

Lithiated Silicon/Activated Carbon Lithium Ion Hybrid Capacitor

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Several types of electro-chemical power sources have been widely studied in order to meet the requirements. Among them, the secondary batteries and the electrochemical capacitors (ECs) are regarded as promising candidates for those applications. However, neither the secondary batteries nor the ECs are quite suitable because the former shows limited power density and the latter has low energy density. One possible solution is to make a new type of energy storage device with high energy density and high power output. In recent years, asymmetric hybrid capacitors which consist of a secondary battery electrode and an electrochemical double layer capacitor (EDLC) electrode in one unit cell have been studied. Its power density is higher than that of the secondary batteries and its energy density is higher than that of the capacitors. Also, since various combinations of electrode materials are possible, it is worthy of further study.

In this study, a novel nano-patterned dome-shaped silicon on the copper foil was synthesized by templating method and it was employed as the electrode of lithium ion capacitor after lithiating the silicon electrode. In order to improve the rate capability and the specific capacitance of asymmetric hybrid capacitors. The structural characterization of the synthesized material was performed using X-ray diffraction (XRD), transmission electron microscopy (TEM), and nitrogen adsorption/desorption measurements. Also, its electrochemical characteristics were investigated by galvanostatic charge/discharge cycling tests and electrochemical impedance spectroscopy (EIS).