Supporting Information

for

Templated Magnesiothermic Synthesis of Silicon Nanotube Bundles and Their Electrochemical Performances in Lithium Ion Batteries

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1. Preparation of Si nanoparticles

Synthesis of SiO_2 nanoballs: ethanol, deionized water and concentrated ammonia solution (volume ratio, 5:1:2) were mixed together under stirring at 30 °C. Addition of ammonia is to provide the alkaline environment. A mixture of tetraethoxysilane (TEOS) and ethanol (volume ratio 1:1) was added drop by drop in the solution afterwards. After 2 h continuing stirring, SiO_2 nanoballs can be obtained by hydrolysis of TEOS under the assistance of NH3•H_2O

Fabrication of Si nanoparticles: Magnesium powder (90%, 80 nm Aladdin) and SiO_2 NBs (molar ratio of Mg to Si NBs was 2: 1) were mixed and then transferred to a corundum boat. The mixture was heated to 650 °C for 2 h under argon gas protection. The resulted products were washed with 1 M HCl to remove the byproducts like MgO, Mg_2Si and the unreacted Mg. Si nanoparticles can finally be obtained through washing with deionized water, vacuum filtrating and drying.

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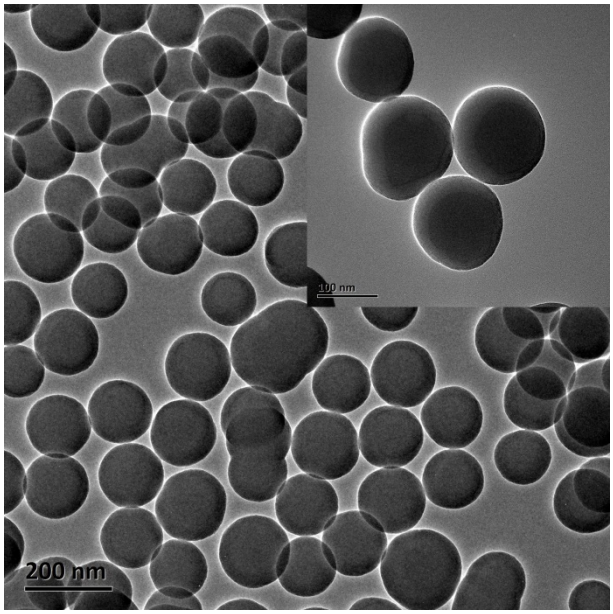

Figure 1S: TEM image of SiO_2 nanoballs

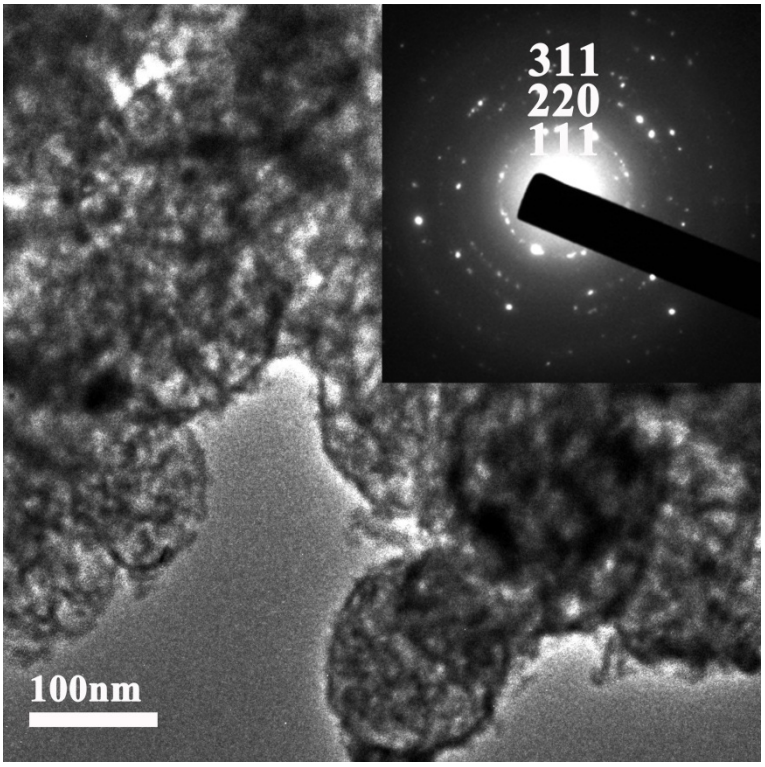

Figure 2S: TEM image of Si nanoparticles

2. XRD comparison of Si NBs and Si nanoparticles

Both the XRD patterns of Si NBs and Si nanoparticles were composed of diffraction peaks of crystalline Si and a broad peak characteristic of amorphous SiO_2.

It was worth to note that the intensity of broad peak from amorphous SiO_2 in Si nanoparticles is slightly lower than that in Si NBs, indicative of smaller silica content in Si nanoparticles, hence smaller SEI resistance. Albeit this, the overall electronic performances of Si NBs were better than Si nanoparticles as anode materials. These results indicated that the better performance of Si NBs could be ascribed to the nanotube structure, which allows them to accommodate a large volume change during cycling.

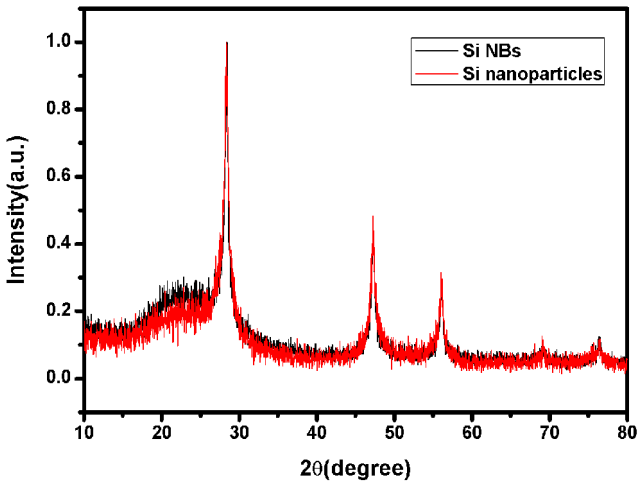

Figure 3S: XRD patterns of Si NBs and Si nanoparticles