Electronic Supplementary Material (ESI) for CrystEngComm.

Supplementary Information

Interpenetrating gel-enabled uniform integration of metal and carbon dual matrices with nanoporous silicon for high-performance lithium storage

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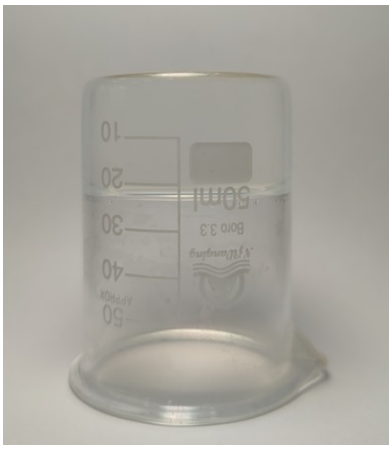

Fig. S1 Photograph of the single SiO_2 hydrogel.

Synthesis of the SiO_2 hydrogel: 8 mL 0.01 M HCl solution was added to a mixed solution of 4 mL tetraethyl orthosilicate, 4 mL ethanol, and 8 mL water. After stirring for 2 h, 200 μL 0.5 M hexamethylenetetrmine (HMT) aqueous solution was added to the above solution, and the mixed solution was further stirred until the formation of single SiO_2 hydrogel.

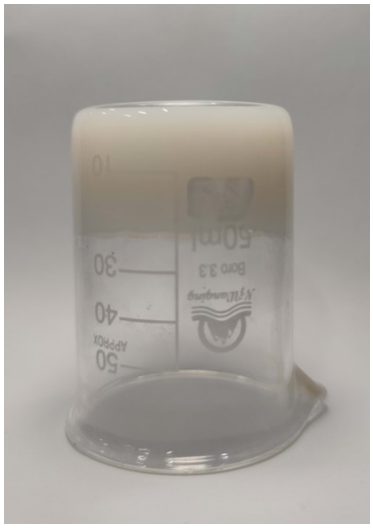

Fig. S2 Photograph of the single In−Co cyanogel.

Synthesis of the In−Co cyanogel: Single In−Co cyanogel was obtained by mixing aqueous solutions of 0.5 M $InCl_3$ and 0.5 M $K_3Co(CN)_6$ with a volume ratio of 1:1.

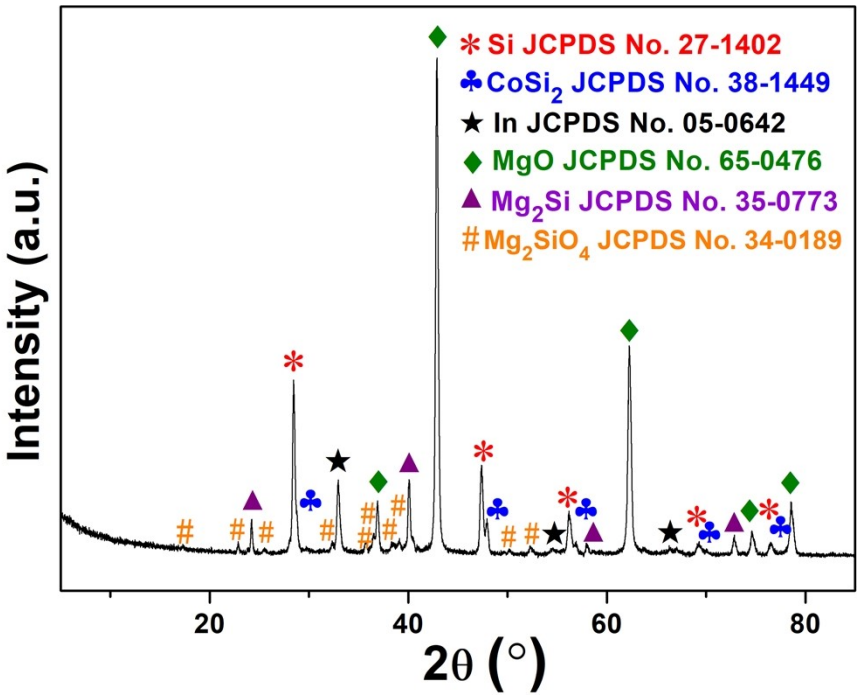

Fig. S3 XRD pattern of the annealed product before acid etching process.

