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Effect of carbon coating on Cu electrodes for hydrogen production by water splitting

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ABSTRACT

In recent years, fossil fuel depletion has been increasing, which leads to environmental issues. Hydrogen energy is considered a promising renewable energy to replace fossil fuels because it is a sustainable, clean, and green energy source. Among hydrogen production methods, water splitting has the highest reliability and is used the most often. Platinum is normally used as water splitting catalyst and an electrode. However, there has been much effort to replace it as such owing to its high cost. Copper (Cu) is not used as water splitting catalyst or an electrode, despite its high current density, because of its corrosive properties. In this study, carbon was coated onto a Cu substrate and a hydrogen production experiment was carried out with 0.1 M Na_2SO_4 and 0.1 M H_2SO_4 electrolytes. As a result, the carbon coating decreased oxidation rate of the Cu electrode and effected stability in short-term hydrogen evolution experiment. This indicates the possibility of carbon-Cu electrode with other catalytic materials.

Introduction

Demand for alternative energy is increasing because of fossil fuel depletion and global warming [1]. Among renewable energy sources, hydrogen is promising because it can solve energy resource depletion and environmental problems [1,2]. In addition, hydrogen has high energy capacity and is nearly pollutant free when utilized [2]. Water splitting has the highest reliability among hydrogen production methods and is capable of producing high purity hydrogen [3,4]. However, disadvantages of water splitting are low conversion efficiency and high production cost [5–9], which can be improved by increasing the electrode surface area with synergistic effect of catalyst component [10,11].

Recently, many researchers have been trying to develop new low-cost electrode materials that have high current density for use in hydrogen production reactions. Platinum (Pt) is a very effective catalytic substance in the production of hydrogen, hence many studies have been conducted to develop low Pt loading electrodes [10]. Raoof et al. [12] developed a Pt-coated nanoporous copper (Cu) electrode that showed a remarkable increase in electrochemical activity for

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