Electronic Supplementary Information

Preparation and electrochemical properties of NiMn-LDH with petal-like lamellar structure derived from Mn MOF-74

Jing Shi, Hongbo Tai, Dongwei Xu, Xiaomin Kang* and Zhiliang Liu*

Inner Mongolia Key Laboratory of Chemistry and Physics of Rare Earth Materials, College of Chemistry and Chemical Engineering, Inner Mongolia University, Hohhot, 010021, PR China.

E-mail: kangxm@imu.edu.cn, E-mail: cezlliu@imu.edu.cn

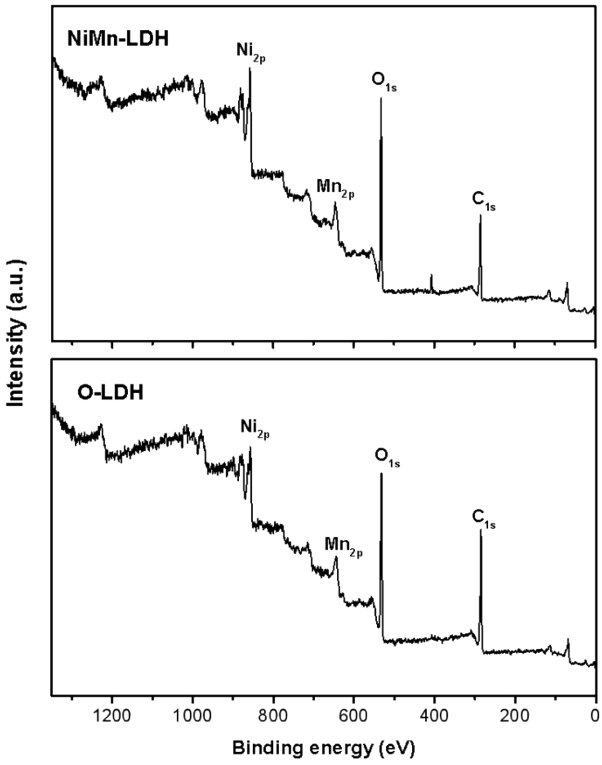

Fig. S1 The full XPS spectra of NiMn-LDH 3 and O-LDH samples.

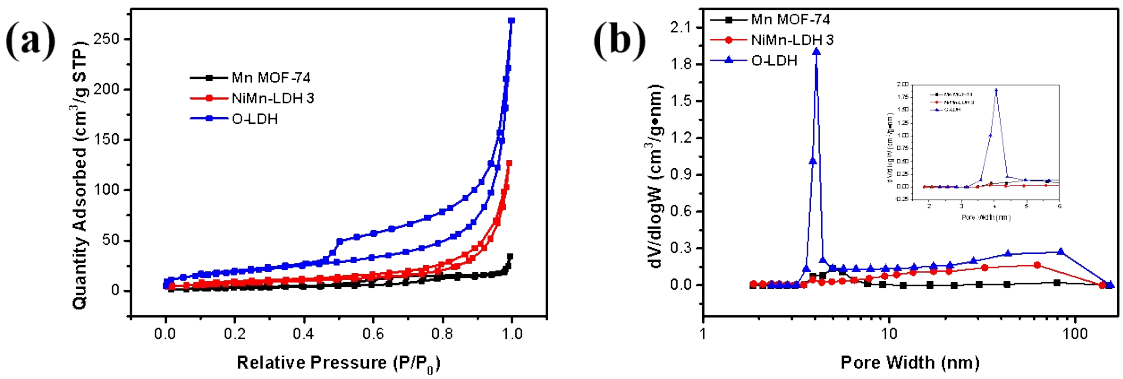

Fig. S2 (a) N_2 adsorption/desorption isotherms of Mn MOF-74, NiMn-LDH 3 and O-LDH; (b) corresponding pore size distribution curves of Mn MOF-74, NiMn-LDH 3 and O-LDH.

Table S1 O 1s peak for NiMn-LDH 3 and O-LDH materials.

Binding energy (eV) / Relative peak area	530.8 O^{2-}	531.6 OH^{-}	532.9 H_2O
NiMn-LDH	2196.6	14645.2	10916.8
O-LDH	2728.7	11437.8	10036.9

Table S2 Mn 2p peak for NiMn-LDH 3 and O-LDH materials.