Fig. S3 shows the XRD pattern of the annealed product before acid etching. As can be seen, the crystalline phases could be well assigned to Si (JCPDS No. 27-1402), $CoSi_2$ (JCPDS No. 38-1449), In (JCPDS No. 05-0642), MgO (JCPDS No. 65-0476), Mg_2Si (JCPDS No. 35-0773), and Mg_2SiO_4 (JCPDS No. 34-0189), respectively. After subsequent acid etching process, only crystalline Si and $CoSi_2$ components are reserved in the final nanoporous Si−Co−C material, confirming the removal of metallic In and Mg-containing byproducts.

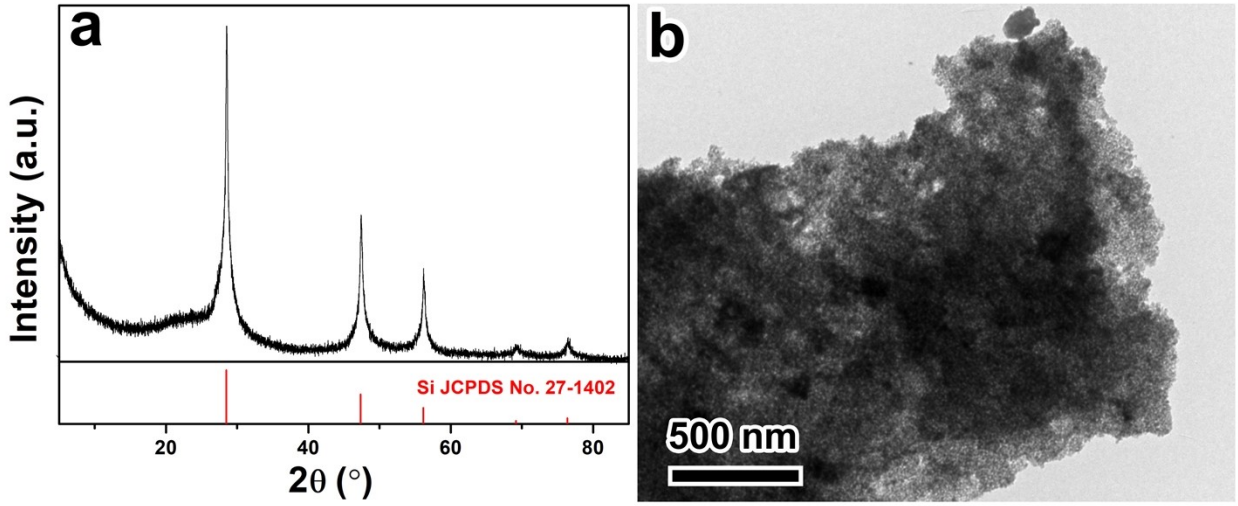

Fig. S4 (a) XRD pattern and (b) TEM image of the single SiO_2 gel-derived pure nanoporous Si material.

Synthesis of the pure nanoporous Si material: The obtained single SiO_2 hydrogel (Fig. S1) was freeze-dried, and the aerogel was annealed at 500 °C under N_2 atmosphere for 3 h. The annealed product and Mg powder were mixed with a weight ratio of 1:1, and the mixed powders were further annealed at 650 °C under Ar atmosphere for 4 h and subsequently washed with 1 M HCl solution, yielding the final nanoporous Si material.

