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Pre-Lithiation of SiO_2 Nanoparticles-Based Anode for Lithium Ion Battery Application

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Abstract : Lithium-ion batteries are widely used for providing energy for mobile electronic devices. Graphite is a traditional anode material that was used in almost all commercialized lithium-ion batteries. It gives a specific capacity of 372 mAh/g for lithium storage. But there are multiple better choices for storing lithium that propose significantly higher specific capacities. As an example, silicon-based materials can be mentioned. In this regard, SiO_2 material can offer a huge specific capacity of 1965 mAh/g. Due to this high lithium storage ability, large volume change occurs in this electrode material during insertion and extraction of lithium, which may lead to cracking and destruction of the electrode. The use of nanomaterials instead of bulk material can significantly solve this problem. In addition, if we insert lithium in the active material of the battery before its cycling, which is called pre-lithiation, a further enhancement in the performance is expected. Here, we have fabricated an anode electrode of the battery using SiO_2 nanomaterial mixed with Graphite and assembled a lithium-ion battery half-cell with this electrode. Next, a pre-lithiation was performed on the SiO_2 nanoparticle-containing electrode, and the resulting anode material was investigated. This electrode has great potential for high-performance lithium-ion batteries.

Keywords : SiO_2 nanoparticles, lithium-ion battery, pre-lithiation, anode material
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