Reverse-design-strategy for C@Li_3VO_4 Nanoflakes toward superb high-rate Li-ion storage

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Keywords: Lithium vanadate; Reaction kinetics; Anode; Lithium ion batteries

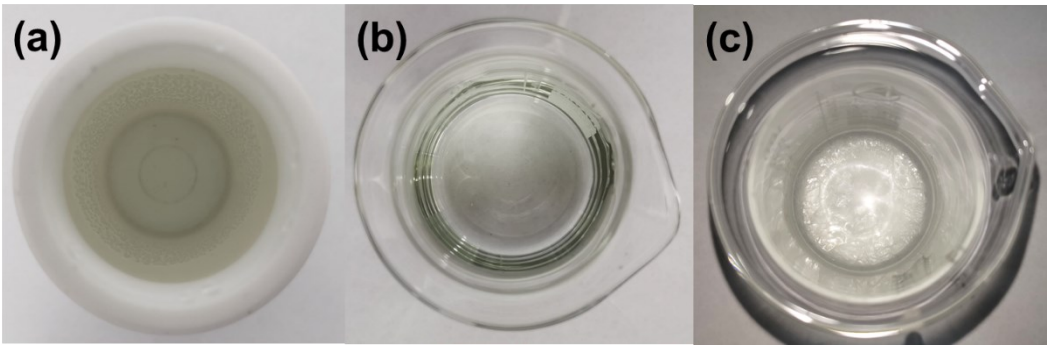

Fig. S1 Optical photograph of the LVO precursor. (a) Obtained via hydrothermal reaction. Transferred into a beaker before (b) and after (c) drying.

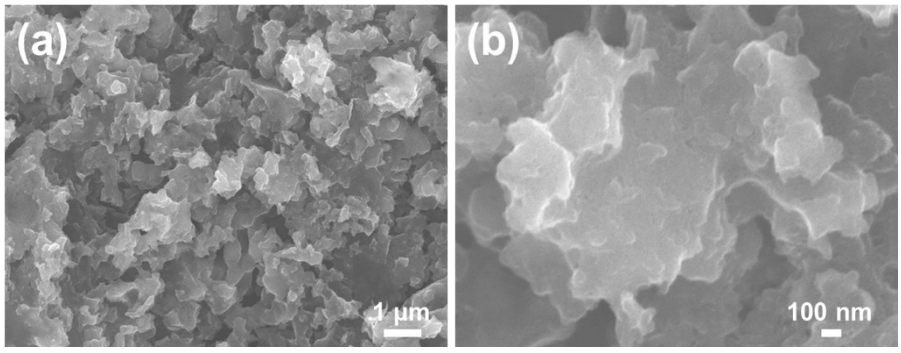

Fig. S2 SEM image of LVO@C with low (a) and high (b) magnification.

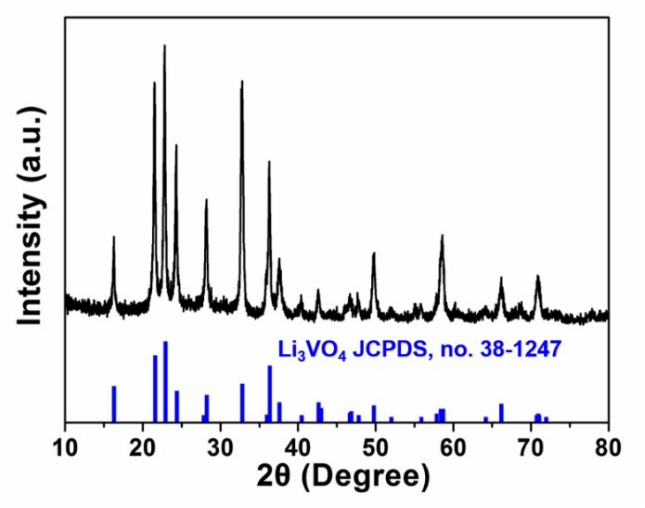

Fig. S3 XRD pattern of the LVO@C.

