Supporting information

Probing the Lithium-Ion Storage Properties of Positively and Negatively Carved Silicon

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Figure S1 shows the schematic diagram of the laser interference lithography (LIL). It describes the optical configuration of the LIL process for the fabrication of the polymer templates having positive pillar- or negative well-arrays via the interference phenomena by controlling the 4-fold symmetry on the photoresist surface. The actual positively- and negatively-developed polymer templates are added below.

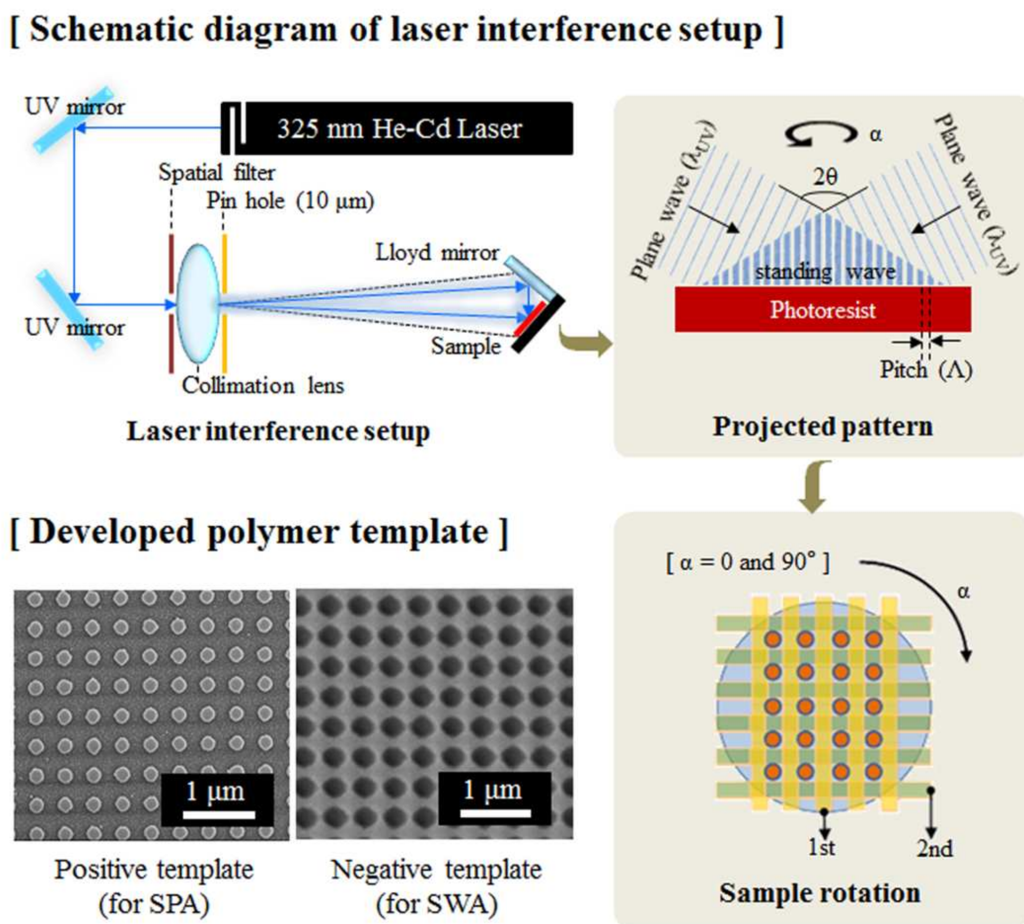

Figure S1. Schematic diagram of laser interference setup and developed polymer template.

Transmission electron microscopy (TEM) and the selective area electron diffraction (SEAD) pattern were observed on the Si thin-film. The TEM image [Figure S2a] exhibits uniform speckle contrast and the SAED pattern [Figure S2b] reveals a broad diffuse ring, implying that the Si deposited in this work represents characteristics of amorphous phase of Si materials [Figure 3a].

