Session: NS9

Carbon Nanotube Embedded Three Dimensional (3-D) Carbon Microelectrodes for Rechargeable Microbatteries

Abstract # 1299

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Abstract:

Lithium ion rechargeable batteries power a wide range of electronic devices including cell phones, laptop computers, digital cameras, and medical devices because of the high energy density. However, the technological development of the battery has been held back by the limited range of available electrode materials. Desirable battery electrodes are to have a large surface area for high energy density and device compactness, and a fast charging/recharging property for high power demand. Recently, three dimensional (3-D) carbon electrodes have been successfully demonstrated using the polymer carbonization process with lithographically defined high aspect ratio microstructures [1]. The advantages of this approach include the accurate definition of 3-D microstructures using ultraviolet (UV) lithography and converting them into the carbon electrode by pyrolysis, resulting in chemically and mechanically stable, low cost electrodes. However, the carbon electrodes from polymer pyrolysis show relatively high electrical resistivity resulting in slow charging/discharging response. On the other hand, carbon nanotubes (CNT) are known to provide outstanding electrical, mechanical and chemical performance.

In this study, we report carbon nanotube (CNT) embedded 3-D carbon electrodes by using UV lithography on CNT embedded SU8 (photosensitive negative tone epoxy) and subsequent carbonization. Since the final electrodes consist of CNTs embedded in pyrolyzed carbon, they contain high electrical conductivity to contribute to increasing charging/discharging speed and chemical, mechanical stability in the electrolyte environment. Also, the small amount of CNTs in polymer does not interfere much with UV dose in the photolithography process, maintaining the high aspect ratio 3-D micropatterning capability.

[1] G.T. Teixidor, R.B. Zaouk, B.Y. Park, M.J. Madou, "Fabrication and characterization of threedimensional carbon electrodes for lithium-ion batteries", Journal of power sources 183 (2008) 730-740.

Note: Requested a Poster Session.