

## Graphene Materials: Fabrication and Use in Electrochemical Energy Storage

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Electrochemical energy storage devices, in particular, supercapacitors, lithium-ion batteries and lithium-sulfur batteries, have been extensively explored. Graphene with different structures and functionalities plays a key role in these energy storage devices for use as electrodes, conductive fillers, coating layers, etc. We have fabricated different types of graphene materials, such as graphene oxide (GO), reduced GO, graphene nanosheets, graphene films and single crystal domains, and 3D graphene networks, by chemical exfoliation and chemical vapor deposition, and from them we have prepared various graphene-based hybrid electrode materials by mechanical mixing, coating, hydrothermal deposition, and *in-situ* synthesis for supercapacitors, lithium ion and lithium-sulfur batteries. These hybrid electrode materials showed desirable electrochemical properties in terms of long cycling life, good high rate capability, and high reversible capacity. Using graphene in flexible energy storage devices is another emerging field, and we have also explored several kinds of graphene-based flexible electrodes. For example, by coating active materials on a graphene foam-like structure synthesized by CVD, a thin, lightweight and flexible lithium ion battery was assembled to show high rate capability and capacity, and excellent flexibility.