COBALT-IRON LAYERED DOUBLE HYDROXIDE AND REDUCED GRAPHENE OXIDE BASED NANOCOMPOSITE FOR HIGH PERFORMANCE HYBRID SUPERCAPACITOR APPLICATION

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Transition-metal-based layered double hydroxides have emerged as promising candidates for electrochemical energy storage because of their tunable composition, stacked architecture, and large number of redox-active sites. Despite these advantages, their performance is often hindered by limited electrical conductivity and the tendency of nanoscale particles to cluster. In this work, a cobalt–iron LDH integrated with reduced graphene oxide was produced through a single-step hydrothermal route for supercapacitor applications. Structural and morphological analyses verified the successful formation of a mesoporous CoFe-LDH/rGO hybrid. Electrochemical testing in a three-electrode configuration showed that the material delivered a high specific capacitance of 1460 F g^{-1} at 1 A g^{-1}, along with strong rate performance and stable cycling behavior. A hybrid supercapacitor was further assembled using CoFe-LDH/rGO as the positive electrode, activated carbon as the negative electrode, and a gel-based electrolyte. The resulting CoFe-LDH/rGO//AC device achieved an energy density of 45 Wh kg^{-1} at a power density of 2700 W kg^{-1} and maintained 87% of its initial capacitance after 10,000 charge–discharge cycles. The enhanced performance is attributed to the presence of rGO, which improves charge transport, minimizes particle aggregation, and increases the number of accessible active sites.

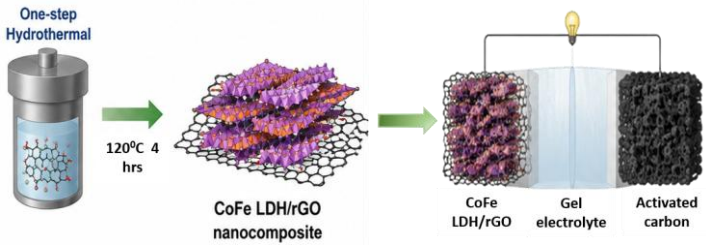

Fig. 1. Schematic representation of the hydrothermal synthesis of the CoFe-LDH/rGO nanocomposite for hybrid supercapacitor applications.

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References

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