Simple Low-Cost Battery Electrode Alternative

Tech ID: 31735 / UC Case 2016-350-0

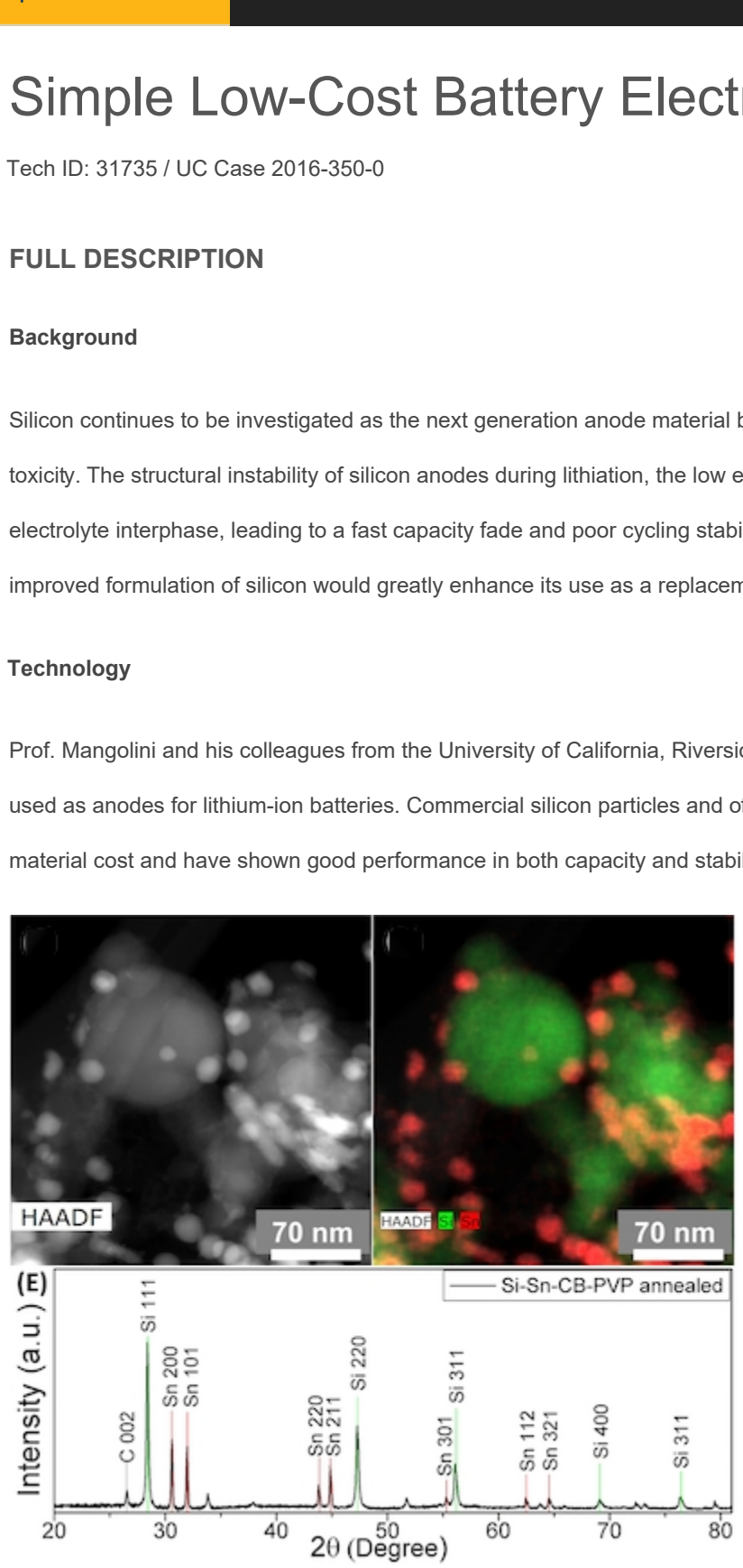
FULL DESCRIPTION

Background

Silicon continues to be investigated as the next generation anode material because of its high lithiation capacity, abundant availability and non-toxicity. The structural instability of silicon anodes during lithiation, the low electrical conductivity and the formation of an unstable solid electrolyte interphase, leading to a fast capacity fade and poor cycling stability of the electrodes – have hampered increased adoption. An improved formulation of silicon would greatly enhance its use as a replacement for graphite anodes in lithium-ion batteries.

Technology

Prof. Mangolini and his colleagues from the University of California, Riverside have developed a novel silicon-tin nanocomposite that may be used as anodes for lithium-ion batteries. Commercial silicon particles and off-the-shelf additives such as tin dichloride are used due to their low material cost and have shown good performance in both capacity and stability.



(**Left**) High angle annular dark field image confirming the compositional variation between the large particles and the smaller one decorating the surface of the larger particles. (**Right**) Elemental mapping corresponding to (**Left**), confirming that the larger particles are silicon while the smaller ones are tin. (**Bottom**) XRD pattern for the silicon-tin nanocomposite, confirming the presence of both the silicon and the tin crystalline phases.

APPLICATIONS

- To replace graphite anodes in lithium-ion batteries for improved battery capacity and stability
- For use in electrochemical energy storage systems

ADVANTAGES

The significance benefits of this invention are:

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OTHER INFORMATION

KEYWORDS

coating silicon nanoparticles, anode, silicon-tin nanoparticles, lithium-ion battery, silicon anode, electrochemical energy storage, energy storage

CATEGORIZED AS

- **Energy**
  - Storage/Battery
- **Materials & Chemicals**
  - Composites
  - Nanomaterials
- **Nanotechnology**
  - Materials
- **Transportation**
  - Aerospace
  - Automotive
  - Other

RELATED CASES

2016-350-0

- The hybrid structures show a dramatic improvement compared to those prepared with silicon alone.
- Measurements suggest that these composites have an overall lower active layer resistance compared to a silicon-only case and are demonstrating the full utilization of the active material.
- The effectiveness of this simple, low-cost approach suggests that if used in combination with more advanced structures, it may provide the critical improvement necessary to finally realize a silicon-based next-generation anode.

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	11,152,608	10/19/2021	2016-350

RELATED MATERIALS

- Zhong, L., et al. Tin Nanoparticles as an Effective Conductive Additive in Silicon Anodes. Nature Scientific Reports 2016 (6) 30952 - 08/03/2016

INVENTIONS BY PROF. MANGOLINI

Please review all inventions by Prof. Mangolini and his team at UCR.

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