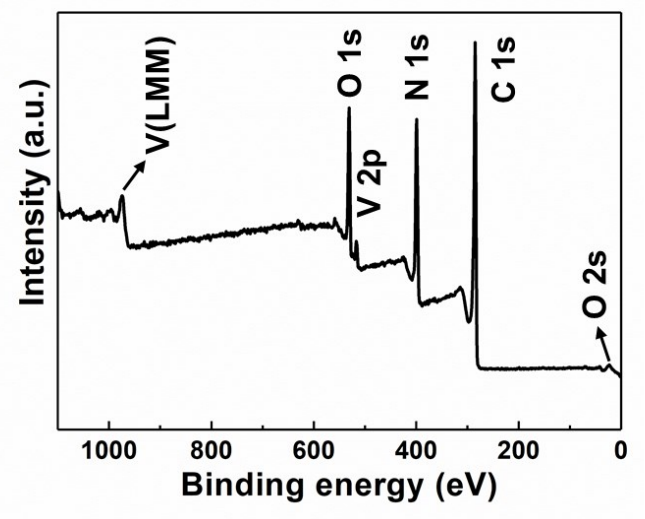

Fig. S4 Survery XPS spectrum of the as-prepared C@LVO-NFs.

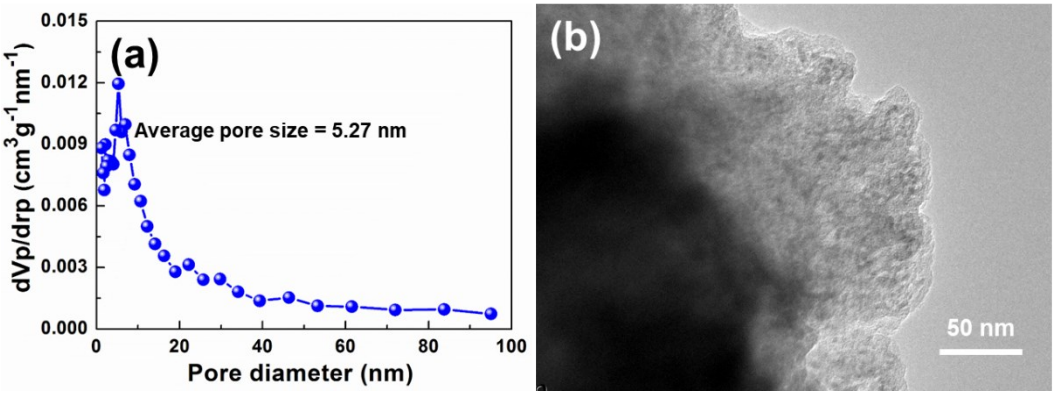

Fig. S5 (a) Pore size distribution curve and (b) TEM image of the C@LVO-NFs.

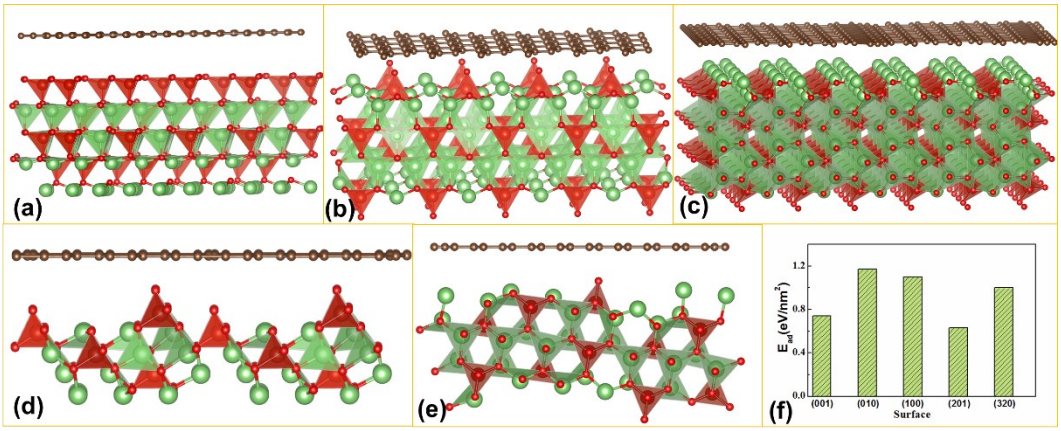

Fig. S6 The atomistic hybrid structure of C nanoflake and LVO surface. (a) The hybrid structure of C/LVO(001) surface; (b) The hybrid structure of C/LVO(010) surface; (c) The hybrid structure of C/LVO(100) surface; (d) The hybrid structure of C/LVO(201) surface; (e) The hybrid structure of C/LVO(320) surface; (f) The statistical data of the absorption energy of different hybrid structures.

