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ABSTRACTS

EFFICIENT WATER OXIDATION CATALYZED BY A GRAPHENE OXIDE/COPPER ELECTRODE, SUPPORTED ON CARBON CLOTH

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Cost-effectiveness, high performance, and stable electrocatalysts toward oxygen evolution reaction (OER) play a vital role in improving energy technology. In this study, composite materials consisting of electrochemically reduced graphene oxide (ERGO)/sulfur-doped copper oxide supported with carbon cloth (CC) was successfully synthesized as an efficient OER electrocatalyst in NaOH electrolyte. The results of the X-ray diffraction pattern revealed the effect of sulfur on copper as dopant and a transformation from GO to reduced GO through an electrochemical route, respectively. Furthermore, scanning electron microscopy micrographs showed the dendritic structure that had a high surface area to be used for electrochemical applications. Moreover, energy-dispersive X-ray spectroscopy revealed the uniformly-successive distribution of Cu and sulfur throughout the structure that enabled a high rate of diffusion of ions and electrons across the electrode and electrolyte interface. As a matter of fact, the prepared electrocatalyst in this work (ERGO/S-doped Cu/CC) showed a small overpotential of 390 mV to reach a current density of 30 mA cm^{-2}. The ERGO/S-doped Cu/CC demonstrated good durability under conditions of high applied potential of 0.7 V (vs. Ag/AgCl) and robust alkaline solution. The good OER activity of ERGO/S-doped Cu/CC is related to the presence of the graphene and sulfurized copper, enhancing the electrochemical surface area as well as the synergetic effects of sulfurized copper and ERGO sheets. This efficient and cost-effective electrocatalyst suggests that the prepared electrode can be a candidate for an OER electrode.

Keywords: water splitting, oxygen evolution reaction, copper electrocatalyst, graphene oxide, sulfur doping
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CONCLUSIONS

In brief, simple electrodeposition following by a simple solvothermal route was adapted for the preparation of ERGO/S-doped Cu/CC. A defect-rich structure was obtained. The electrochemical results demonstrated good activity for the oxygen evolution reaction. Our work indicated that the unique composition of ERGO and sulfurized Cu on carbon cloth a substrate possesses a high surface area and porosity. The merit of the prepared composite electrode is to facilitate the diffusion rate of ions and enhance the electron charge transfer from the electrode/electrolyte interface. Furthermore, the prepared electrode possesses higher active sites, which is of great importance to the electrochemical water oxidation. In fact, the porous structure of electrochemically reduced graphene oxide in composition with S-doped Cu provided high active sites and open structures to further speed-up ions in the electrolyte to diffuse toward active sites and to accelerate gas release. The developed ERGO/S-doped Cu/CC composites with good electrocatalytic activity provide a promising platform not only for water splitting but also for other applications in supercapacitors, biosensors, and fuel cells.

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