Facile Synthesis of Self-Supported Amorphous Cobalt-Nickel Tungstate Thin Films for High Performance Asymmetric Supercapacitor: Role of Co and Ni variation

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Abstract
Pseudocapacitors and redox capacitors are among the most promising candidates for high specific energy and power delivery owing to their rapid charge-discharge capability and excellent cyclic stability. In this work, high-performance, self-supported nickel cobalt tungstate electrodes are fabricated via a facile successive ionic layer adsorption and reaction (SILAR) method with varying nickel-cobalt ratios. The optimized nanospherical $Ni_{0.25}Co_{0.75}WO_4$ electrode achieves a remarkable specific capacity of 785.72 C g^{-1} at 1.1 A g^{-1}, nearly three times higher than that of pristine nickel tungstate and cobalt tungstate. Moreover, $Ni_{0.25}Co_{0.75}WO_4$ exhibits excellent cycling stability, retaining 87% of its initial capacity even after 5000 cycles at 4.1 A g^{-1}. When assembled into a hybrid supercapacitor (HSC) with reduced graphene oxide (rGO) as the negative electrode, the resulting device achieves an operational voltage of 1.6 V and delivers a specific energy of 50.41 Wh kg^{-1} at a specific power of 1.74 kW kg^{-1}. This configuration demonstrates a high specific energy without compromising power performance. These findings demonstrate that nickel cobalt tungstate is a promising electrode material for high performance supercapacitors and highlight a cost-effective synthesis approach with outstanding charge storage capability.

References

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Figures

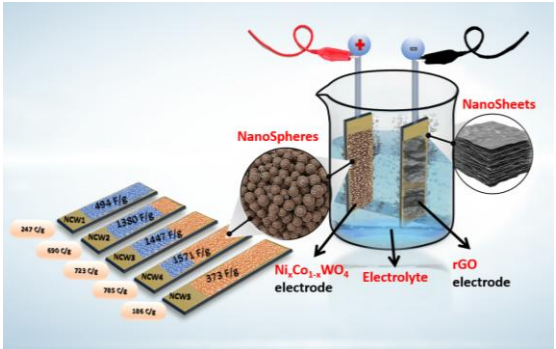

Figure 1: Graphical abstract.