Electronic Supplementary Material (ESI) for Dalton Transactions.

Supporting Information

Architecting NiFe-LDH/MXene nano-arrays hybrid toward exceptional capacitive lithium storage

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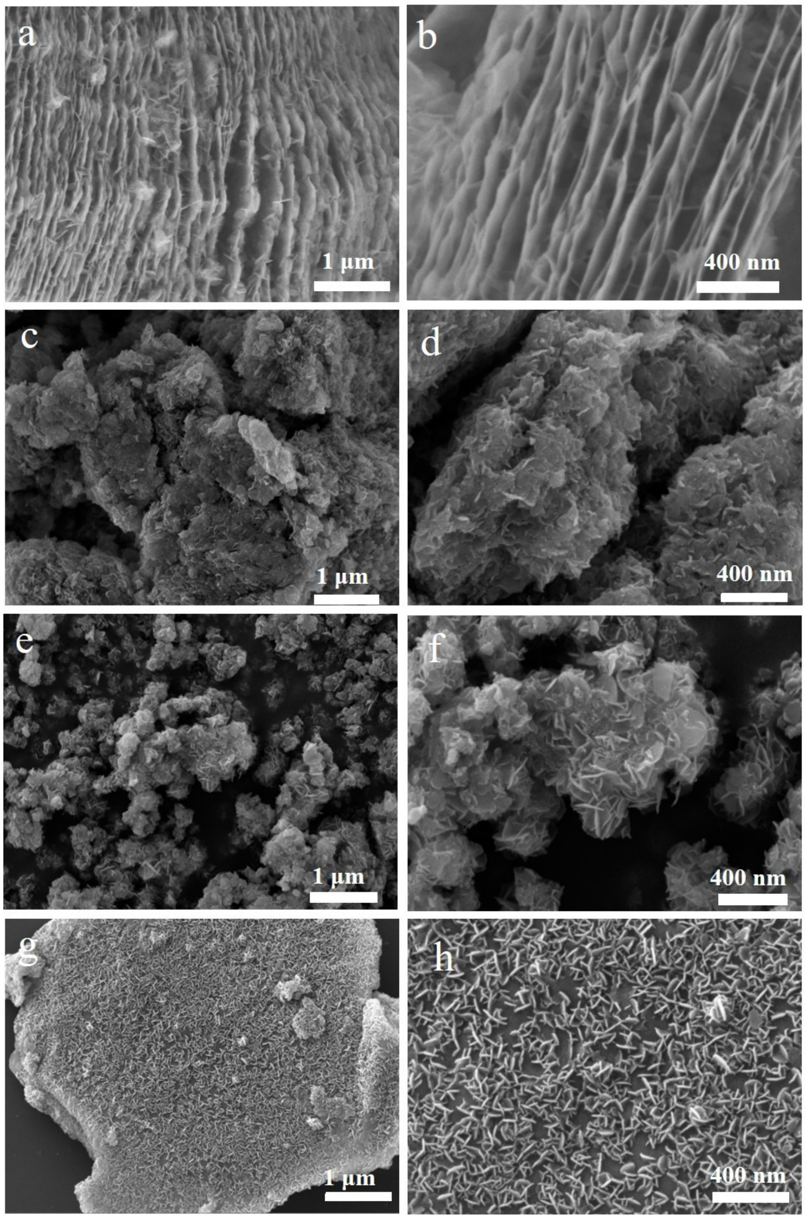

Figure S1. SEM images of (a-b) $Ti_3C_2T_x$-MXene, (c-d) NiFe-LDH, (e-f) NiFe-LDH /MXene-50, (g-h) NiFe-LDH /MXene-200.