Tab. S1 The calculated bandgap and D-value between LVO and the monolayer C.

Different surface	Bandgap（eV）	D(LVO-C) (nm)
001	0.14	2.153
010	0.16	1.788
011	0.11	1.977
201	0.17	2.245
320	0.09	1.927

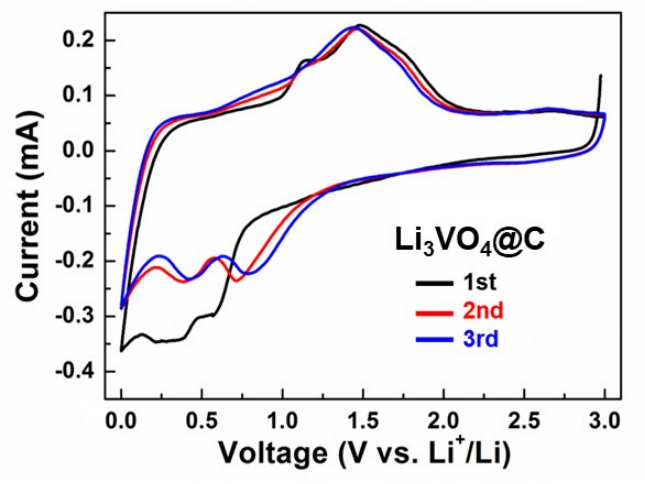

Fig. S7 CV curves of the LVO@C.

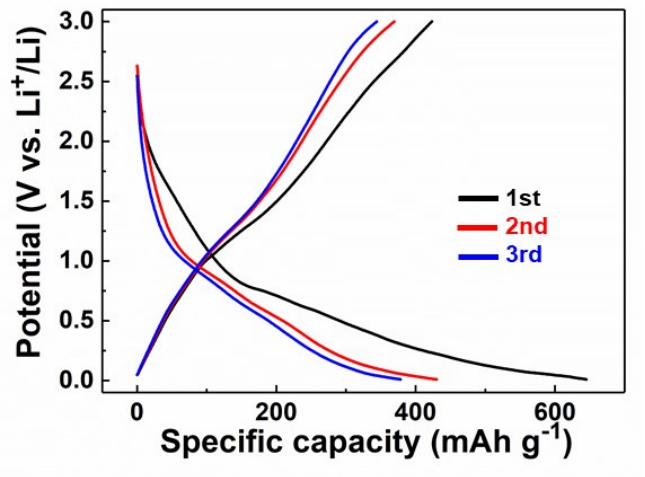

Fig. S8 The initial three charge/discharge curves of the LVO@C.

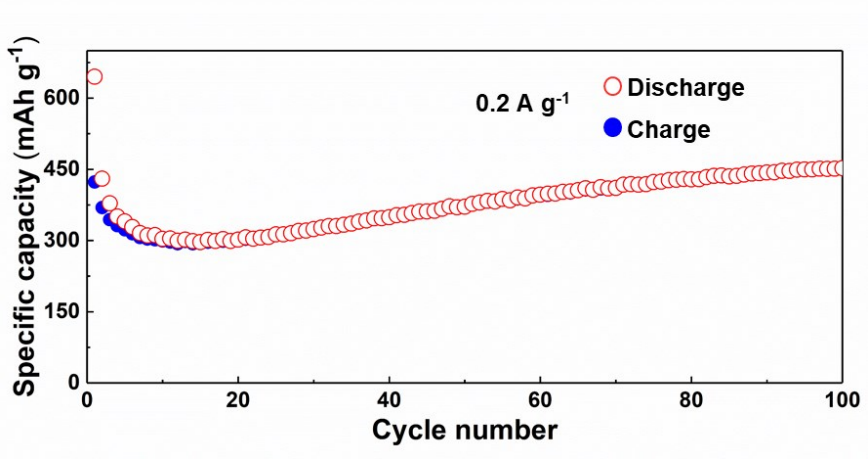

Fig. S9 Capacity retention of the LVO@C at 0.2 A g^{-1}.

