SiLix-C Nanocomposites

For high energy density Li-ion battery anodes

For this Phase II project, Superior Graphite Co., in collaboration with the Georgia Institute of Technology and Streamline Nanotechnologies, Inc., developed, explored the properties of, and demonstrated the enhanced capabilities of novel nanostructured SiLix-C anodes. These anodes can retain high capacity at a rapid 2-hour discharge rate and at 0 °C when used in Li-ion batteries.

In Phase I, these advanced anode materials had specific capacity in excess of 1,000 mAh/g, minimal irreversible capacity losses, and stable performance for 20 cycles at C/1. The goals in Phase II were to develop and apply a variety of novel nanomaterials, fine-tune the properties of composite particles at the nanoscale, optimize the composition of the anodes, and select appropriate binder and electrolytes. In order to achieve a breakthrough in power characteristics of Li-ion batteries, the team developed new nanostructured SiLix-C anode materials to offer up to 1,200 mAh/g at C/2 at 0 °C.

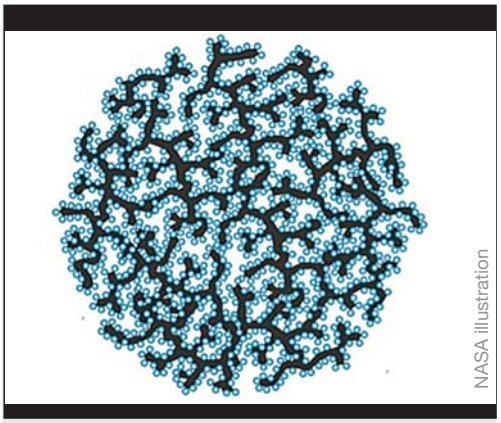
Applications

NASA

- Ascent module of the Altair Lunar Lander
- Lunar extravehicular activity (EVA) suit and integrated portable life support systems
- Lunar surface systems and mobility systems
- Uninterruptable power systems (UPS) for Orion spacecraft, the International Space Station (ISS), and other spaceflight vehicles

Commercial and Military

- Power sources for hybrid electric and electric vehicles (HEV and EV)
- Portable consumer electronics
- Handheld military equipment, exploration robots, and drones



NASA illustration

Phase II Objectives

- Identify ideal combination of binder and electrolyte material to maximize performance for silicon-carbon (SiC) nanocomposite powder at 0 °C using a charge/discharge rate of C/2
- Identify and adjust optimum parameters of SiC nanocomposite powder, such as particle size, thickness, and morphology of the carbon coating; porosity of the adaptive carbon matrix; size of Si crystals; and Si content
- Determine origin of irreversible capacity loss
- Plan and build small pilot plant
- Optimize synthesis process of SiC nanocomposite powders to maximize uniformity and reproducibility
- Develop an anode-based on the novel SiC nanocomposite powder that offers 1,200 mAh/g at C/2 at 0 °C and a long cycle life

Benefits

- High energy density
- Dramatically improved capacity
- Cycling performance

Firm Contact

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Proposal Number: 08-2 X6.02-8492