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Continuous nanobelts of nickel oxide–cobalt oxide hybrid with improved capacitive charge storage properties

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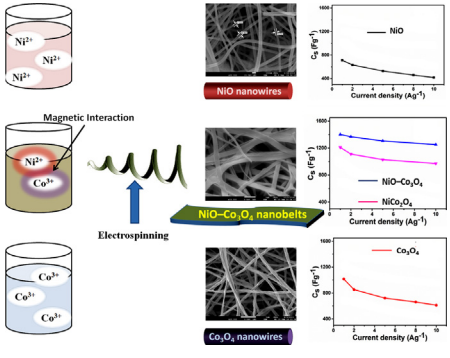
HIGHLIGHTS

- Continuous nanobelts of a material hybrid (HNBs) are prepared.
- Thickness of the HNBs is less than half of its pore diameter.
- Electrochemical properties of the HNBs are benchmarked with three other materials.
- HNBs showed superior charge storage properties.

GRAPHICAL ABSTRACT



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ABSTRACT

This paper reports the synthesis of continuous nanobelts, whose thickness is less than half of its pore diameter, of a material hybrid composing of nanograins of nickel oxide and cobalt oxide by electrospinning technique and their capacitive charge storage properties. While the constituent binary metal oxides (NiO and Co_3O_4) formed solid cylindrical nanofibers the hybrid and a stoichiometric compound in the Ni-Co-O system, i.e., spinel-type $NiCo_2O_4$, formed as thin nanobelts due to the magnetic interaction between nickel and cobalt ions. The nanobelts showed six-fold larger surface area, wider pores, and impressive charge storage capabilities compared to the cylindrical fibres. The hybrid nanobelts showed high specific capacitance (C_S ~ 1250 F g^{-1} at 10 A g^{-1} in 6 M KOH) with high capacity retention, which is appreciably larger than found for the stoichiometric compound (~970 F g^{-1} at 10 A g^{-1}). It is shown that the hybrid nanobelts have lower internal resistance (1.3 Ω), higher diffusion coefficient (4.6×10^{-13} cm^2 s^{-1}) and smaller relaxation time (0.03 s) than the benchmark materials studied here.