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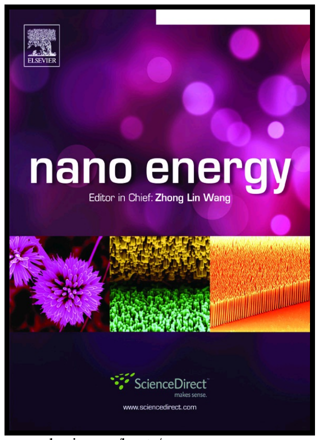

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Highly Compressible, Binderless and Ultrathick Holey Graphene-based Electrode Architectures

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Abstract

Graphene is a renowned material due to its unique structural characteristics and chemical properties. By heating graphene powder in an open-ended tube furnace, a highly compressible carbon material, holey graphene (hG), can be created with controlled porosity and be further decorated with nanosized catalysts using a solvent-free procedure to impart functionality and electrocatalytic activity. For the first time, we demonstrate an additive-free, dry press method to compression mold hG-based materials into ultrathick, binderless and high mass loading architectures using a hydraulic press at room temperature. The compressibility and structure of the hG allows for fabrication of unique ultrathick electrode architectures (mixed, sandwich, and double-decker) using both hG and catalyst/hG nanohybrid materials. These high mass loading, mixed and stacked hG electrode architectures are the first of their kind and are successfully demonstrated as lithium-oxygen (Li-O_2) cathodes. The scalable, binderless, and solventless dry press method and novel additive-free electrode architectures presented here greatly advance both electrode fabrication options, and open up new electrode designs for potential energy storage advancements.