Effect of Surface Coating on Electrochemical Properties of Rare Earth-Based AB₅-type Hydrogen Storage Alloys

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In our endeavor to improve overall electrochemical properties of AB₅-type alloys, we performed an electroless plating on the alloy surface. X-ray diffraction shows that the bulk structure is not changed via coating, however, scanning electron microscopy results show that particle shape Ni-coating and flake shape Co-coating adhere tightly to the alloy surface. The electrochemical tests show that initial activation is greatly improved as activation number reduces from 9 (untreated) to 5 (Ni-coated) and 3 (Co-coated). The surface coating improves the charge transfer rate at surface, enlarging hydrogen concentration between in the bulk and at the surface, and therefore promotes the hydrogen diffusion rate process. Consequently, the high rate dischargeability is ameliorated. At a discharge current density 1200 mA/g, HRD increases from 48.6% to 61.0% and 60.9% for Ni-coating and Co-coating alloy, respectively. The coating layer provides a protective function to the alloy surface and leads to an increase in cycling stability. After charge /discharge for 200 cycles, the capacity retention increases from 63% (untreated) to 71% (Ni-coated) and 73% (Co-coated), respectively.

Keywords: Hydrogen storage alloys; Surface coating; Rare earth-based alloys; Electrochemical properties; Kinetics

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