

Monolithic Corrugated Graphene/Nickel Foam for Lithium Metal Storage

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Li metal batteries such as Li-air and Li-S are promising next-generation energy storage systems. However, Li dendrites can develop due to partial current concentration at previously formed Li protrusions during repeated cycling, which causes dangerous short-circuiting and low coulombic efficiency. This major obstacle makes it difficult for Li metal batteries to be used for practical applications. In this study, we introduce the use of 3D monolithic corrugated graphene/nickel metal foam (GPNf) to store Li metal in a highly reactive carbonate electrolyte and EC/DMC solvents. Monolithic GPNf was prepared by a simple acid-catalyzed hydrothermal method.

The 3D-GPNf hybrid structure allows the facile diffusion of Li ions and reduces the effective current density and Li deposition rate. The GPNf can achieve 99.9 % average coulombic efficiency for 1,000 cycles without the development of dendrite morphology at a fixed capacity of 1 mAh cm⁻² @ 2 mA cm⁻² in a carbonate electrolyte system. In addition, the GPNf exhibits a high rate capability and capacity limitation (20 mAh cm⁻² @ 20 mA cm⁻²).