中国有色金属学报
中国有色金属学报(英文版)
中国科学技术协会 主管
中国有色金属学会 主办

论文摘要

中国有色金属学报
ZHONGGUO YOUSEJINSHUXUEBAO XUEBAO
第18卷 第11期 (总第116期) 2008年11月

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文章编号：1004-0609(2008)11-2036-08

Al对La-Mg-Ni系贮氢合金电极电化学性能的影响

江冰洁1，王 敬1，2，穆道斌1，2，陈 实1，2，吴伯荣1，2，吴 锋1，2

(1．北京理工大学 化工与环境学院 环境科学工程北京重点实验室，北京 100081；
2．国家高技术绿色材料发展中心，北京 100081)

摘 要：采用固相扩散法制备$La_{0.7}Mg_{0.3}Ni_{3.5-x}Al_x$($x$=0，0.1，0.3，0.7，1.0)和$La_{0.7}Mg_{0.3}Ni_{2.8}Co_{0.7-x}Al_x$ (x=0，0.1，0.2，0.3，0.4)贮氢合金，采用X射线衍射、能谱分析及循环伏安等方法分析合金的相结构和电极电化学性能，研究元素Al替代对合金电化学性能的影响。结果表明：合金由$LaNi_5$、La_2Ni_7和$LaNi_3$三相组成，随着Al替代量的增加，La_2Ni_7相晶胞逐渐膨胀，$LaNi_5$相大量减少，$LaNi_3$相增加，La_2Ni_7相有利于合金电化学性能的提高，然而过高的Al含量会对合金的放电性能带来不利影响。$La_{0.7}Mg_{0.3}Ni_{3.4}Al_{0.1}$和$La_{0.7}Mg_{0.3}Ni_{2.8}Co_{0.6}Al_{0.1}$合金电极的最大放电容量分别为354.5 mA·h/g和373.1 mA·h/g。循环伏安测试显示较明显的氧化峰和还原峰，且峰电位差较小，反映合金电极较好的吸放氢反应可逆性。

关键字： La-Mg-Ni-Al；La-Mg-Ni-Co-Al；贮氢合金；Al替代

Effect of Al substitution on electrochemical performance of La-Mg-Ni hydrogen storage alloys

JIANG Bing-jie1, WANG Jing1, 2, MU Dao-bin1, 2, CHEN Shi1, 2, WU Bo-rong1, 2, WU Feng1, 2

（1. Beijing Key Laboratory of Environmental Science and Engineering, School of Chemical Engineering and the Environment, Beijing Institute of Technology, Beijing 100081, China;
2. National Development Center of High-technology Green Materials, Beijing 100081, China）

Abstract: La0.7Mg0.3Ni3.5−xAlx (x=0, 0.1, 0.3, 0.7, 1.0) and La0.7Mg0.3Ni2.8Co0.7−xAlx (x=0, 0.1, 0.2, 0.3, 0.4) hydrogen storage alloys were prepared by solid diffusion reaction under Ar atmosphere. The phase structures of alloys were analyzed by X-ray diffraction (XRD), as well as the electrochemical performance of alloy electrode with cyclic voltammetry (CV)and charge/discharge test, so as to investigate the effect of Al substitution on electrode characteristics. The results show that all alloys are composed of LaNi5， La2Ni7 and LaNi3 phases. With the increase of x value, the cell volume of La2Ni7 phase enlarges and the content of LaNi5 phase becomes low markedly, while the content of LaNi3 phase increases. La2Ni7 phase can be favorable to improve charge/discharge properties of alloy electrode. However, excessive content of Al has a

negative impact on the discharge performance of alloys. The maximum values are 354.5 mA·h/g and 373.1 mA·h/g for La0.7Mg0.3Ni3.4Al0.1 and La0.7Mg0.3Ni2.8Co0.6Al0.1 electrodes, respectively. Cyclic voltammetry results indicate that the significant peaks responding to oxidation and reduction reactions and small difference between peak potentials mean good reversibility of the electrode during charge/discharge reaction.

Key words: La-Mg-Ni-Al; La-Mg-Ni-Co-Al; hydrogen storage alloys; Al substitution