

Hierarchially Porous Carbon Particles for Electrochemical Applications

Tech ID: 24583 / UC Case 2012-419-0

SUMMARY

UCLA researchers in the Department of Chemical Engineering have developed carbon particles with high power and energy density for use in battery electrodes and supercapacitors.

BACKGROUND

Advanced carbon materials present a strong market opportunity for energy related applications. Current state of the art focuses on activated carbon as an inexpensive and widely used material in applications from electrodes to water filters. However, conventional activated carbon offers minimal control over physical and electrical properties. Battery electrodes and supercapacitors need high power and energy density, but these are often inversely related. To increase electrode energy density while maintaining the power density, electrodes with high ion-storage density, excellent electrical conductivity, and effective ion-transport abilities are required.

INNOVATION

Professor Lu and coworkers have developed a novel porous carbon particle for energy applications. These carbon particles contain pores with various sizes, providing a 20% increase in surface area that is greater than activated carbon. This increases the ion transport rate, resulting in increased energy density while maintaining the power density. The synthesis is scalable and inexpensive and cycling lifetimes greater than 500,000 lifetimes have been reported.

APPLICATIONS

- ▶ Electrodes in supercapacitors
- ▶ Electrodes in advanced water-splitting devices
- ▶ Advanced battery electrodes
- ▶ Traditional activated carbon applications, such as medicinal, spill cleanup, ground water remediation, filtration, air purification, capture of volatile compounds, gas purification, and sound absorption

ADVANTAGES

- ▶ Improved surface area results in increased energy density
- ▶ Scalable synthesis
- ▶ Interconnected pores facilitate ion transport
- ▶ Carbon spheres can be easily and densely packed into electrodes

STATE OF DEVELOPMENT

Material has been prepared and used to make supercapacitor devices.

RELATED MATERIALS

- ▶ Z. Chen, J. Wen, C. Yan, L. Rice, H. Sohn, M. Shen, M. Cai, B. Dunn, and Y. Lu, High-Performance Supercapacitors Based on Hierarchically Porous Graphite Particles, in *Adv. Energy Mater.*, 2011.
- ▶ Z. Chen, D. Weng, H. Sohn, M. Cai, and Y. Lu, High-performance aqueous supercapacitors based on hierarchically porous graphitized carbon, in *RSC Adv.*, 2012.

PATENT STATUS

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INVENTORS

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OTHER INFORMATION

KEYWORDS

Activated carbon, aerosols,
hierarchical structures, porous
materials, graphite, supercapacitors

CATEGORIZED AS

- ▶ **Energy**
 - ▶ Storage/Battery
- ▶ **Engineering**
 - ▶ Engineering
 - ▶ Other
- ▶ **Materials & Chemicals**
 - ▶ Other
- ▶ **Nanotechnology**
 - ▶ Electronics
 - ▶ Materials

RELATED CASES

2012-419-0

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	8,784,768	07/22/2014	2012-419

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- ▶ Voltage-Responsive Coating for Lithium-Sulfur Battery
- ▶ Highly-Stablized Nanocapsules for siRNA Delivery
- ▶ Making Nanostructured Porous Hollow Spheres with Tunable Structure
- ▶ Hyperbranched Polyglycerol Encapsulated Proteins for Oral Protein Delivery
- ▶ A Method Of Making Carbon Coated Oxides As High-Performance Anode Materials
- ▶ Viral Vector Nanocapsule for Targeting Gene Therapy

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