Three-dimensional well-interwoven M-Co-oxide (M = Ni, Zn, and Mn) nanowire arrays for high-performance supercapacitors

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Mixed nanostructured transition metal oxides with hierarchical and porous structures, constructed from interconnected nano-building blocks, are considered as advanced electrode materials for supercapacitor applications. Here, ternary hierarchical M-Co-oxide (M = Ni, Mn, Zn) mesoporous 3D complex structures assembled from perfectly-aligned and well-interwoven nanowire arrays (NWAs) were uniformly grown on nickel foam (conductive substrate) using a facile hydrothermal method followed by calcination. When tested as a binder-free positive electrode in a three-electrode system, the Zn-Co-oxide NWAs showed high specific capacitance (1005 F g^{-1} at 3 mA cm^{-2}), outstanding rate capability (59% at 50 mA cm^{-2}), and excellent cyclic stability (90 % after 5000 cycles) superior to those of binary-component Ni-Co-oxide and Mn-Co-oxide NWAs. The enhanced electrochemical performance of Zn-Co-oxide is attributed to the 3D hierarchical architecture, high specific surface area, porous nanonetworks, improved conductivity, and synergistic interaction within the active components.