Electrochemical and Thermogravimetric Study of Manganese–Cobalt Oxide Composites as Electrode Materials for Supercapacitor Applications

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In recent decades, the growing dependence on non-renewable fossil fuels has led to a significant increase in energy consumption, posing serious threats to both human health and the environment.

This situation urgently demands the development of renewable, sustainable, environmentally friendly, and economically accessible energy storage systems.

Among various energy storage technologies, supercapacitors stand out due to their high power density, excellent cycle stability, and fast charge/discharge capability, making them highly promising candidates for next-generation energy storage devices.

Despite these advantages, supercapacitors still lag behind traditional batteries in terms of energy density.

The electrochemical performance of supercapacitors largely depends on the materials used for their electrodes.

In this regard, transition metal oxides (TMOs) have garnered significant attention as promising electrode materials for supercapacitors.

This study focuses on two such transition metal oxides – Co_3O_4 and MnO_2.

By selecting and combining various parameters, cyclic voltammetry (CV) and galvanostatic charge/discharge (GCD) curves were obtained for each case using a CH Instruments Electrochemical Workstation.

These curves were then used to determine the specific capacitance and energy density of the electrode samples.

The resulting powders were analyzed by thermogravimetric analysis (TGA) using a NETZSCH STA 2500 Regulus thermal analyzer.

Additionally, the electrode materials were characterized by SEM, EDS, and XRD analyses. The obtained results clearly demonstrate the promising potential for further research and application.