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Phase Structure and Electrochemical Performances of $La_{0.63}Gd_{0.2}Mg_{0.17}Ni_{3.0-x}Co_{0.3}Al_x$ (x = 0.0, 0.1, 0.2, 0.3, 0.4) Alloys

Zhijie Gao [1,*], *Yongchun Luo* [2,*]

[1] Department of Chemical Engineering and Safety, Binzhou University, Binzhou 256600, PR China
[2] School of Materials Science and Engineering, Lanzhou University of Technology, Lanzhou 730050, PR China
[*]E-mail: gaozhijie1983@126.com, luoyc@lut.cn

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The influences of Al substitution for Ni on the phase abundance, structures and electrochemical properties of $La_{0.63}Gd_{0.2}Mg_{0.17}Ni_{3.0-x}Co_{0.3}Al_x$ (x = 0.0, 0.1, 0.2, 0.3, 0.4) alloys have been investigated. The main phase of Al-free base alloy is Ce_2Ni_7-type phase, Gd_2Co_7-type phase and $CeNi_3$-type phase. After a little Al substitution, AB_3 phase shifts to A_2B_7 phase. Further Al addition promotes the formation of $CaCu_5$-type phase over the A_2B_7-type phase. The sample of x = 0.1 (AB_3 to A_2B_7) increases cycling stability and its discharge capacity almost unchanged. The further addition of Al (A_2B_7 to $CaCu_5$) still increases cycling stability, but decreases the maximum discharge capacity and high rate dischargeability. The substitution of Al elements increases the phase abundance of A_2B_7-type or $CaCu_5$-type so as to improve the cycling stability. The ability of phase pulverization resistance of the metal hydride alloy at the negative electrode appeared to be the intrinsic reason of failure mode of this series of alloys.

Keywords: La-Mg-Ni-based hydrogen storage alloy, Al substitution, Microstructure, Electrochemical properties

FULL TEXT