

Title: Thin Film Electrochemical Energy Storage Micro-Devices : Li-Ion Batteries and Flexible Supercapacitors

Abstract

The developments of renewable conversion energy from solar and wind are very important but these energies are often not even and continuous. Therefore, energy storage devices are of significant importance since they are the one stabilizing the converted energy. Portable electronics also demands urgently high-performance energy storage devices with higher energy density. The first part of this talk involves lithium-ion micro-batteries utilizing single silicon rolled-up tubes as anodes, which are fabricated by the rolled-up nanotechnology approach. A lab-on-chip electrochemical device platform is presented for probing the electrochemical kinetics, electrical properties and lithium-driven structural changes of a single silicon rolled-up tube as an anode in lithium ion batteries. The second part introduces the new design and fabrication of on chip, all solid-state and flexible micro-supercapacitors based on MnO_x/Au multilayers, which are compatible with current microelectronics. The micro-supercapacitor exhibits a maximum energy density of $1.75 \text{ mW h cm}^{-3}$ and a maximum power density of 3.44 W cm^{-3} . The micro-supercapacitor also shows good long-term cycling stability, with a capacitance retention of 74.1% after a large cycling number of 15 000 times. The micro-supercapacitor shows potential applications in smart environments and miniaturized electronic devices, which require power resources with small dimensions and high power density.