Novel Fabrication Method Of Nanoscale Fibers And Tubes

A set of techniques that enhance key physical characteristics of materials by manipulating the structures at the micro/nanoscale levels

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Inventors
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Field
Nanotechnology

Technology
Molecular profiling kit

Stage of Development
Prototype developed and concept validated

Status
Seeking development & licensing partners

Background

These inventions deal with fabrication of materials with improved physical properties and characteristics. These materials can be used as key components to improve the performance of systems such as Li-ion battery, sensors and other systems. Li-ion batteries are getting greater visibility nowadays because of their use in new applications such as hybrid and all-electric vehicles. However, there are some key limitations to the technology such as low cyclability and low current delivery capacity that is inhibiting them from providing superior performance and gaining greater adoption. If some of these issues could be overcome, the adoption rate would increase tremendously while simultaneously lowering the price point for use of these batteries in cars and other applications.

While the most proficient application for these inventions is in the area of Li-ion battery technology, there are several other applications where they can be used. Sensors and delivery agents are another area where application of the techniques would be of great use. The extremely complex structures that can be fabricated using these techniques could help in enabling detection of different chemicals, delivery of drugs and extremely fine screens to prevent intermixing of two compounds.

Benefits of Technology

- Controlled construction of complex structures at the micro and nanoscale level using electrostatic deposition technique
- Fabrication of hollow fibers, tubes and fibrous web structures using electrospinning techniques
- Ability to manipulate the properties of the resulting structures by using different materials and liquids in the construction process

Potential Commercial Applications

- Batteries – High capacity, high cyclability anodes
- Biosensors – Detection of and entrapment nets for small particles
- Drug Delivery – creation of complex compounds used for targeted dose applications

Description of Technology

The inventors have created two sets of methods for developing structures with controlled properties. By changing the materials used in the construction – these structures can be used for different applications. In the first method, an electrospinning technique consisting of a syringe and an aluminum foil is used to create extremely fine nanofibers and nanotubes. Adjusting the feeding rate of the solution in the syringe enables control over the quality and dimensions of the fibers and tubes. Multiple syringes can be incorporated into this technique to obtain more complex structures with varying properties.

The second method involves the use of electrostatic spray deposition (ESD) to develop extremely thin films of different materials. In this technique, ESD is used to atomize a material and have it deposited on another material – thus creating a thin film structure. The resulting combination allows the creation of composite structures with special properties.

Opportunity

Incorporation of these techniques (processes) into existing processes for manufacture of battery components such as anodes, biosensor materials and targeted drug delivery substances.

FLORIDA INTERNATIONAL UNIVERSITY

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Inventor

Dr. Chunlei (Peggy) Wang (Ph.D. ’97 – Jilin Univ., P.R. China) is an expert in materials science and MEMS/NEMS. Her expertise is specifically in CVD diamond growth, carboneous materials, Si processing, GaN based LED, advanced packaging, carbon-MEMS/ NEMS, 3D microbatteries, nanoscale materials, biosensors, conductive polymers and drug delivery. Her recent research is focusing on on-chip micropower (microbattery, microsupercapactor, and microbiofuel cell), nanostructured materials for Li-ion battery and biosensor applications. She has published one book chapter, 54 journal papers, 28 conference papers and had 112 conference presentations. Before joining Florida International University as a tenure-track assistant professor on 2006, she worked as a Lecturer at Jilin University (’95-’01), a Research Associate at Osaka University (’98-’01), and as a postdoctoral fellow and Assistant Researcher at University of California at Irvine (’01-’06). Dr. Wang was a recipient of a Japanese Government (MONBUSHO) Scholarship (’95-’97), DARPA Young Faculty Award (2008) and FIU Kauffman Professor Award (2009). She was also a co-founder of Carbon Micro Battery Corp.