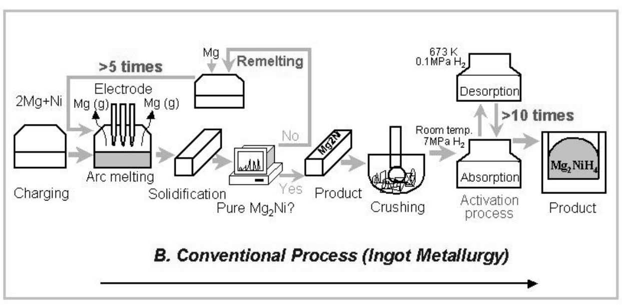

Fig.1 Conventional process of production of Mg-based alloys

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.

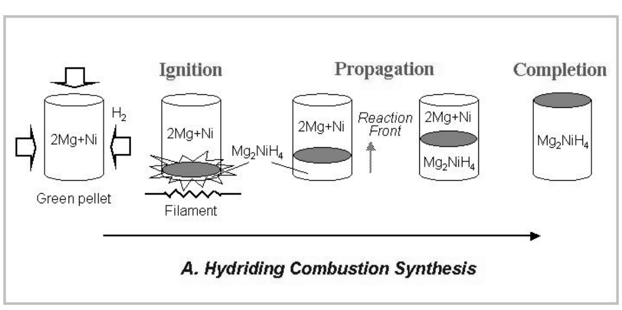

Fig.2 Schematic flow sheet of the process of hydriding combustion synthesis of Mg_2NiH_4

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 %[8](see Fig.3).
2) Based on this method, Mg_2FeH_6 and Mg_2CoH_5, having 5.5 mass % and 4.5 mass% in storage capacity, were obtainable[10](see Figs.4&5).

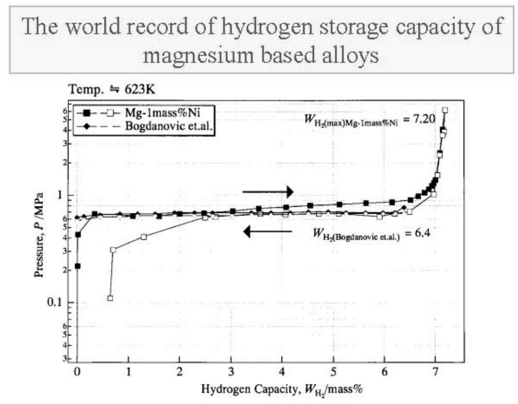

Fig.3 PCT property of the Mg–1mass%Ni, in comparison with data of Bogdanovic et al.

The hydriding combustion synthesis of hydrogen storage alloys of Mg_2FeH_6 and Mg_2CoH_5

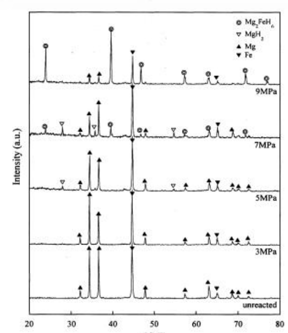

Fig.4 Effect of hydrogen pressure on the product after Mg-Fe sample was kept at 773 K for 36 ks

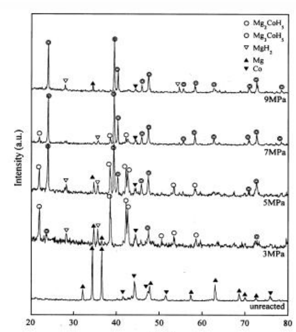

Fig.5 Effect of hydrogen pressure on the product after Mg-Co sample was kept at 723 K for 36 ks

References

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