Phase Transformation, Hydrogen Absorption/Desorption and Electrochemical Properties of a Novel AB_{4.5}-type La_{0.8}Mg_{0.2}Ni_{4.0}Co_{0.5} Alloy

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In this work, the phase transformation, hydrogen storage performance and electrochemical properties of a novel AB_{4.5}-type La_{0.8}Mg_{0.2}Ni_{4.0}Co_{0.5} alloy before and after annealing are studied. It is shown that the as-cast alloy contains a CaCu₅-type phase and Ce₂Ni₇- and Pr₅Co₁₉-type superlattice phases. After annealing at 850 °C for 12 h, the CaCu₅- and Ce₂Ni₇-type phase abundances decrease, while that of the Pr₅Co₁₉-type phase increases through short atomic diffusion. The *P-C-T* curve of the as-cast alloy exhibits one plateau, while that of the annealed alloy shows two plateaus in both the hydriding and dehydriding processes. Electrochemical results show that phase transformation benefits the alloy's discharge capacity owing to the increase in the total amount of the superlattice phases. The cycling stability is also improved after annealing due to fewer microstrains and defects. In particular, these alloys exhibit excellent high rate discharge capacities of 136 and 128 mAh g⁻¹ at 3000 mA g⁻¹ for the as-cast and annealed alloys, respectively. The higher capacity of the as-cast alloy is due to the increase in the LaNi₅ phase, which is found to desorb hydrogen at higher pressures than the superlattice phases. This alloy system is a promising material for the high-power negative electrodes of Ni/MH batteries.

Keywords: Nickel metal hydride battery; AB_{4.5}-type alloy; Phase transformation; Hydrogen storage property; Electrochemical performance

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