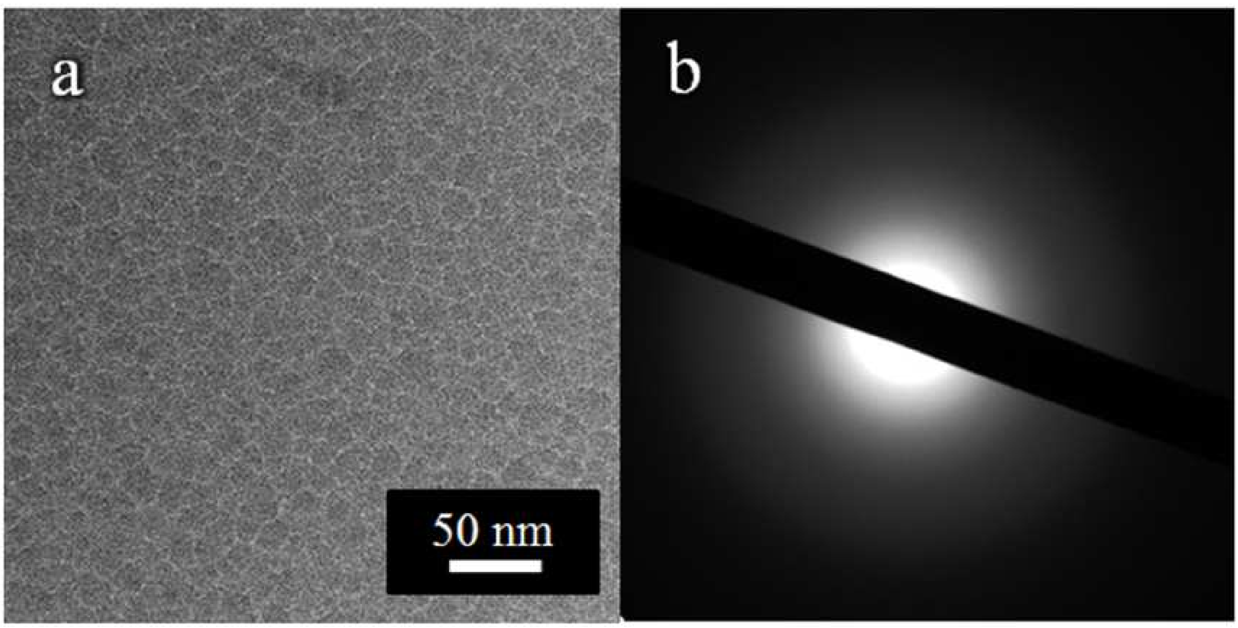

Figure S2. (a) Transmission electron microscopy (TEM) image and (b) Selective area diffraction (SAED) pattern for the Si thin-film.

In Figure S3, the capacity was measured for 5 cycles up to 40 cycles at each C-rate.

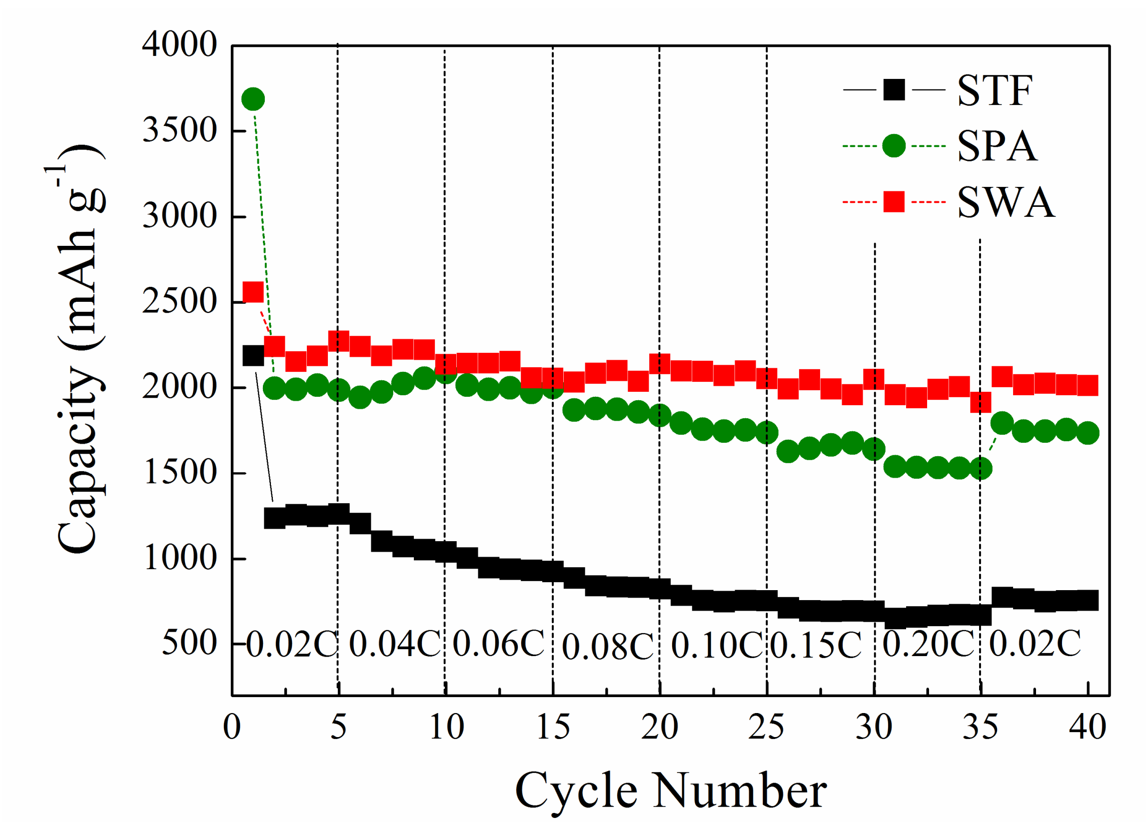

Figure S3. The discharge capacity *versus* cycle number for the prepared Si electrodes with the gravimetric capacity at the various C-rates (0.02C – 0.2C).

An electrical measurement using four-point technique was carried out. One of the reasons for the good electrochemical performance of the carved Si, especially for the SWA, may be the facilitated charge transport, which can play an important role in battery performance. As summarized in Table S1, sheet resistance (R_s) of STF was measured to be *ca.* 3.19 Ω/□. The carved Si of SWA showed a significantly reduced sheet resistance (*ca.* 1.75 Ω/□) than the STF, which is also consistent with the initial voltage drops. SWA voltage profile showed a relatively small initial voltage drop at the first discharge with a smaller internal resistance. However, the SPA revealed the similar level of sheet resistance to that of STF. Consequently, the nanopatterned Si electrode of SWA has the highest conductivity among the prepared samples.

Table S1. Sheet resistance and the initial voltage drop of the prepared Si electrodes.

Sample	Sheet resistance [Ω/□]	Initial voltage drop [V]
STF	3.19	1.28
SWA	1.75	1.05
SPA	3.32	1.40