2nd International Conference on

Battery and Fuel Cell Technology

July 27-28, 2017 | Rome, Italy

High capacity anode with Si nanopowder fabricated from swarf for lithium ion battery

Taketoshi Matsumoto, Katsuya Kimura and Hikaru Kobayashi Osaka University, Japan

S i swarf is generated during slicing Si ingots to produce Si wafers for solar cells. The weight of Si swarf, i.e., industrial waste, is nearly the same as that of Si wafers. Si swarf and Si nanopowder produced by the ball and beads milling methods possesses flake-like shape with length smaller than a few μ m and thickness thinner than 40 nm. We have applied Si nanopowder produced from swarf to Li ion batteries, fluorescent materials, a hydrogen generation material, and solar cells. In this study, Si has been applied to high capacity active materials for anodes in Li ion batteries. Si nanoparticles smaller than 150 nm are known to show good cyclability; while for larger Si particles, peeling-off of Si due to their volume change occurs during lithiation and delithiation, resulting in degradation of the cyclability. Si swarf is a promising low-cost material for mass production of Si anodes, while Si nanoparticles have been fabricated so far using high-cost processes such as CVD and laser ablation. Cyclability of a Si anode fabricated from Si swarf is improved by addition of 10-15 wt% fluoroethylene carbonate (FEC) to ethylene carbonate (EC)/diethylene carbonate (DEC)=1/1 electrolyte solutions with 1 M LiPF6. The solutions form a thin and stable solid-electrolyte interphase (SEI) layer, leading to decreases in the SEI resistance (R_{SEI}) and charge transfer resistance (R_c). Carbon-coating (C-coating) on Si also improves the cyclability of the Si anode. Limitation of the delithiation capacity at 1500 mA h/g after deep lithiation at 0.01 V with a Li foil counter electrode also shows better cyclability than that for limitation of the lithiation capacity at 1500 mA h/g after deep delithiation at 1.5 V.



Fig. 1 Application of Si swarf to Li ion battery anode with a high capacity.

Biography

Taketoshi Matsumoto (Assoc. Prof., Sci, PhD) received his MSc and PhD degrees from Tokyo Institute of Technology, Yokohama, Japan in 2001. From 2000 to 2002, he was a Research Fellow of the Japan Society for the Promotion of Science. Since 2001, he was a Postdoctoral Research Associate in University of Southern California, CA, US. Since 2003, he was a Lecturer in University of Tsukuba, Tsukuba, Japan. Since 2004, he was a Research Associate in Institute for Molecular Science, Okazaki, Japan. Since 2007 and 2014, he has been an Assistant and Associate Professor, respectively, in the Institute of Scientific and Industrial Research, Osaka University, Osaka, Japan. He is interested in energy related nano-materials and devices such as TFTs, LSI, luminous materials, sealed permanent memories, solar cells and Li ion batteries.

tmatsumo@sanken.osaka-u.ac.jp

Notes: