

Supporting Information

Novel Silicon-Nickel Cone Arrays for High Performance LIB Anodes

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Experimental Section

Electrodes preparation: A piece of 15 μm thick copper foil disk is sequentially cleaned using acetone and IPA for 5 mins, respectively and used as the substrate. TiN of ~ 50 nm thick is then coated onto the copper foil by sputtering a titanium target in an Ar/ N₂ mixture (ELITE RF/ DC magnetron sputtering). A 20 nm thick Ni is then deposited using the same equipment. After that, the Ni/ TiN/ Cu foil is heated to 800 °C for 5 mins in a tube furnace to dewet the Ni thin film into Ni particles. During the whole de-wetting process, an Ar/ H₂ mixture is continuously fed through the tube to prevent sample oxidation. Finally, a blanket of Si is deposited using the sputtering system. The mass of the deposited Si is determined by measuring the weight of the copper foil before and after Si deposition using an analytical balance (Mettler Toledo XP 26, 0.02 mg).

Electrochemical characterization:

To perform electrochemical testing, CR 2032 type half cells are assembled in a glove box filled with pure Ar (Mbraun). The fabricated Si-Ni cone array electrode is used as the working electrode, pure Li metal and a Celgard 2300 membrane are employed as the counter electrode and the separator, respectively. The electrolyte used is LiPF₆ (1.0 M) dissolved in ethylene carbonate and diethyl carbonate (EC/ DEC, 1:1 by volume). CV test is carried out using a multi-channel electrochemical station (AUTOLAB, M 101) at a scan rate of 0.1 mV s⁻¹. Discharge/charge capacity of the fabricated electrodes is determined by galvanostatic cycling the half cells over

the potential range between 10 mV and 1.2 V in a battery tester. (NEWARE BTS-5 V, Neware Technology Co., Ltd., China)

SEM characterization is carried out in a field-emission SEM (LEO 1550 Gemini). Elemental analysis is performed in an EDX system in conjunction with the SEM. Raman spectrum is tested using a WITec Raman system with a laser operating at $\lambda = 633$ nm as excitation source.

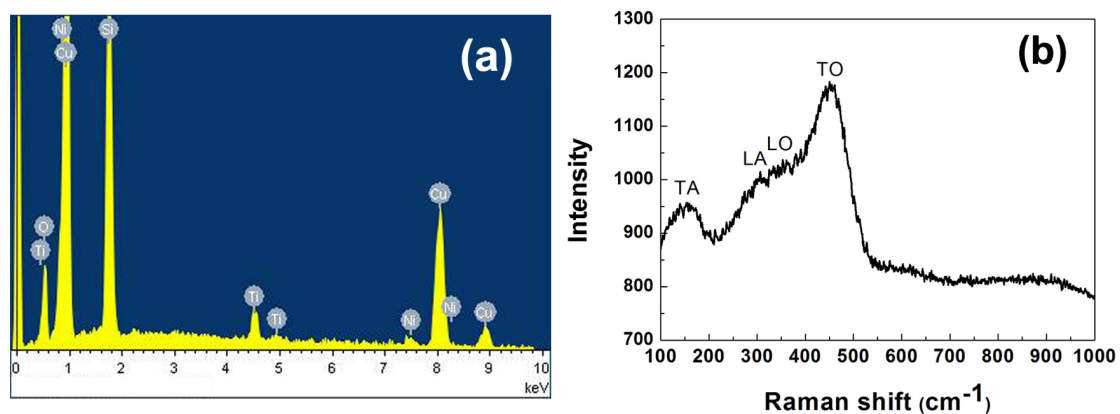


Fig. S1 (a) The EDX spectrum and (b) Raman spectra of the Si coating.

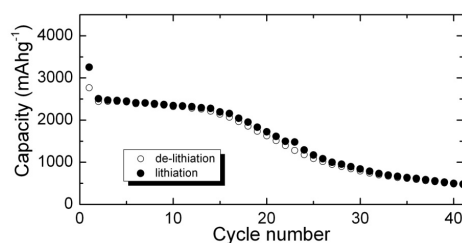


Fig. S2 Cycling performance of a conventional Si electrode.