Mesoporous Silicon-Based Anodes

For high-capacity, high-performance lithium-ion batteries

A new high-capacity anode composite based on mesoporous silicon is being developed. With a structure that resembles a pseudo one-dimensional phase, the active anode material will accommodate significant volume changes expected upon alloying and dealloying with lithium (Li). The mesoporosity is created without the aid of a surfactant template using a novel, high-volume synthetic process. The anode composite based on this material is designed to have a reversible Li-ion capacity exceeding 600 mAh/g—or nearly twice that obtainable with graphite anodes—and much higher capacities could be attainable. Phase I successfully demonstrated the synthesis of this new meso-silicon (Si) material as well as its high electrochemical activity and rechargeability. Phase II expanded the investigation of the development of mesoporous Si-based Li-ion anodes. The optimum anode was evaluated in Li-ion cells containing 4-V oxide cathodes.

Applications

NASA
- Power for landers, rovers, and extravehicular activities (EVAs)
- Space-related applications in Moon and other planetary habitats

Commercial

The new anodes will result in high-performance Li-ion batteries suitable for the following commercial applications:
- Electric vehicle propulsion
- Portable consumer products:
  - Cellular phones
  - Portable power tools
  - Cameras
  - Laptop computers

Phase II Objectives

- Expand the investigation of the development of a mesoporous, Si-based Li-ion anode
- Evaluate the optimum anode in Li-ion cells containing 4-V oxide cathodes

Benefits

- Reversible Li-ion capacity exceeding 600 mAh/g (nearly twice that obtainable with graphite anodes)
- Nonflammable
- Subambient temperature operation

Firm Contact

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