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LTO-MWCNTS BASED NANOCOMPOSITE FLEXIBLE ELECTRODES FOR LI ION BATTERIES

Abstract

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Li-ion batteries (LIBs) have become dominant power sources for portable appliances as well as high end applications viz. electric vehicles and hybrid electric vehicles, spacecraft due to their highest gravimetric and volumetric energy densities. For the fabrication of conventional LIB electrode, binder and current collector are introduced to inhibit the collapse of the active materials and maintain the electrode conductivity, respectively which decreases the energy density of LIBs because of its dead weight. Compared with conventional electrode material in the bulky form, free-standing composite electrodes have several advantages. First of all, with the removal of the binders and current collector, the dead weight of an electrode is decreased, leading to the increase of usable capacity and specific energy density for the overall battery design. Secondly, the ease of handling the electrodes makes them readily shaped into various forms required in a variety of flexible and lightweight electronic devices. In present work, we are proposing the fabrication of free-standing, flexible and foldable Multi walled carbon nanotubes/ lithium titanate oxide (LTO) based composite buckypapers by a facile, scalable, cost-effective and environmental friendly surface engineered tape casting method. The structural, morphological, electrical and electrochemical properties of LTO-MWCNTs buckypaper were investigated. The composite buckypaper is demonstrated as anode material for LIB. Electrical conductivity was found to be 4.4102 Scm-1 at room temperature. The composite electrode shows the specific capacity of 150 mAhg-1 at 0.2 C rate which is mainly attributed to enhanced electric and ionic transfer during electrochemical reactions.

Acknowledgements This project is part of the implementation plan for the United Arab Emirates Space Agency's STI Roadmap and it falls under Level 1 STI area of "space power and energy storage" and level 2 "energy storage". The project is aimed at developing enabling technologies for promising mission and system concept; in particular, an in-house prototype of lithium-ion battery. The project can potentially result in a commercially viable lithium-ion battery technology for spacecrafts/satellites. This work is funded by the United Arab Emirates Space Agency, Space Missions' Science and Technology Directorate, Reference M04-2016-001.