

# 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 ( $\text{Co}_3\text{O}_4$ ) from spent lithium-ion batteries is successfully enhanced by the magnetic field effect. In the presence of magnetic field, well-defined hierarchical  $\text{Co}_3\text{O}_4$  nanostructures with higher electroactive surface area are formed during the electrodeposition process. Electrochemical analysis shows that the enhanced  $\text{Co}_3\text{O}_4$  nanostructures exhibit excellent charge storage capabilities of  $1273 \text{ F g}^{-1}$  at  $1 \text{ A g}^{-1}$ , approximately 4 times higher than the electrodeposited  $\text{Co}_3\text{O}_4$  that is formed without magnetic field effect. It also reveals the high cycling stability of enhanced  $\text{Co}_3\text{O}_4$  nanostructures, with 96% capacitance retention at 5000 charge discharge cycles. The results manifest the enhancement of  $\text{Co}_3\text{O}_4$  recovery from spent lithium-ion batteries, which can be the potential electrode material for supercapacitor application.

**Keywords:** Magnetic Electrodeposition; cobalt oxide; supercapacitor electrode