Analysis of CoTi superior hydrogen evolution catalyst by Quick Scanning X-ray Absorption Spectroscopy

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Abstract

High performance catalysts for hydrogen evolution reaction in alkaline electrolysis are in demand to improve the performance of water splitting. In this study, we report the synthesis of highly stable and efficient CoTi electrocatalyst as cathode in alkaline electrolysis. CoTi hydroxide layer is *in-situ* grown on the surface of nickel foam by hydrothermal method. The effects of precursor variation in synthesis of hydroxide structures are studied. The onset potential for hydrogen generation in 1 M NaOH electrolyte is only 123 mV with a Tafel slope of 98.4 mV/dec. CoTi catalyst exhibits only a minor decay of 3.5% after 12 hours of chrono-potentiometry test at -100 mA/cm^2. A negligible difference of 0.7 mV is observed in over potential before and after stability test [1]. The potentiality for the oxygen evolution reaction of the CoTi catalysts is also investigated. The onset potential for oxygen generation in 1M NaOH electrolyte is 270 mV with a Tafel slope of 99 mV/dec. The overall water splitting is performed with the lab fabricated CoTi catalyst as an anode and cathode. Electrolysis results show that the over potential at 10 mA/cm^2 and 100 mA/cm^2 is 1.69 V and 2.06 V during the electrolysis of the sample. To analyze the reaction mechanism for the outstanding stability of the catalyst, the samples were analyzed during the electrolysis at synchrotron by quick scanning X-ray absorption near edge spectroscopy. Therefore, this is achieved by efficient charge transfer and the metal active center at the edges of hydroxide structures. CoTi hydroxide structures helps in favoring the alkaline electrolysis at lower potentials for generation of clean energy.

Keywords: hydrogen evolution reaction, CoTi hydroxide, electrocatalyst, alkaline electrolysis, water splitting.

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