Article

Pseudocapacitive Charge Storage in Single-Step-Synthesized CoO–MnO_2–$MnCo_2O_4$ Hybrid Nanowires in Aqueous Alkaline Electrolytes

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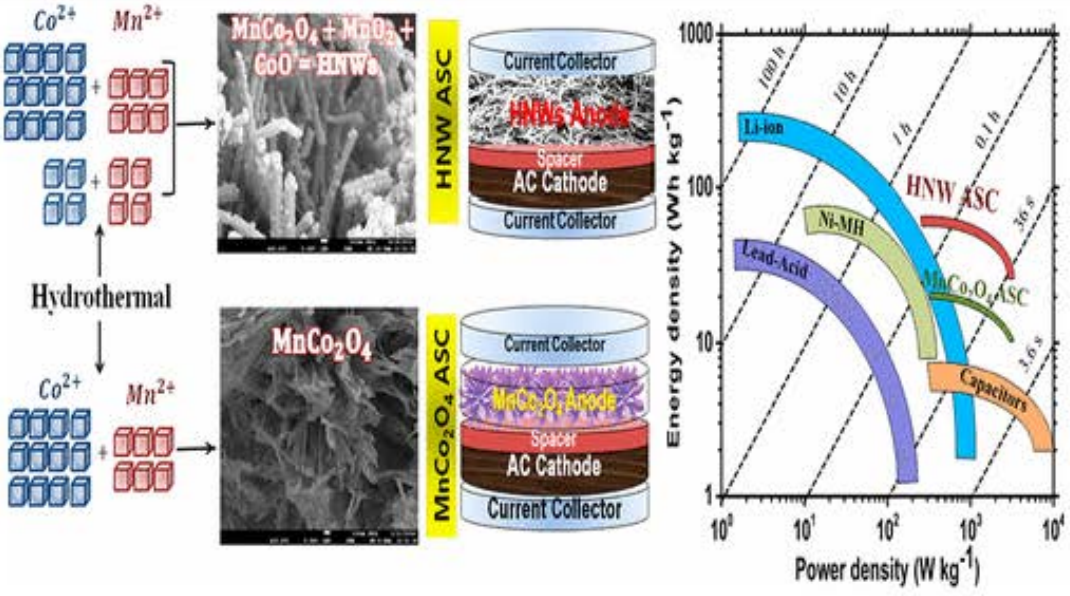
Abstract



A new pseudocapacitive combination, viz. CoO-MnO_2–$MnCo_2O_4$ hybrid nanowires (HNWs), is synthesized using a facile single-step hydrothermal process, and its properties are benchmarked with conventional battery-type flower-shaped $MnCo_2O_4$ obtained by similar processing. The HNWs showed high electrical conductivity and specific capacitance (C_s) (1650 F g^{-1} or 184 mA h g^{-1} at 1 A g^{-1}) with high capacity retention, whereas $MnCo_2O_4$ nanoflower electrode showed only one-third conductivity and one-half of its capacitance (872 F g^{-1} or 96 mA h g^{-1} at 1 A g^{-1}) when used as a supercapacitor electrode in 6 M KOH electrolyte. The structure–property relationship of the materials is deeply investigated and reported herein. Using the HNWs as a pseudocapacitive electrode and commercial activated carbon as a supercapacitive electrode we achieved battery-like specific energy (E_s) and supercapacitor-like specific power (P_s) in aqueous alkaline asymmetric supercapacitors (ASCs). The HNWs ASCs have shown high E_s (90 Wh kg^{-1}) (volumetric energy density $E_v \approx 0.52$ Wh cm^{-3}) with P_s up to ~10^4 W kg^{-1} (volumetric power density $P_v \approx 5$ W cm^{-3}) in 6 M KOH electrolyte, allowing the device to store an order of magnitude more energy than conventional supercapacitors.