

### A High-Energy Lithium-ion Battery using Si-based Anode

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Currently, high-energy lithium ion batteries are in unprecedented demand for use in various energy storage applications including emerging electronic devices and a series of electrified vehicles. In this study, high capacity electrodes based on a Si composite anode and a layered composite oxide cathode, were evaluated and combined to fabricate a high energy lithium ion battery. The Si composite anode, Si/C-IWGS (Si/C composite internally wired with graphene sheets), was prepared by a scalable sol-gel process. The Si/C-IWGS anode delivered a high capacity of >800 mAh g<sup>-1</sup> with excellent cycling stability up to 200 cycles mainly due to the small amount of graphene, which was ideally dispersed to maintain an electrical network in the composite against large volume changes. A novel lithium ion battery system based on the Si/C-IWGS anode and a layered composite oxide cathode successfully demonstrated a high energy density (240 Wh kg<sup>-1</sup> at least) as well as an unprecedented excellent cycling stability up to 750 cycles between 2.7 and 4.2 V at 1 C. As a result, the novel battery system can be an attractive candidate for energy storage applications demanding a high energy density and long cycle life.