High Performance Battery Electrodes Using Electrospun Nanofibers

VANDERBILT UNIVERSITY
CTTC Center for Technology Transfer & Commercialization

Summary

A Vanderbilt researcher has developed a new battery electrode that uses particle/polymer electrospun nanofiber mats to increase energy density and decrease the required charge time for the battery. The technique can be used with any high energy density metal-ion batteries such as lithium-ion or sodium-ion.

Addressed Need

There is a great consumer need for high capacity, long cycle life, and fast charge batteries. Given the increasing reliance on battery-powered vehicles and portable electronic devices, it is clear that this need will continue to grow.

Technology Description

This technology uses submicron particle/polymer fibers that are electrospun into an electrode mat of controlled porosity and thickness. The fibers contain both electroactive material and carbon powder when electrical conduction in the fiber is needed. In some cases separate fibers of electroactive material and carbon powder are electrospun simultaneously, where numerous interfiber contact points provide electrical conduction pathways throughout the electrode. By utilizing two fibers to create the electrode mat, the nanofiber mat can be made thicker with a higher areal capacity. By optimizing/minimizing fiber mat porosity, the volumetric capacity can be made high.

Technology Features

- The electrospun mats can be used for both the anode and the cathode of the battery
- The technology is straightforward to use with nearly any high-capacity, metal-ion battery
- Nanorods, nanotubes, and other nanomaterial structured materials can be integrated into the electrospun fibers to increase battery performance

Technology Development Status

Nanofiber anodes have been electrospun with silicon nanoparticles or nanorods mixed with carbon powder, carbon particles, and titania and carbon nanoparticles. Nanofiber cathodes have been prepared with mixtures of LiCoO2 and carbon. These anodes are currently undergoing testing in lithium-ion battery coin cells for evaluation of capacity, cycle life, and charge/discharge rates.

Intellectual Property Status

A patent application has been filed.

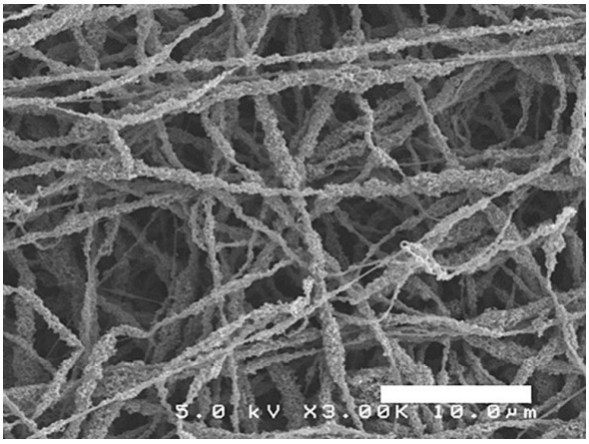

Figure 1: SEM image of an as-spun nanofiber anode.

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