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Reduced Graphene Oxide as an Efficient Platform for Rechargeable Lithium Batteries

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Abstract

Graphene has been intensively investigated as a conducting support for controlling nanostructures of the electrodes. Here we present some of recent results using reduced graphene oxides as an efficient two dimensional platform for rechargeable lithium batteries in our group. Specifically, high surface area, structural flexibility and excellent conductivity of graphene have allowed graphene to be used as a conducting additive or two dimensional (2D) templates to provide efficient electrical pathways for insulating active materials in lithium ion batteries (LIB). We fabricated nanostructured $LiFePO_4$-reduced graphene oxide (rGO) hybrid materials for high power lithium ion battery cathodes. The fabricated hybrid cathodes showed superior rate capability and cyclability with rates from 0.1 C to 60 C: This study demonstrated the synergistic combination of nano-sizing with efficient conducting templates to afford facile Li^+ ion and electron transport for high power applications. Next, our recent results of using reduced graphene oxide as a catalyst support for lithium air batteries will be presented. The use of a two-dimensional graphene support has been proven to be quite effective in enhancing catalytic activity compared to conventional carbon supports, such as Vulcan carbon or carbon black. The favorable behaviour of graphene supports may be attributed to a series of positive features, such as: i) a high dispersion and low aggregation of noble metal catalysts resulting from an enhanced interaction between functionalized graphene surface and the noble metals and ii) a large surface area of the graphene support. We demonstrate that the nanohybrid structures developed benefitting by the unique combination of a porous rGO support with catalyst hybrid nanocrystals, decrease the value of the charging overpotential compared to that resulting from the use of conventional carbon-based, catalyst-free electrodes.