Remarkable Enhancement in Electrochemical Performances of La-Mg-Ni-based Alloy Decorated with the Reduced Graphene Oxide Supported Cobalt

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A reduced graphene oxide supported cobalt (Co@G) was synthesized via a wet-chemical method and was then introduced into a La_{0.7}Mg_{0.3}(Ni_{0.85}Co_{0.15})_{3.5} alloy (designated as La-Mg-Ni) by means of mechanical alloying. Experimental results indicated that the La-Mg-Ni alloy electrodes decorated with Co@G nanocomposites exhibited excellent electrochemical performance. At a discharge current density of 1200 mA/g, the high rate dischargeability (HRD₁₂₀₀) of the undecorated alloy electrode was 59.8%. This value increased to 82.3%, 84.7%, and 70.7%, respectively, when the alloy electrode was decorated with *x* wt.% (*x*=3,6,9) Co@G nanocomposites, respectively. The exchange current density (*I*₀) and the limiting current density (*I*_L) were also enhanced under the catalytic action of the Co@G nanocomposites. The electrode decorated with the 6.0 wt.% Co@G nanocomposite exhibited the best electrochemical performance. The improvements in electrochemical performance of the La-Mg-Ni alloy electrodes are attributed to the synergistic catalytic action of graphene and Co, thereby facilitating the electron transport and shortening the ion transportation paths in the alloy electrodes.

Keywords: Battery; Electrochemical performance; Dynamics; Graphene; Rare earths

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