Nanostructured CuO/Cu_2O shish-kebab electrode preparation for metal oxide supercapacitor applications

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The growing demand for high-capacity energy storage has led to an increased focus on developing novel electrode materials for supercapacitors. This work reports the synthesis and characterization of an unprecedented shish-kebab CuO/Cu_2O nanostructure for supercapacitor electrode active material. The electrode was prepared in a multistep procedure which involves anodization of the copper electrodeposited Ti substrate to form $Cu(OH)_2$ nanowires, thermal annealing for conversion into CuO nanowires, and finally, electrochemical deposition of Cu_2O nanoparticles using an aqueous solution of 0.1M sodium acetate (CH_3COONa) and 0.01M copper acetate ($C_2H_4CuO_2$) for 20 minutes on the layer of CuO nanowires. For the material characterization, SEM and XRD were used to observe the morphology and crystallinity, which demonstrated the formation of the desired nanostructure of shish-kebab. The CV and GCD tests of the shish-kebab supercapacitor electrode prove the pseudocapacitive charge storage behaviors. The study revealed that the $Ti/CuO/Cu_2O$ shish-kebab nanostructure exhibited excellent performance, with a specific capacitance value of 0.448 F. Hence, these results primarily conclude that the $Ti/CuO/Cu_2O$ shish-kebab nanostructure has given rise to vastly improved charge storage. The findings also lead to a promising approach to the design of advanced supercapacitor electrodes based on copper oxide nanostructures and intermediate energy storage devices.

Keywords: *Supercapacitor, CuO/Cu_2O Nanostructure, Shish-kebab, Pseudocapacitance, Energy storage*