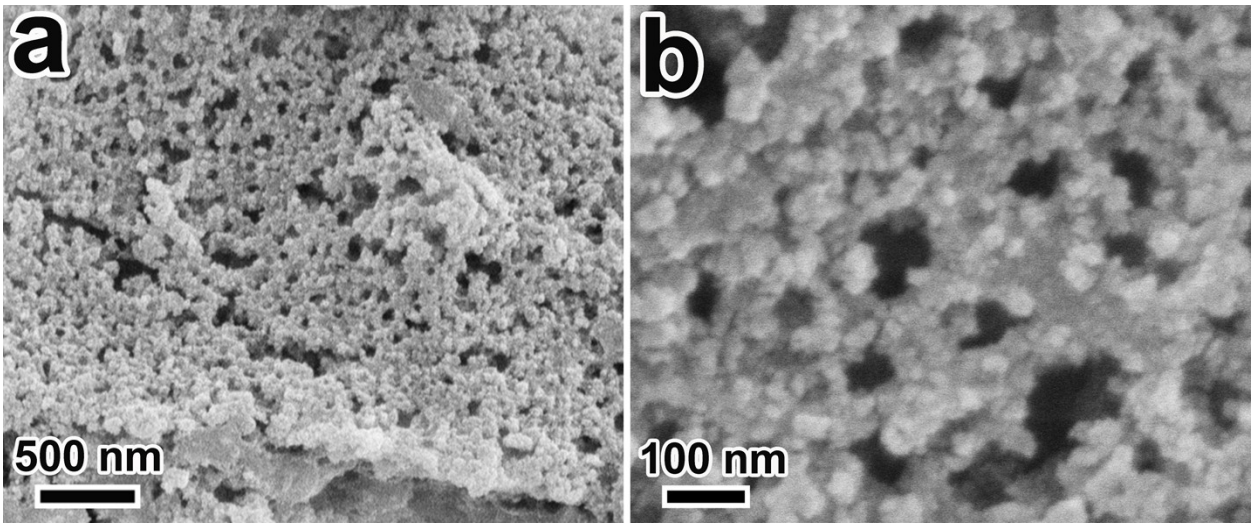

Fig. S5 SEM images of nanoporous Si−Co−C material.

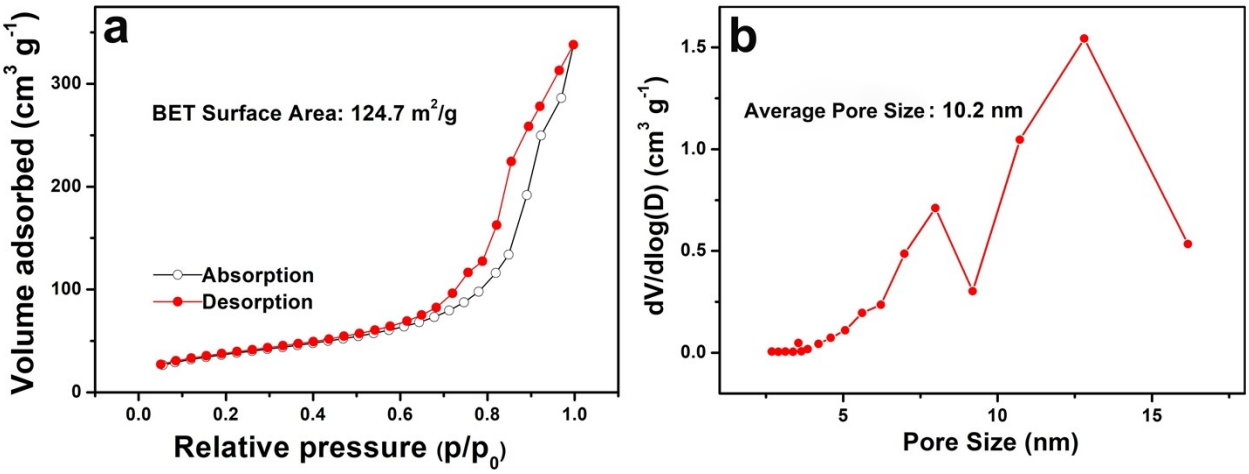

Fig. S6 Nitrogen adsorption/desorption isotherms (a) and pore size distribution (b) of the nanoporous Si−Co−C material.