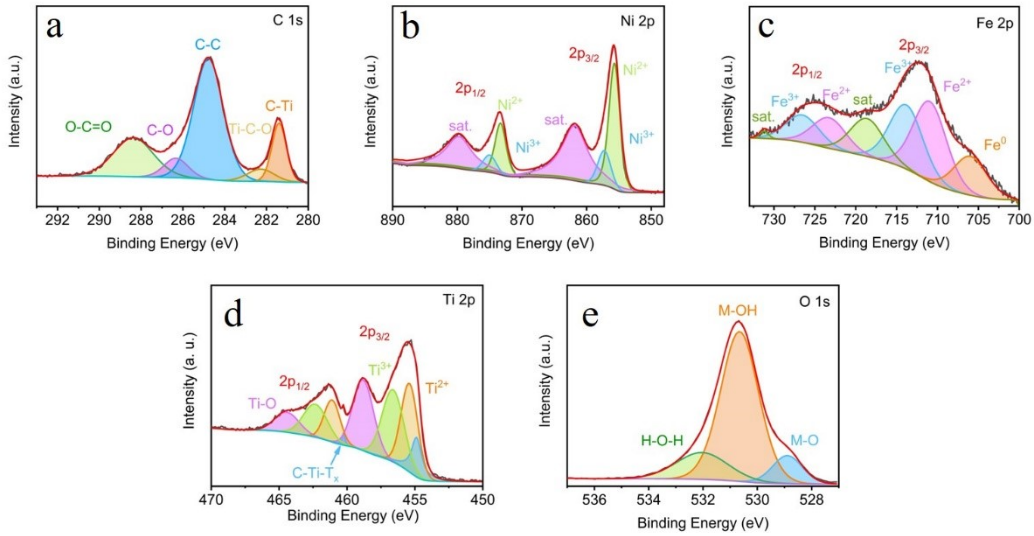

Figure S2. High-resolution XPS spectra of (a) C 1s, (b) Ni 2p, (c) Fe 2p, (d) Ti 2p, (e) O 1s for NiFe-LDH/MXene-500.

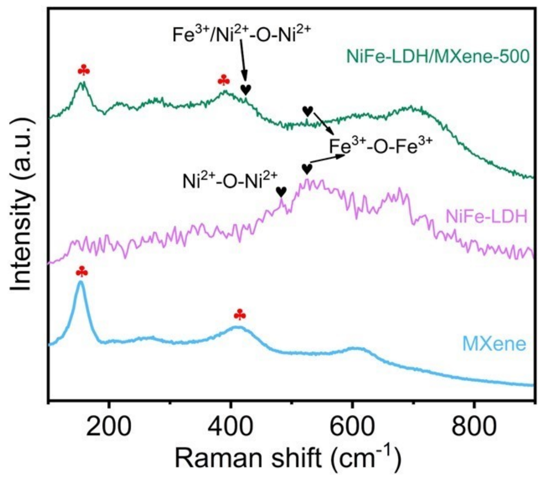

Figure S3. Raman spectra of NiFe-LDH, Mxene and NiFe-LDH /MXene-500.

Table S1. The specific surface areas and total pore volumes of the samples.

Electrode materials	NiFe-LDH	NiFe-LDH/MXene-50	NiFe-LDH/MXene-200	NiFe-LDH/MXene-500	MXene
Specific surface area (m^2 g^{-1})	223.31	77.77	54.98	41.07	2.04
Total pore volume (cm^3 g^{-1})	0.4399	0.2908	0.1691	0.1305	0.0181

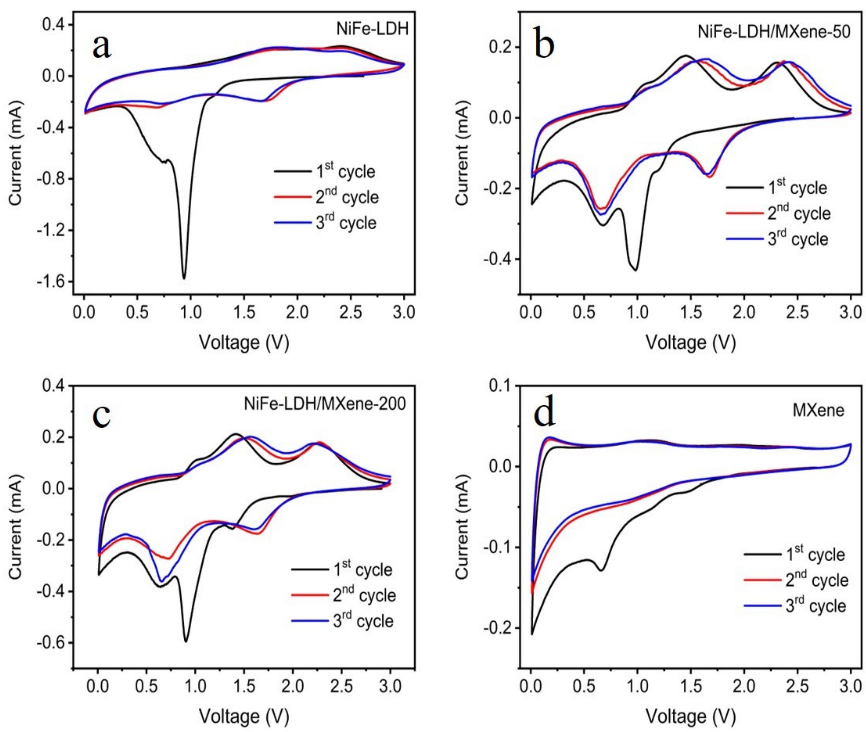

Figure S4. CV curves at a scan rate of 0.2 mV s^{-1} for (a) NiFe-LDH, (b)NiFe-LDH/MXene-50, (c) NiFe-LDH/MXene-200 and (d) MXene.

