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One-step Facile Route to Copper Cobalt Sulfide Electrodes for Supercapacitors with high-rate long-cycle life performance

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ABSTRACT

The impressive electrochemical energy storage performance of Earth-abundant ternary copper cobalt sulfide (CCS) thin film electrodes that are prepared on stainless steel substrates via a simple and cost-effective hydrothermal process is demonstrated. The optimized CCS electrode shows a high specific capacitance of ~ 516 F/g at a current density of 10 A/g, a good rate capability of ~ 72% at a high current density of 50 A/g, and a good cycling retention of ~ 66% with a coulombic efficiency of ~ 99% after 10,000 charge-discharge cycles. The CCS electrode exhibits a high energy density of ~ 35.2 Wh/kg at a power density of ~ 6.6 kW/kg. The excellent electrochemical supercapacitor properties of the CCS electrode are a result of a synergetic effect between the uniform full coverage, robust adhesion, and desired chemical composition. A low charge transfer resistance, resulting from the large electrochemically active surface area (ECSA) and good diffusion, significantly contributes to the enhanced electrochemical supercapacitor performance. This excellent CCS electrode material has the potential to become a low-cost and long-cycle life electrode for the next-generation high-power-capacity supercapacitors.

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