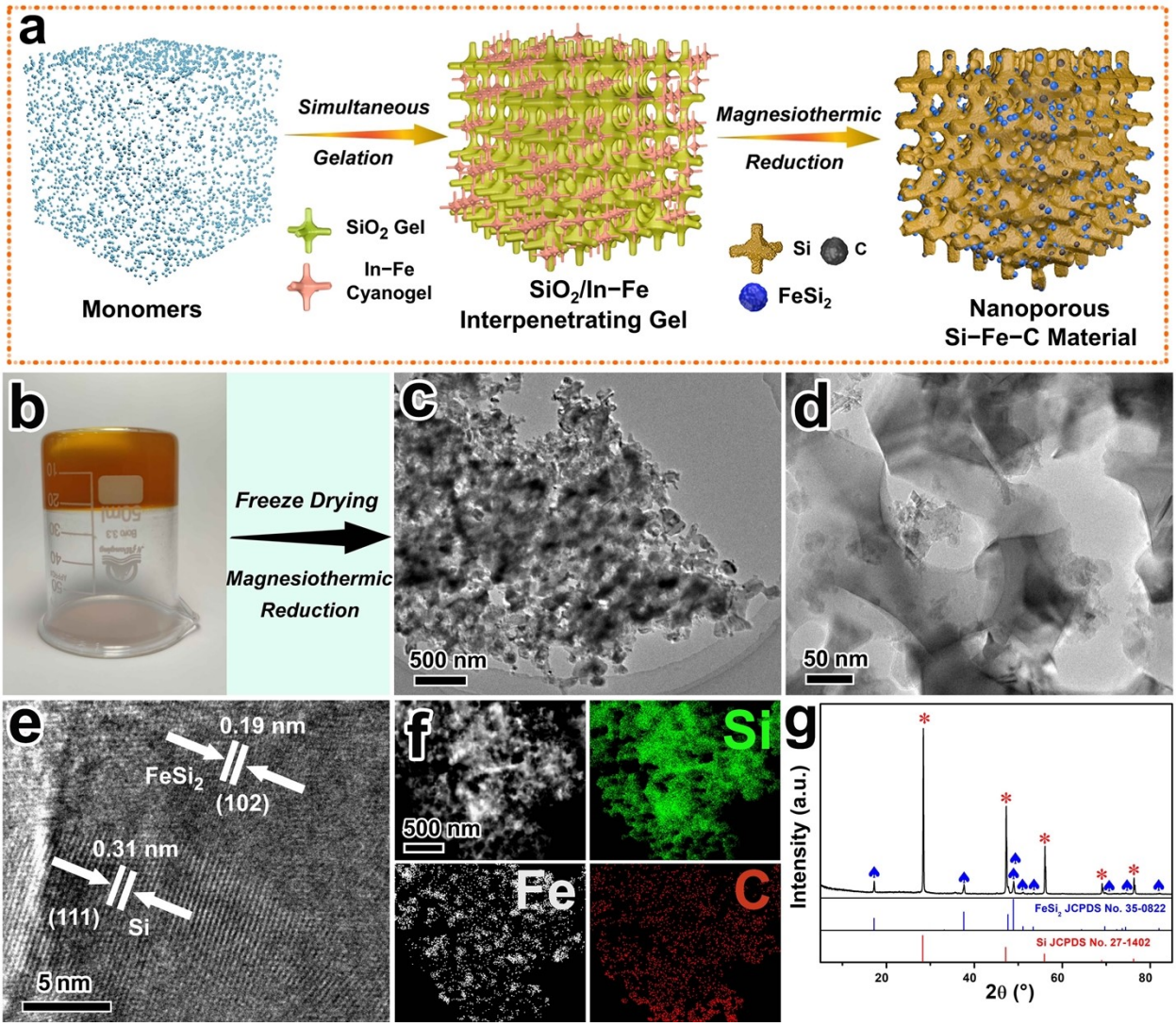

Fig. S7 (b) Photograph of SiO_2/In−Fe interpenetrated hydrogel. (a) Synthetic diagram, (c, d) TEM images, (e) HRTEM image, (f) EDS elemental mappings, and (g) XRD pattern of the nanoporous Si−Fe−C material.

