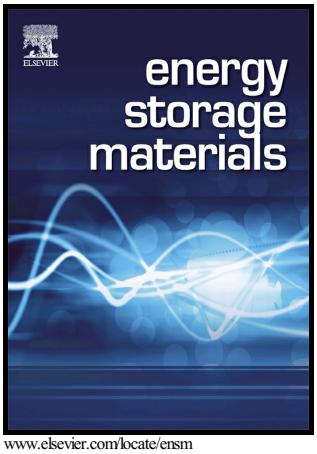

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Structural hybridization of ternary (0D, 1D and 2D) composites as anodes for high-performance Li-ion batteries

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Abstract

We report herein on a novel structural hybridization strategy to synthesize a ternary composite $(Fe,Co)_3O_4/Co_3O_4$/rGO using a facile hydrothermal method for high-performance lithium-ion batteries (LIBs). In the as-fabricated hybrid structure, high-capacity $(Fe,Co)_3O_4$ sub-microparticles (zero-dimension) and Co_3O_4 nano-rods (one-dimension) are composited with highly conductive network of reduced graphene oxide (rGO) nano-sheets (two-dimension). Benefiting from the unique architecture, the volume expansion of $(Fe,Co)_3O_4$, Co_3O_4 during charging/discharging and their direct exposure to the electrolyte have been effectively alleviated by the spatially confining effects of rGO nano-sheets. On the other hand, the intrinsic wrinkle morphology of graphene nano-sheets was alleviated by the nano-rods support, leading to enhanced transportation mobility of electrons and ions. Furthermore, the formed hierarchical pores effectively increase the reaction sites and kinetics. As a result, the as-built electrode of the ternary composite shows remarkably cycling stability (1668.5 mAh g^{-1} for the first cycle and 80.97% capacity retention after 500 cycles at 1A g^{-1}) and rate capability (341.6 mAh g^{-1} at 10 A g^{-1}), which are much superior to those of binary composites. The newly fabricated ternary composites as well as the structural hybridization strategy show great potentials in energy storage applications.