Highly Efficient Electrocatalytic Performance of NiRh Nanosponges for Hydrogen Evolution Reaction

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The development of Ni-based nanoalloys have been extensively explored due to their low cost, high activity and durability in hydrogen evolution reaction (HER). In this study, a facile method is reported to prepare NixRhy nanosponges by using NaBH4 as a reducing agent without any surfactant. The different ratios of Ni and Rh were changed to get various NixRhy electrocatalysts (Ni, Ni3Rh1, Ni1Rh1, Ni1Rh3 and Rh), respectively. Among these prepared catalysts, Ni1Rh3 electrocatalyst exhibited a high electrocatalytic activity with an overpotential of 48 mV at a current density of -10 mA.cm-2 and a superior stability after 2000 cycles of CV in 0.5 M H2SO4 electrolyte. In addition, the Ni1Rh3 electrocatalyst showed a good electrocatalytic acitivty in 1.0 M KOH electrolyte compared to commercial Pt/C (20 wt% of Pt) (c-Pt/C). Moreover, the overall water splitting system of the Ni1Rh3 cathode and the commercial RuO2 anode was performed, which system given an excellent performance with a potential of 1.52 V (vs. RHE)　at a current density of 10 mA.cm-2　 and very stable in 1.0 M KOH electrolyte for over 100,000 seconds.