

Life Estimation of $MmNi_{4.2}Al_{0.8}$ Hydrogen Storage Alloy

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Abstract

Service life of widely known hydrogen storage system $MmNi_{4.2}Al_{0.8}$ (Mm is mischmetal) has been estimated by hydrogen absorption/ desorption cycling technique. The hydrogen storage properties like: plateau pressure, storage capacity, hysteresis loss, hydrogen desorption kinetics and particle size distribution have been investigated by Pressure-Composition-Temperature (PCT) technique. The pressure-composition (PC) isotherms for hydriding/ dehydriding both after initial activation and after 1000 absorption/ desorption cycles were measured at 288, 298 and 308 K (Fig.1). Similarly the hydrogen desorption kinetics was also estimated at these temperatures. It was observed that there was no significant change in hydrogen storage capacity (hydrogen to metal atom ratio, H/M), plateau pressure and desorption kinetics even after 1000 cycles (Fig.1). However, a slight increase in hysteresis (energy) loss during absorption and desorption cycle was observed at 298 and 308 K after 1000 cycles. There was no hysteresis loss at 288 K. The particle size distribution of the disintegrated sample after 1000 cycles showed a wider band ranging from $0.5\mu m$ to $90\mu m$ as compared to that after initial activation which is $5\mu m$ to $90\mu m$ (Fig.2). Large scale continued disintegration of bulk sample was observed after 1000 absorption/ desorption cycles (Fig.3). The lattice parameters (a and c) of the hexagonal structure of the parent alloy were decreased after 1000 cycle. Alloy $MmNi_{4.2}Al_{0.8}$ was found relatively stable over 1000 cycles and this has been explained based on the purity of hydrogen gas used and the crystal structure of the alloy.

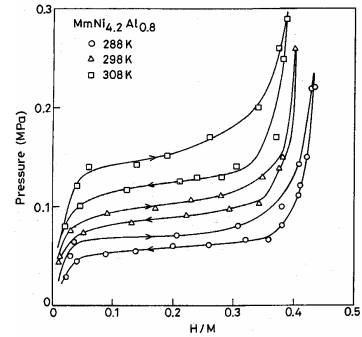


Figure 1

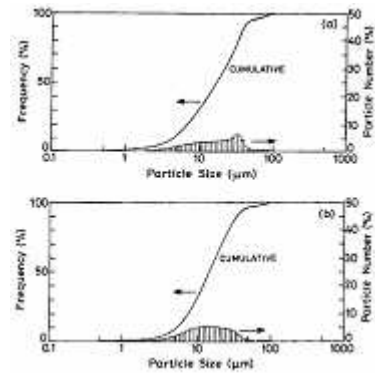


Figure 2

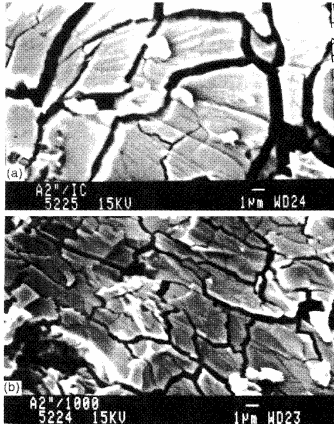


Figure 3