Graphene Technology for the Next Generation Energy Storage Devices

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Abstract

Graphene is an allotrope of carbon consisting of a single layer of carbon atoms arranged in a two-dimensional honeycomb lattice. Graphene in 2D and 3D structure has received increasing attention due to its unique physicochemical properties including high surface area, excellent conductivity, high mechanical strength, flexibility and ease of functionalization and synthesis and low cost material . Graphene has recently applied in the area of energy storage applications both in battery and supercapacitor. In our research lab at NSTDA, electrochemical-exfoliated 2D graphene and Hummer-made reduced Graphene Oxide (rGO) are widely used for enhancing energy density and cyclability performance in various types of batteries and supercapacitors such as 3D hollow graphite nanotetrapods by Vapor Phase Transport and In-situ Chemical Vapor Deposition/Etching which is used to fabricate 3D graphene for high-performance Lithium-Sulfur batteries based on 3-D graphene foam structures. In this talk, both 2D and 3D graphene and other carbon nanomaterials are used to enhance performance in electrode composition, coated separator and enhanced electrolyte for both lithium-based and beyond-Lithium-based energy storage devices including Lithium-Sulfur battery, Zinc ion battery, Sodium ion battery and high energy density supercapacitors.

Keywords: Carbon, Graphene, Battery, Supercapacitors, Energy Storage