PBA derived Co_3O_4 nanoparticle embedded in nitrogen-doped carbon as stable anode material for lithium-ion batteries

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Lithium-ion batteries (LIBs), advanced energy storage devices, have shown a wide range of practical applications, such as intelligent grids, electric vehicles and portable electronic consumer devices. Among transition metal oxides, Co_3O_4 has attracted intensive attention and have been identified to be a promising anode material because of its high theoretical capacity of 890 mAh g^{-1}, relatively low cost and abundance [1-6]. However, most approaches for preparing morphology-tailored Co_3O_4 with satisfactory high specific capacity and high rate capability always include complex preparation routes such as etching, which are time-consuming and costly, thus doubting the commercial applications. Here, we report the design and preparation of ball-like and tube-like Co_3O_4 embed in nitrogen-doped carbon (B-Co_3O_4@N-C and T-Co_3O_4@N-C) using a Co-based metal organic framework (MOF) template after the calcination in N_2 and subsequent in air. T-Co_3O_4@N-C exhibits excellent reversible capacity, long cycling life, and great rate capability for lithium storage when evaluated as an anode for LIBs. A remarkable and stable discharge capacity of 795 mAh g^{-1} was maintained at 0.5 A g^{-1} after 300 cycles when T-Co_3O_4@N-C is applied as an anode. In addition, a full Co_3O_4@N-C/$LiFePO_4$ battery displayed stable capacity retention of 95% after 100 cycles. The proposed preparation strategy is facile, scalable, and tunable, which can be applied in the mass production of high-performance and stable anode for LIBs.

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