A Low-Cost Preparation of Si@C Composite Anode from Si Photovoltaic Waste

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doi: 10.20964/2020.07.24

Received: 8 March 2020 / Accepted: 16 April 2020 / Published: 10 June 2020

Silicon materials are recognized as one of the most attractive anode materials in Li-ion batteries (LIBs) due to their ultrahigh capacity. However, there are still challenges to fabricate silicon-based anodes with a sustainable, scalable and cost-effective method. In this work, nanoscale Si was synthesized using the wafer slicing wastes from photovoltaic (PV) industry via a scalable and facile fabrication approach. After purification and sand milling, the obtained Si of 100–200 nm delivers a high discharge capacity of 2554 mAh g⁻¹. To address the potential application of the nanoscale Si in practical LIBs, a silicon/carbon composite (Si@C-G) was made, which is composed of the nanoscale Si, artificial graphite, graphene and pyrolytic carbon. The Si@C-G composite anode could yield a stable capacity of around 400 mAh g⁻¹, and a high retention rate of 91% can be achieved after 100 cycles, where the introduced graphene provide a better conducting/buffering network. Our work shows the waste Si from PV industry can be recycled and reused in LIBs industry.

Keywords: Nano silicon, Si/C composite, Anode material, Photovoltaic waste silicon, Lithium-ion battery.

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