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Rational design of metal-organic framework-templated hollow $NiCo_2O_4$ polyhedrons decorated on macroporous CNT microspheres for improved lithium-ion storage properties

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Abstract:

We report three-dimensional (3D) porous microspheres comprising interconnected carbon nanotubes (CNT) decorated with hollow $NiCo_2O_4$ polyhedrons (H-NCO/CNT) for high-performance lithium-ion batteries (LIBs). The rationally designed composites are successfully fabricated via the combination of spray-pyrolysis and solution-based methods. The macroporous CNT microsphere obtained by spray pyrolysis acts as a substrate for the growth of the zeolitic imidazolate framework-67 (ZIF-67) in ethanol solution. During ion exchange and subsequent oxidation processes, the ZIF-67 polyhedrons were converted into hollow $NiCo_2O_4$ polyhedrons consisting of small crystal domains. Rational design of such composite microspheres offers a highly conductive 3D porous network that simultaneously enables fast ion and electron diffusion deep inside the electrodes during cycling. In addition, the hollow polyhedron interiors can accommodate