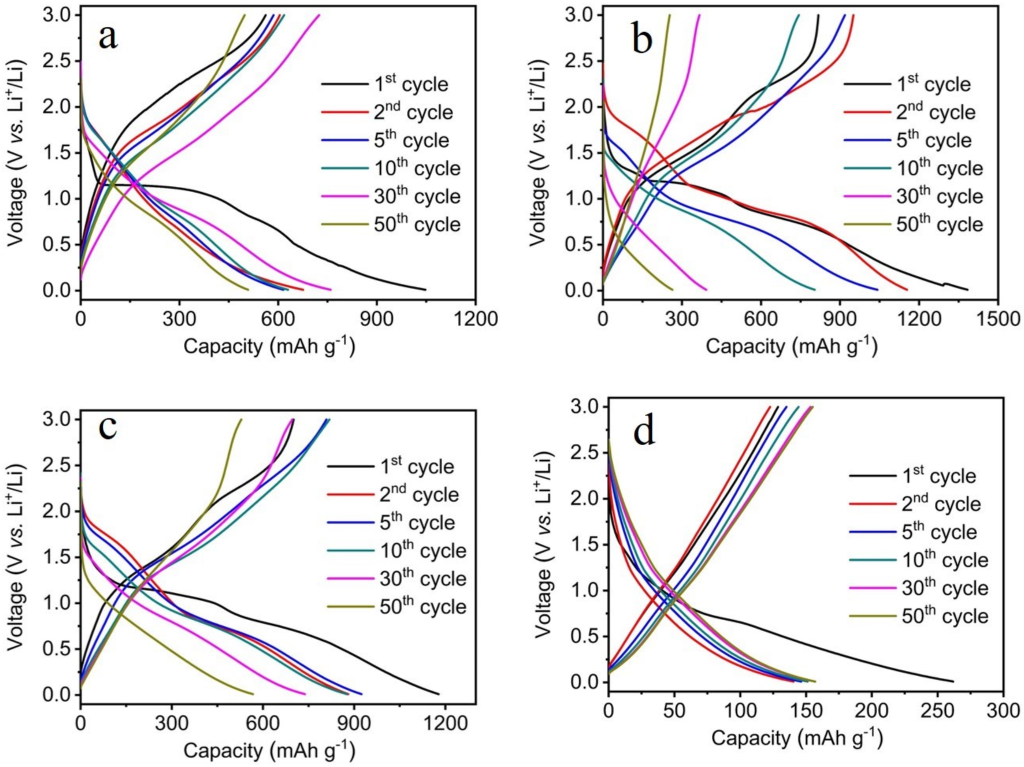

Figure S5. GCD profiles of (a)NiFe-LDH, (b) NiFe-LDH/MXene-50, (c) NiFe-LDH/Mxene-200, (d) MXene.

