Supplementary Information

Hydrothermal Carbon Spheres Containing Silicon Nanoparticles: Synthesis and Lithium Storage Performance

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Figure S1: TGA profile of the C/Si nanocomposite



Figure S2: Raman spectra of the pure silicon nanoparticles and of C/Si nanocomposite



Figure S3: Adsorption-desorption isotherms of C/Si nanocomposite and pure carbon spheres



Figure S4: Galvanostatic discharge/charge curves of the nano-sized Si (a) and hydrothermal carbon (b) electrode at a current density of 300 mA g^{-1} in the voltage range of 0.05 and 1.2 V, (c) variation in discharge/charge capacity versus cycle number for the C-Si nanocomposite, nano-sized Si and hydrothermal carbon electrodes cycled at a current density of 300 mA g^{-1} .



(a)







Experimental Part:

Synthesis of hydrothermal carbon and C/Si nanocomposites:

0.5 g glucose was dissolved in 10 mL water with and without 4 wt.-% Si nanoparticles, which were placed in a stainless still autoclave equipped with a Teflon inlet and heated at 180°C for 12 h. After the resulting carbon and carbon/nanoparticles composites were isolated *via* filtration, the pure hydrothermal carbon and nanocomposites were further carbonized in a nitrogen oven at 900°C for 2h.

Characterisations:

X-ray diffraction (XRD) patterns were recorded in reflection mode (Cu K α radiation) on a Bruker D8 diffractometer. The particle size and morphology was visualised using a "Gemini" Scanning Electronic Microscope (SEM) and an Omega 912 Transmission Electron Microscope (TEM) (Carl Zeiss, Oberkochen, Germany). Nitrogen adsorption and desorption isotherms were measured at 77 K with a QuadraSorb-SI instrument (Quantachrome, Germany). Micro-Raman spectra were recorded on a Jobin Yvon LabRam spectrometer using a 632.8 nm excitation laser line.

Electrochemistry:

Electrochemical experiments were carried out using two-electrode Swagelok-typeTM cells. The working electrodes were prepared by mixing the C/Si nanocomposite or nano-sized Si or hydrothermal carbon, carbon black and poly-vinylene di fluoride (PVDF) at a weight ratio of 70:20:10 and pasted on pure Cu foil (99.6 %, Goodfellow). The glass fiber (GF/D) from Whatman® was used as a separator. Pure lithium foil (Aldrich) was used as counter electrode. The electrolyte consisted of a solution of 1 M LiPF₆ in ethylene carbonate (EC)/dimethyl carbonate (DMC) (1:1 by volume) containing 2 wt-% vinylene carbonate (VC). The cells were assembled in an argon-filled glove box. Galvanostatic discharge-charge experiments were tested at different current densities in different voltage ranges on an Arbin MSTAT battery test system.