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Hydrogen Storage Properties of Mg-Zn-Gd-Y-Nd Alloys As-Processed by SPD

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Metal hydrides, particularly MgH_2, have attracted considerable attention as safe and feasible hydrogen storage materials [1]. The combined effect of (i) adding alloying elements and (ii) applying deformation paths of severe plastic deformation (SPD) can significantly improve the absorption/desorption kinetics in Mg [2, 3]. Concerning (i), rare earth alloying elements like Gd, Y and Nd form long period stacking ordered (LPSO) interfaces which provide additional fast paths for hydrogen diffusion [4]. Regarding (ii), extended plastic strains achieved by SPD attain high densities of grain boundaries, dislocations and especially vacancy agglomerates [2, 3]; mainly the latter trap the hydrogen atoms and thus act as nuclei for the hydride formation; the alloying elements provide the thermal stability of the vacancy agglomerates which is necessary for the stability of sorption/desorption cycles up to high cycle numbers. Considering different paths of SPD deformation, it is shown that ECAP creates more vacancy-type defects than HPT, resulting in a better performance of hydrogen storage (Fig.1).

Keywords: SPD induced vacancy agglomerates

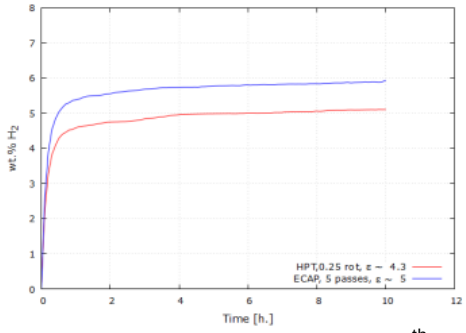

Fig.1. Hydrogen absorption in HPT and ECAP samples at the 11th cycle done at 340°C and 13 bar.

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