A Method Of Making Carbon Coated Oxides As High-Performance Anode Materials

Tech ID: 29926 / UC Case 2012-805-0

SUMMARY

UCLA researchers in the Department of Materials Science and Engineering have developed a carbon-coated silicon nanoparticle-based electrode material for lithium-ion batteries with high energy density and long lifetime. They have also developed a scalable fabrication method for this material.

BACKGROUND

Li-ion batteries are widely used as energy storage devices in many consumer electronics, automobile and aerospace industries. Graphite is the material commonly used for cathodes in industry-standard Li-ion cells. It is cost-effective but does not have an ideal energy density. There are many novel alternative electrode materials with better performance, yet their commercialization is limited by cost of materials and manufacturing, and/or short lifetime.

INNOVATION

UCLA inventors have developed a novel Li-ion electrode material along with a scalable method to fabricate it. The material consists of carbon/graphite coated silicon nanoparticles. The void-less carbon layer protects the Si substrate while the pores in the Si substrate allow it to accommodate volume change during cycling. These features can provide high energy density and long lifetime for Li-ion batteries compared to current technology. Moreover, the fabrication method, which involves vaporizing silicon and carbon precursors, creates a high-quality coating and more versatility in substrates compared to the conventional process. This fabrication method has the potential for cost-effective scaling up and can be utilized in other nanomaterial fabrication and applications.

APPLICATIONS

- Lithium-ion batteries for automobiles and portable electronics
- Fabrication method can be applied to other nanoparticle applications, such as catalysts

ADVANTAGES

- High energy density due to high surface area of nanoparticles
- Flexible form to accommodate volume change in cycling, which leads tolonger cycle life and improved safety
- High-quality carbon coating that protects active material
- Versatile manufacturing process

STATE OF DEVELOPMENT

Prototype electrode has been made.

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	9.362.552	06/07/2016	2012-805

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

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OTHER INFORMATION

KEYWORDS

Li-ion battery, electrode, graphite, vapor deposition, silicon, nanomaterial, energy storage, lifetime, fabrication method

CATEGORIZED AS

- **Energy**
  - Storage/Battery
- **Materials & Chemicals**
  - Composites
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  - Materials

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