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Two-dimensional Porous ZnCo₂O₄ Thin Sheets Assembled by 3D Nanoflake Array with Enhanced Performance for Aqueous Asymmetric Supercapacitor

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Abstract

As a new electrode material for supercapacitor, two dimensional (2D) porous cobaltite with spinel structure shows high specific capacitance, long cycle life and especially high energy density, which have great potential in electrochemical energy storage. In the present work, we demonstrated for the first synthesis of 2D porous ZnCo₂O₄ thin sheets (CQU-Chen-Zn-Co-O-2) with micro-mesoporous structure and high specific surface area of 89.63, 151.65 and 63.72 m²·g⁻¹ through simple hydrothermal treatment of a mixed aqueous solution containing two kinds of transition metal nitrates (zinc nitrate (Zn(NO₃)₂) and cobalt nitrate (Co(NO₃)₂)) and benzoic acid (C₆H₅COOH) at 180, 200 and 220 °C for 12 h. The 3D nanoflake array assembled nanostructures of the ZnCo₂O₄ thin sheets facilitate the transmission of ions and electrons throughout the electrochemical testing process, which yield a higher specific capacitance of 3.07 F·cm⁻² at 1.04 mA·cm⁻² in a three-electrode system and a high energy density of 36.31 Wh·kg⁻¹ at a power density of 850 W·kg⁻¹ in an aqueous asymmetric supercapacitor (ZnCo₂O₄ thin sheets//active carbon (AC)). The results indicate that the 2D ZnCo₂O₄ thin sheets exhibit superior supercapacitor performance.

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