Magnetic Electrodeposition of the Hierarchical Cobalt Oxide Nanostructure from Spent Lithium-Ion Batteries: Its Application as a Supercapacitor Electrode

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ABSTRACT

In this study, electrodeposition of cobalt oxide (Co_3O_4) from spent lithium-ion batteries is successfully enhanced by the magnetic field effect. In the presence of magnetic field, well-defined hierarchical Co_3O_4 nanostructures with higher electroactive surface area are formed during the electrodeposition process. Electrochemical analysis shows that the enhanced Co_3O_4 nanostructures exhibit excellent charge storage capabilities of 1273 F g^{-1} at 1 A g^{-1}, approximately 4 times higher than the electrodeposited Co_3O_4 that is formed without magnetic field effect. It also reveals the high cycling stability of enhanced Co_3O_4 nanostructures, with 96% capacitance retention at 5000 charge discharge cycles. The results manifest the enhancement of Co_3O_4 recovery from spent lithium-ion batteries, which can be the potential electrode material for supercapacitor application.

Keywords: Magnetic Electrodeposition; cobalt oxide; supercapacitor electrode