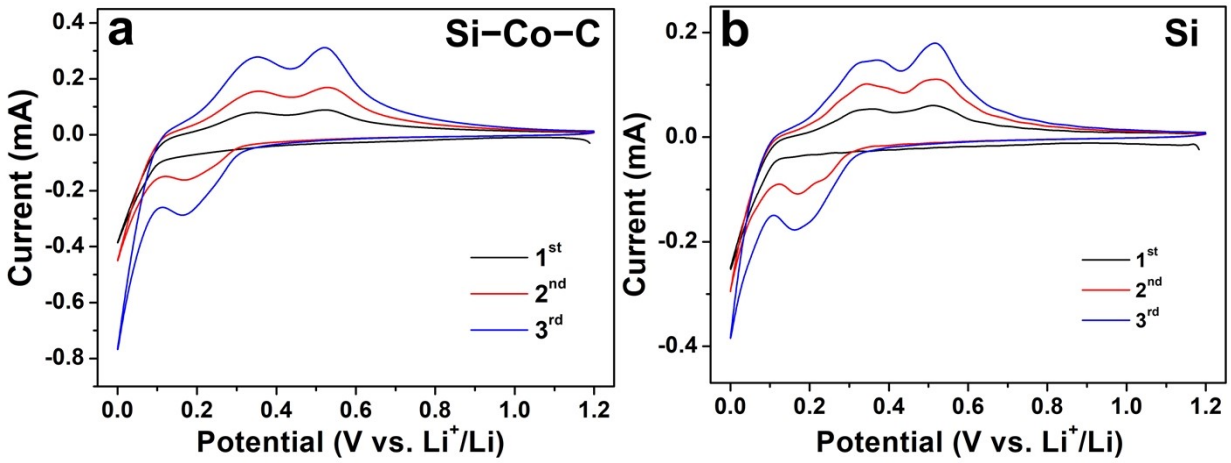

Fig. S8 The initial three CV curves of the nanoporous Si−Co−C (a) and Si (b) anodes.

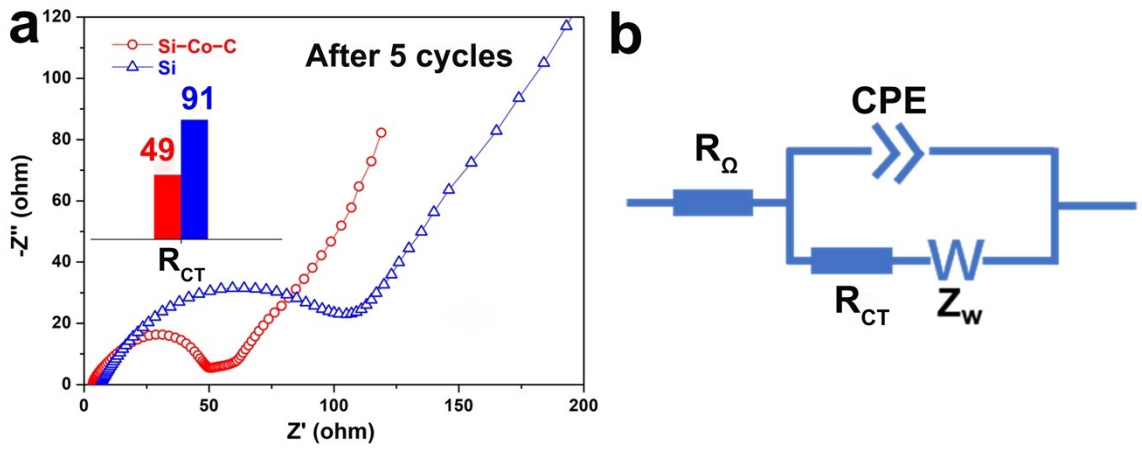

Fig. S9 (a) Nyquist plots from impedance test of the Si−Co−C and Si anodes after 5 cycles. (b) The equivalent circuit model for the fitting of impedance plots.