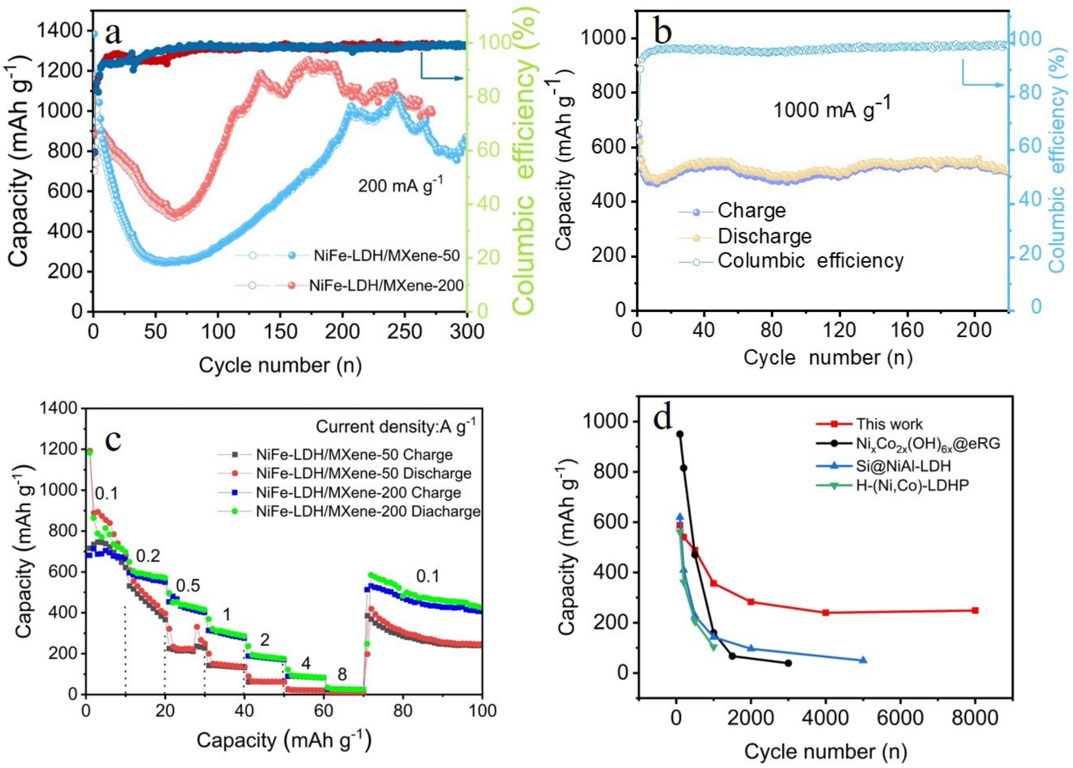

Figure S6. (a) Comparison of cyclability of the NiFe-LDH and MXene at 200 mA g^{-1}. (b) Cycling performance of the NiFe-LDH/MXene-500 electrode at 1000 mA g^{-1}. (c) Comparison of rate capacity of the NiFe-LDH/MXene hybrid materials. (d) Comparisons in the rate capabilities between this work and other LDH-based electrodes.

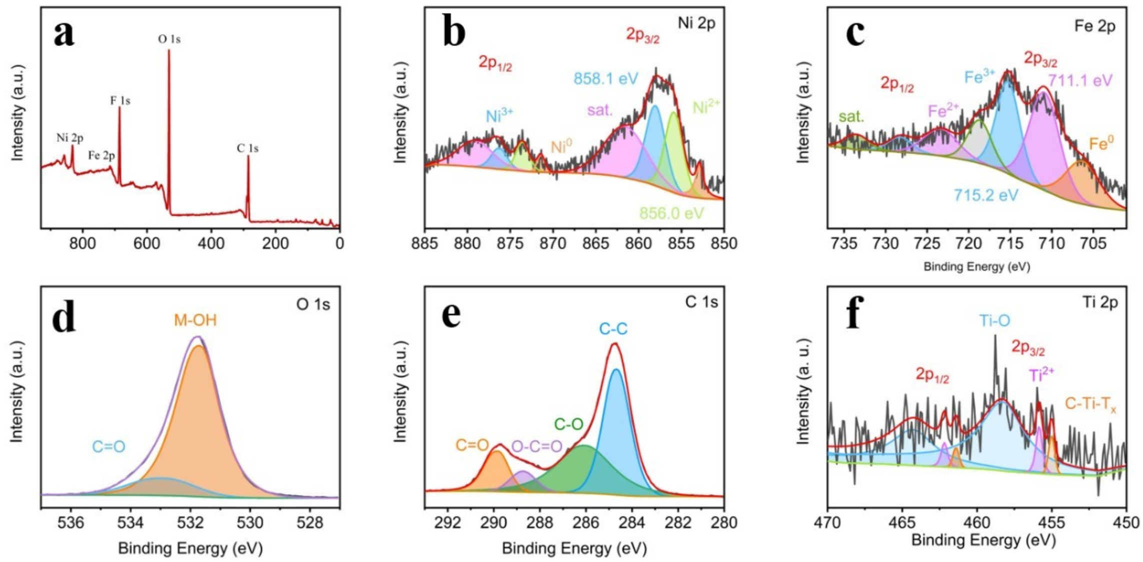

Figure S7. XPS spectra of (a) survey scan; (b-c) Fe 2p, and Ni 2p of NiFe-LDH/MXene hybrid materials and NiFe-LDH; and (d) Ti 2p of NiFe-LDH/MXene-500 electrodes after 50 cycles.

Table S2. Comparison of electrochemical performance of LDH-based materials in LIBs.

Materials	Cycling performance (mAh g^{-1} at A g^{-1})	Rate performance (mAh g^{-1} at A g^{-1})	Ref.
$Ni_xCo_{2x}(OH)_{6x}$@eRG	373.0 at 1 (500 cycles)	950.0 at 0.1, 160.0 at 1	1
Si@NiAl-LDH	534.0 at 0.05 (60 ycles)	619.5 at 0.1, 142.3 at 1	2
H-(Ni,Co)-LDHP	355.4 at 0.1 (50 cycles)	560.3 at 0.1, 103.6 at 1	3

Reference

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[2] Q. Li, Y. Wang, B. Lu, J. Yu, M. Yuan, Q. Tan, Z. Zhong, F. Su, Hollow core-shell structured Si@NiAl-LDH composite as high-performance anode material in lithium-ion batteries, Electrochim. Acta, 331 (2020) 135331.

[3] Y. Lu, Y. Du, H. Li, Template-sacrificing synthesis of Ni-Co layered double hydroxides polyhedron as advanced anode for lithium ions battery, Front. Chem., 8 (2020) 581653.