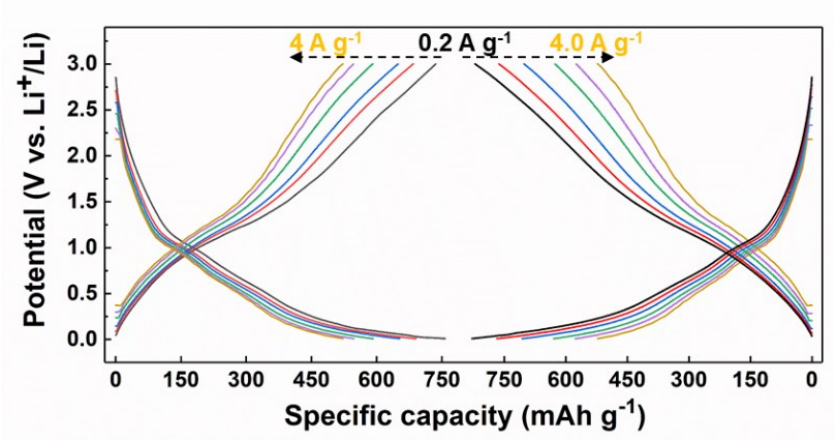

Fig. S10 Representative charge/discharge curves in the first period rate performance testing for Figure 4d.

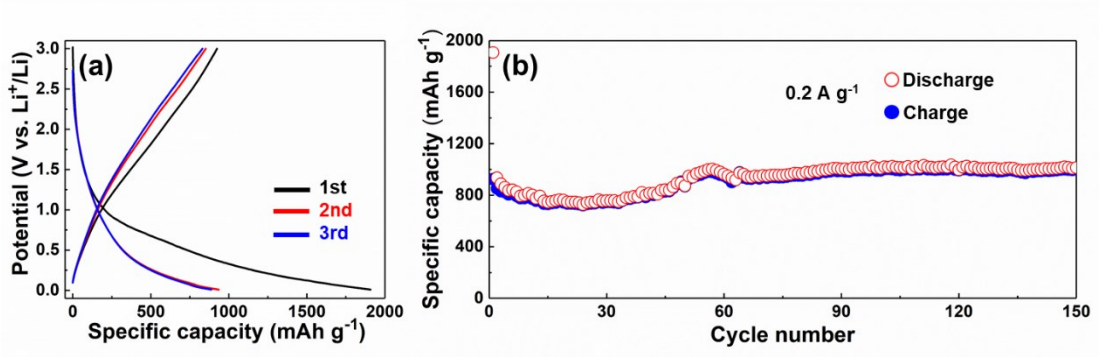

Fig. S11 The initial three charge/discharge curves (a) and cycle performance (b) of C obtained by fully etching C@LVO in diluted HCl and washed by deionized water.

