Structure and Electrochemical Properties of $\text{La}_4\text{MgNi}_{17.5}\text{M}_{1.5}$ ($\text{M}=\text{Co}, \text{Fe}, \text{Mn}$) Hydrogen Storage Alloys

Fan-Song Wei*, Xin Cai, Yu Zhang, Fan-na Wei

School of Materials Science and Engineering, Jiangsu University of Science and Technology, Zhenjiang 212003, China

*E-mail: zjuwei@just.edu.cn

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$\text{La}_4\text{MgNi}_{17.5}\text{M}_{1.5}$ ($\text{M}=\text{Co}, \text{Fe}, \text{Mn}$) alloys were prepared by high-frequency inductive melting. The structure and electrochemical properties of the alloy electrodes were systemically investigated. The XRD showed that all the alloys possessed a multiphase structure, consisting of AB_5 -type phase and A_5B_{19} -type phase. The result of Rietveld fitting revealed that the cell volume of all the phases was in the order: $\text{Co} < \text{Fe} < \text{Mn}$. The electrochemical tests indicated that all the alloy electrodes had good activation performance and the maximum discharge capacity of electrodes increases follow the order: $\text{Fe} < \text{Co} < \text{Mn}$. Meanwhile, the cyclic stability of Fe substitution alloy electrode is worse than that of Co and Mn substitution alloy electrode due to the serious pulverization. Furthermore, it is found that the moderate addition of Co can increase the exchange current density (I_0) of electrodes and the addition of Fe is beneficial for the diffusion of hydrogen atom (D) in the bulk of the electrodes.

Keywords: La-Mg-Ni alloy; hydrogen storage alloy; elements substitution; electrochemical properties

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