Binding energy (eV) / Relative peak area	641.3 Mn^{2+}	642.6 Mn^{3+}	643.9 Mn^{4+}
NiMn-LDH	686.3	527.6	2216.6
O-LDH	1444.2	1105.1	2411.7

Table S3 The analysis results of XPS for NiMn-LDH 3 and O-LDH materials.

	Relative content of O^{2-}	Relative content of OH^-	OH^-/O^{2-}	Relative content of Mn^{2+}	Relative content of Mn^{3+}	Relative content of Mn^{4+}
NiMn-LDH	7.9%	52.8%	6.7	20.0%	15.4%	64.6%
O-LDH	11.3%	47.3%	4.2	29.1%	22.3%	48.6%

Table S4 Pore structure parameters of Mn MOF-74, NiMn-LDH 3 and O-LDH materials.

Materials	S_{BET} (m^2/g)	V_{total} (cm^3/g)	Average pore diameter (nm)
Mn MOF-74	20.25	0.04	13.43
NiMn-LDH 3	46.10	0.19	27.16
O-LDH	111.33	0.35	20.40

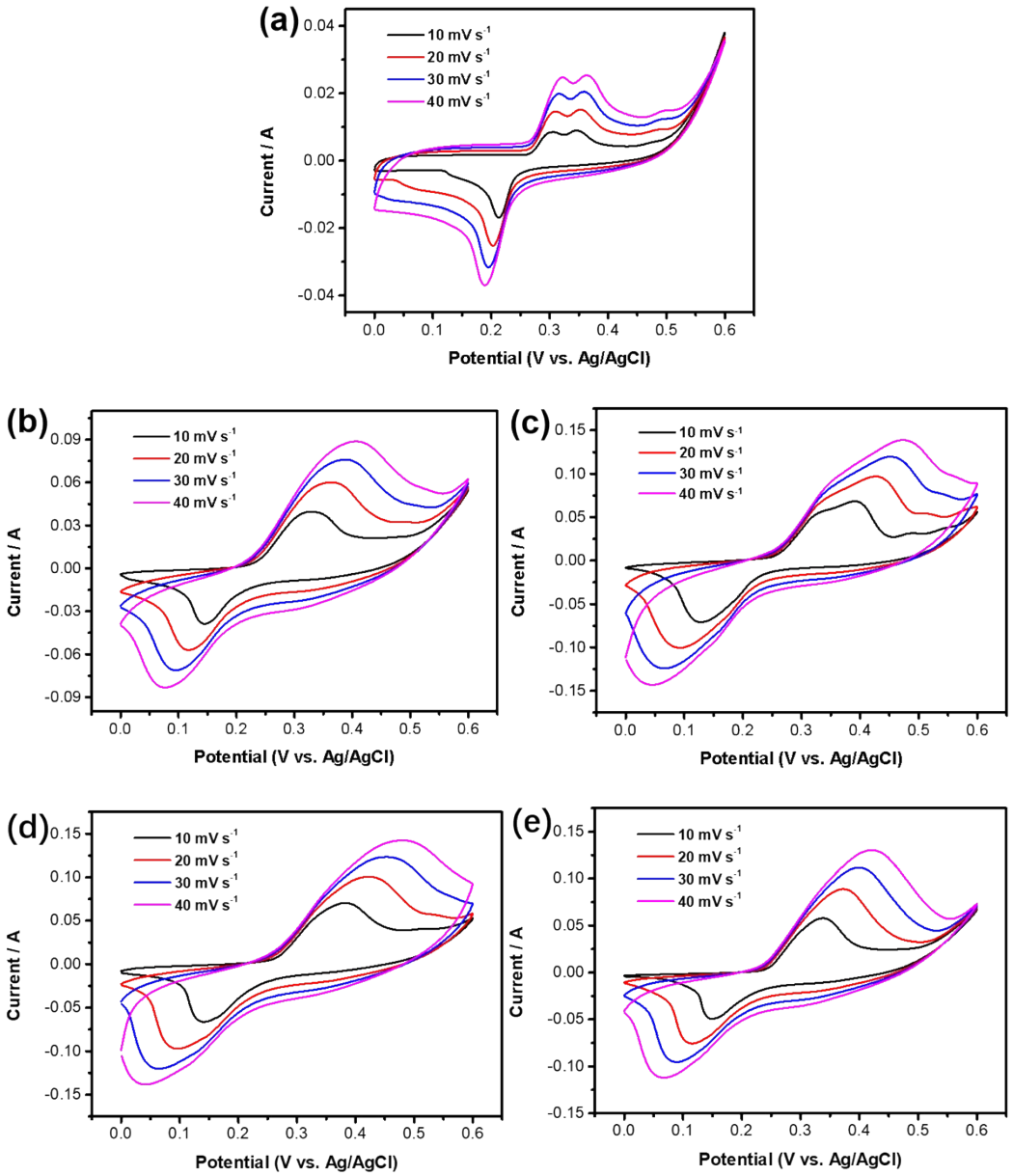

Fig. S3 Cyclic Voltammetry (CV) curves of Mn MOF-74/NF (a), NiMn-LDH 1/NF (b), NiMn-LDH 2/NF (c), NiMn-LDH 4/NF (d) and NiMn-LDH 5/NF (e) electrodes at various scan rates (10-40 mV s^{-1}).