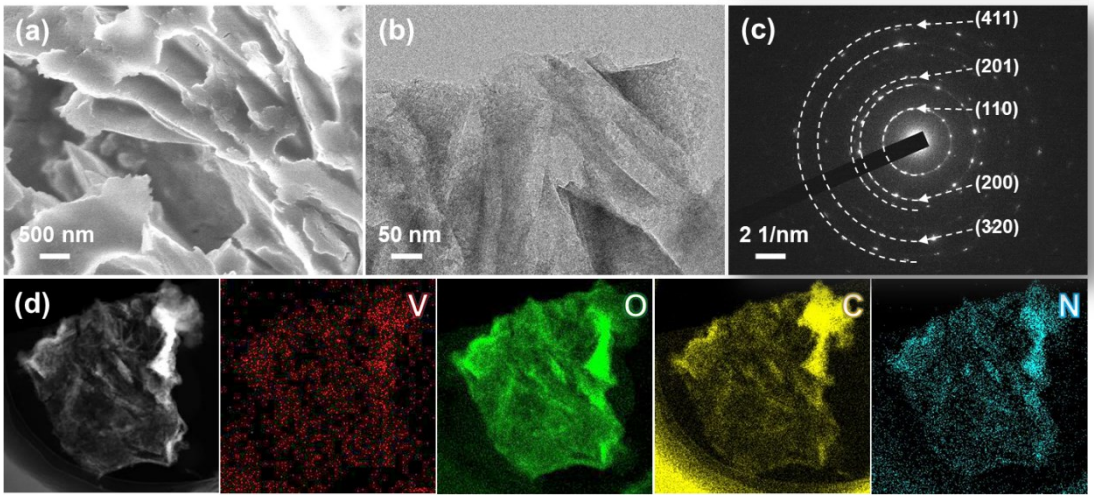

Fig. S12 Microstructure of the C@LVO-NFs after long-life testing. (a) SEM and (b) TEM image, (c) SAED pattern, and (d) scanning TEM image with element mappings of V, O, C and N.

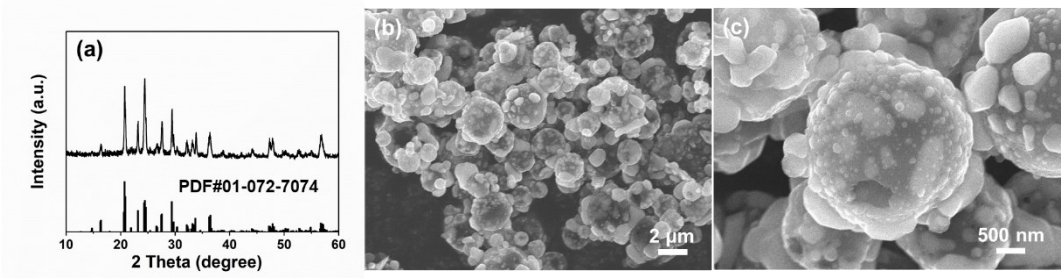

Fig. S13 XRD pattern (a) SEM images with low (b) and high (c) magnification of the as-prepared $Li_3V_2(PO_4)_3$ cathode.

The $Li_3V_2(PO_4)_3$ cathode (LVP) were prepared via hydrothermal reaction with spray drying. Firstly, 5 mmol hexamethylenetetramine, 2 mmol V_2O_5, 3.1 mmol Li_2CO_3 and 0.7479 g $C_6H_{12}O_6 \cdot H_2O$ were dissolved in deionized water and transferred into a 50 mL teflonlined autoclave, reacting at 120 °C for 12 h, to obtain an intermediate solution. Then, 0.6902 g $NH_4H_2PO_4$ were added in the solution with stirring for 30 mins. Finally, the mixed solution was spray dried and collected, sintered at 350 °C for 4 h and then 850 °C for 8 h in N_2.

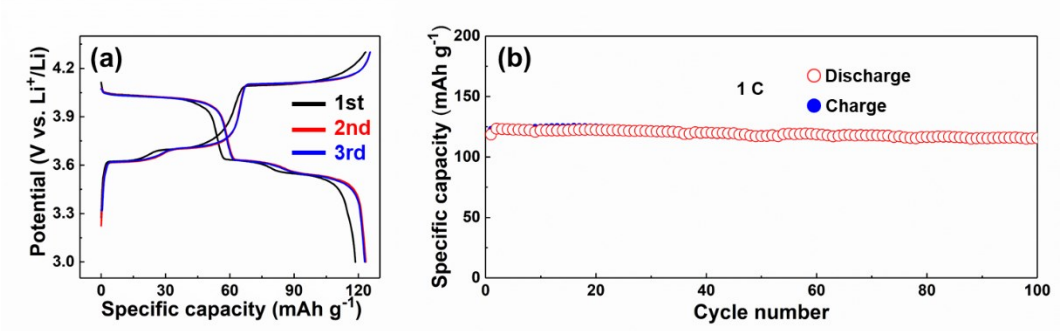

Fig. S14 The initial three charge/discharge curves (a) and cycle performance (b) of the LVP cathode.