Fe-N-doped Carbon Nanofiber and Graphene Modified Separator for Lithium-Sulfur Batteries

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Abstract

A novel lightweight, multi-functional layer comprised of 1D porous Fe-embedded nitrogen-doped carbon nanofibers (Fe-N-C) and 2D graphene sheets is introduced to modify a commercial polypropylene (PP) separator for use in lithium-sulfur batteries. Benefiting from the high electrical conductivity and strong lithium polysulfide (LiPS) chemical adsorption ability of Fe-N-C, the porous intercalation-structured modified layer exhibits excellent ability to suppress LiPS shuttling while maintaining high lithium-ion transport, and the modified layer functions as a highly conductive upper current collector to reutilize active sulfur species. The cell assembled with the modified multifunctional separator shows a high rate capability and excellent cycling stability, exhibiting a capacity of 847.9 mAh g^{-1} at 2 C and a low degradation rate of 0.053% per cycle over 500 cycles at 0.5 C.

Keywords: Separator; Carbon nanofiber; Graphene nanosheets; Lithium-sulfur batteries

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