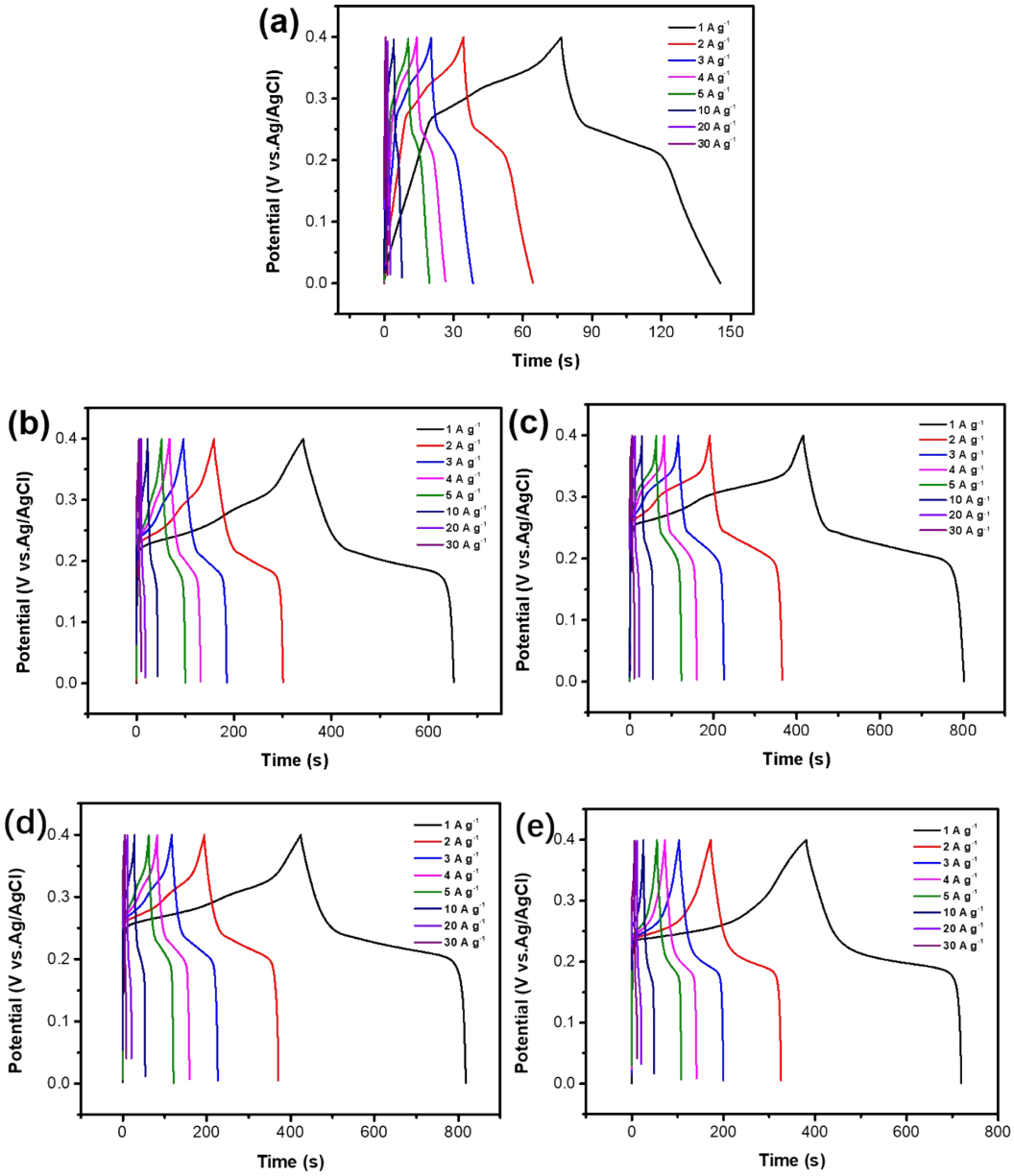

Fig. S4 Galvanostatic charge-discharge (GCD) curves of Mn MOF-74/NF (a), NiMn-LDH 1/NF (b), NiMn-LDH 2/NF (c), NiMn-LDH 4/NF (d) and NiMn-LDH 5/NF (e) electrodes at various current densities (1-30 A g^{-1}).

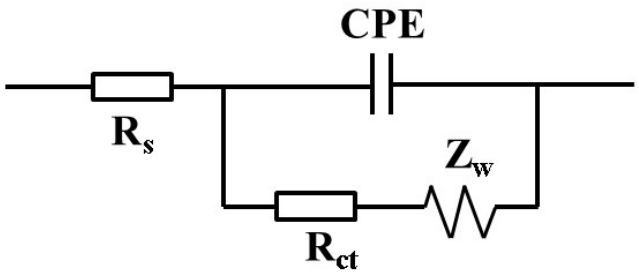

Fig. S5 the equivalent circuit fitting diagram of the EIS data.

Table S5 Comparison of supercapacitor electrochemical performance between the previously reported materials and the active material O-LDH.

Electrode materials	Specific capacitance	Current density	Rate capability	Reference
NiMn-LDH/PC	1634 F g^{-1}	1 A g^{-1}	60.5% at 10 A g^{-1}	1
Ni/Mn LDHs microspheres	1379 F g^{-1}	1 A g^{-1}	75.1% at 50 mV s^{-1}	2
Ni-Mn LDH/Co_3O_4 on carbon paper	1327 F g^{-1}	1 A g^{-1}	70.9% at 50 mV s^{-1}	3
Ni-Mn LDH@Co_3O_4 on nickel foam	607.9 F g^{-1}	0.5 A g^{-1}	73% at 5 A g^{-1}	4
