Enhancement of the Behavior of a Species of NiHcd HER Electrode Using a Stable Ni(OH)2-NiOOH Phase Transformation Redox Mediator in a Developed-Two-Step Alkaline Electrolysis Process Under Variable Current Densities

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An Experimental Study of the Enhanced Behaviour of a species A SPECIFIC COMPOSITION SPECIE OF COMMERCIALLY VIABLE crack-and-pore NiHCd HER Electrode(56.3 wt.% of nickel and 43.7 wt.% of cobalt.) which manifest a synergism between the properties of nickel (high catalytic activity) and cobalt (high hydrogen adsorption),and our improved version of solid-state Ni(OH)2/NiOOH /MWCNT electrode as a recyclable redox mediator.This also the first time that the effect of an induced redox mediator in a two-step alkaline electrolysis was studied on a particular combination of NON-PRECIOUS HER ELECTRODES and AN IMPROVED Ni(OH)2/NiOOH / MWCNT composite electron-coupled proton buffer(intercalation & deintercalation of H+) to separately produce H2 and O2 without any membrane, thus reducing the cost and without having the HER to interfere with specific capacity of the charge-discharge curve of Ni(OH)2 & NiOOH, while ensuring the separate generation of highly pure H2 and O2 with no membrane prevents the product gases from mixing over a range of current densities and simplifies the gas handling without the need for equal pressures on electrodes, which greatly increases the operation flexibility.Also, here the separate H2 and O2 productions require different driving voltages(or power inputs) which implies that unlike that in one-step electrolysis we can flexibly use sustainable energy for H2 production or O2 production based on the output variation in these unstable power sources. According to driving voltages, the efficiency of this two-step water electrolysis is also~92% (=1.973/2.137) compared with its corresponding one-step water electrolysis. The achieved efficiency is slightly higher than that (79%) of the two-step PEM water electrolysis. The Faradaic efficiency is 94.7%(12/12.67).

Awards Won:

Third Award of $1,000