Hydrogen storage alloys

To have the greatest esteem for you

During last seven years in HyTeC a number of hydrogen storage alloys (HSA) were designed, tested and their mass production was begun in the company's factory (about 20 tone per month). The success of the research work was guaranteed with the highly professional research personal of the R & D Center provided with the modern equipped laboratories {computer controlled automatic PCI-monitoring system (GfE), open/closed cell electrochemical testing systems (Arbin Instruments), particle size analyzer (Horiba), glove-boxes (Braun), etc.}.

Depending on application area the designed AB_5-based alloys can be formally separated into two main groups:

- HSA for hydrogen storing and transportation;
- HSA for various types of Ni/MH batteries

a) HSA for hydrogen storing and transportation

Due to near-ambient PCT properties AB_5 – type alloys still remain the best candidates for hydrogen storing and transportation. The relatively low gravimetric density of hydrogen absorption in these alloys (about 1.5 wt. %) is completely compensated by their flat desorption plateaus at room temperature. At present in the commercialized storage systems, based on AB_5 alloys, the reversible hydrogen capacity is about 1.45 wt. %, but sometimes it can be even below 1.4 wt. % (Fig. 1).

The key point for the alloys, designed in our company, is their high hydrogen absorption ability – up to 1.8 wt. % and very flat absorption/desorption P-C characteristics (Fig. 1, curves T.0 and T.1). It has allowed us to design room temperature storage systems with reversible hydrogen capacity from 1.6 up to 1.75 wt. %, while the desorption plateau pressure can be adjusted from 2 up to 10 atm (depending on application needs). The stable gas flow rate at room temperature for small capacity storage systems (20 - 2000 l of H_2) is usually 0.1-20 l/min. However, with the use of a simple water bath the gas flow rate can be increased essentially (from 2 to 5 times) due to the increase of the level of the desorption plateau (Fig. 2).

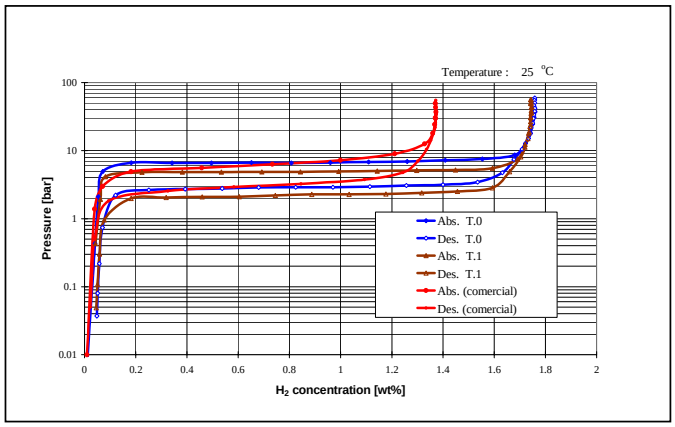

Fig. 1. "Pressure - H_2 capacity" isotherms of AB_5-type alloys.

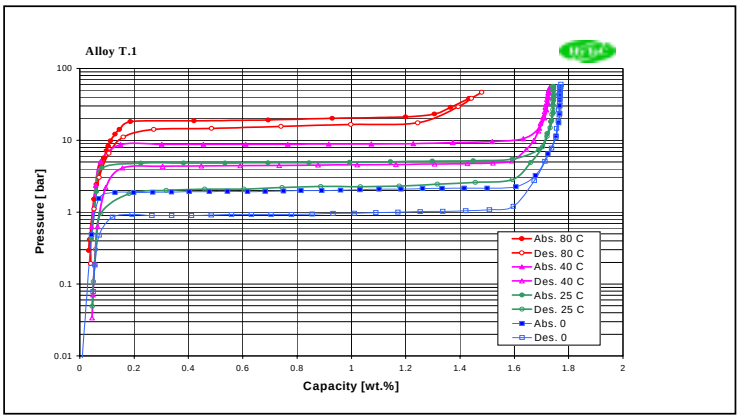

Fig. 2. “Pressure – capacity” isotherms of the T.1 alloy at various temperatures.

It must be noted, that the room temperature values of the gas flow rate of our storage systems cannot be a limiting factor when they are used with the PEM fuel cells. So, our H_2 storage tanks (especially the small ones) seems have a good chance for this kind of application.

b) HSA for various types of Ni/MH batteries.

In traditional commercial Ni/MH batteries AB_5-type alloys have electrical discharge capacity near 300 mA·h/g and cycle life about 250-350 cycles. Only for a few limited number of well-known companies the cycle life of commercial batteries can reach 450-600 cycles.
The designed in HyTeC alloys with special composition of rare-earth mischmetal as well as B-type elements have capacity up to 350mA·h/g and charge/discharge (C/D) cycle life (with 1C) over 850 cycles. At the same time, the cycling stability of the alloy in the batteries is much higher – over 1800 cycles (Fig.3). The two peaks on the curve (each with 10 cycles length) are the result of changing the test current from 1C to 0.2C. This is indicating that the loss of the electrical capacity is connected with the battery performance (for example, with decay of the current collector) but not due to the cycling stability of the HSA.
For special applications in HyTeC were designed also AB_5-type alloys for use in the high rate (> 3C) C/D batteries.

The prices for all type of HSA are varied in the range 50-60 USD/kg depending on Nickel price quoted by LME daily and its type, application specification as well as on the amount.

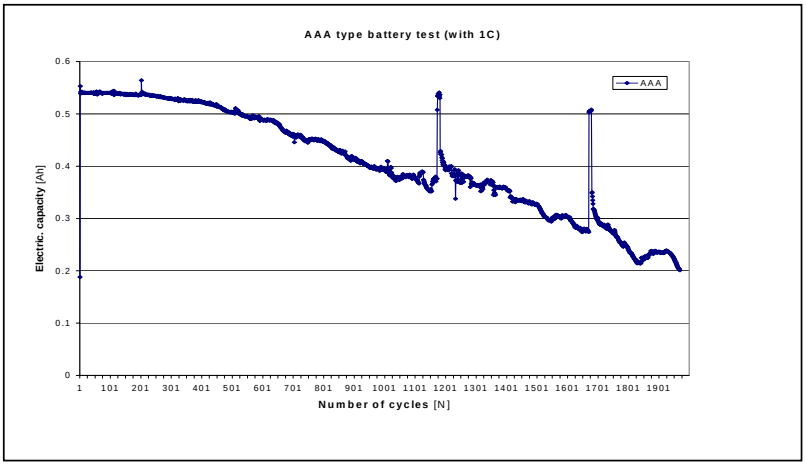

Fig. 3. Charge/discharge test of the AAA-type battery (with 1C).

Possible areas for cooperation

One of the most promising areas for cooperation is the joint development of the systems where your PEM fuel cell is powered by our hydrogen storage tank. Such a system need to have 250 Watt power for the bicycles, 500W – for scooters and 10-20 kW – for the UPS. The first two areas are of a great interest because of, in fact, unlimited market in the Eastern Asia. Obviously, we have to cooperate also with the third partner vehicle and or some electronic company.

Hsu-Yang Technologies Co., Ltd.
General Manager
Jin-Chin Guan

Office: 80 Erh-Chia Road, Ying-Keh,
Taipei-Hsian, Taiwan, ROC
Phone: 886-2-2679-1885
Fax: 886-2-2677-3421
E-mail: gounyang@ms24.hinet.net (Documents dealings or contact prefer)
http://www.hytec.com.tw