NiCo Alloy Anchored Self-supporting Carbon Foam as Bifunctional Oxygen Electrode for Rechargeable and Flexible Zn-air Batteries

Mengyang Dong[1], Huai Qin Fu[1], Yiming Xu[1], Yu Zou[1], Ziyao Chen[1], Liang Wang[1], Mengqing Hu[1], Kaidi Zhang[1], Bo Fu[1], Huajie Yin[1], Porun Liu[2], and Huijun Zhao[1]

[1]Affiliation not available
[2]Griffith University

December 2, 2022

Abstract

The design and fabrication of flexible, porous, conductive electrodes with customizable functions become the prime challenge in the development of new-generation wearable electronics, especially for rechargeable batteries. Here, NiCo bi-alloy particulate catalysts loaded self-supporting carbon foam framework (NiCo@SCF) as a flexible electrode has been fabricated through one facile adsorption-pyrolysis method using a commercial melamine foam. Compared with the electrode with Pt/C and Ir/C benchmark catalysts, the NiCo@SCF electrode exhibited superior bifunctional electrocatalytic performance in alkaline media with a half-wave potential of 0.906V for oxygen reduction reaction, an overpotential of 286 mV at j=10 mA cm-2 for oxygen evolution reaction, and stable bifunctional performance with a small degradation after 20,000 voltammetric cycles. The as-assembled aqueous zinc-air battery (ZAB) with NiCo@SCF as a self-supporting air cathode demonstrated a high peak power density of 178.6 mW cm-2 at a current density of 10 mA cm-2 and a stable voltage gap of 0.94V a 540 h charge-discharge operation. Remarkably, the as-assembled flexible solid-state ZAB with self-supporting NiCo@SCF as air cathode presented an engaging peak power density of 80.1 mW cm-2 and excellent durability of 95 h undisrupted operation, showing promise for the design of wearable ZAB.

Hosted file

`Main_Article.docx` available at https://authorea.com/users/562036/articles/609334-nico-alloy-anchored-self-supporting-carbon-foam-as-bifunctional-oxygen-electrode-for-rechargeable-and-flexible-zn-air-batteries