Mn_3O_4/$NiMoO_4$@NiCo LDH on carbon cloth	815 F g^{-1}	1 A g^{-1}	76.92% at 5 A g^{-1}	5
NiMn-LDH/Mxene	1575 F g^{-1}	0.5 A g^{-1}	91.8% at 2 A g^{-1}	6
ZIF-9@CoAl LDH	702.7 F g^{-1}	1 A g^{-1}	75% at 8 A g^{-1}	7

NiMnMg-LDH	1772 F g^{-1}	1 A g^{-1}	74% at 3 A g^{-1}	8
KCu_7S_4@NiMn LDHs	733.8 F g^{-1}	1 A g^{-1}	84.8% at 2.5 A g^{-1}	9
NiMn-LDH/CNTs/rGO	1268 F g^{-1}	1 A g^{-1}	69.4% at 10 A g^{-1}	10
O-LDH	1875 F g^{-1}	1 A g^{-1}	71.7% at 3 A g^{-1}	**This work**

References

1 M. Yu, R. Liu, J. Liu, S. Li and Y. Ma, *Small*, 2017, **13**, 1702616.

2 T. Li, J. Wang, Y. Xu, Y. Cao, H. Lin and T. Zhang, *ACS Appl. Energy Mater.*, 2018, **1**, 2242-2253.

3 L. Ouyang, C. H. Hsiao, Y. C. Chen, C. Y. Lee and N. H. Tai, *Surf. Interfaces*, 2022, **28**, 101574.

4 H. Peng, C. Jing, J. Chen, D. Jiang, X. Liu, B. Dong, F. Dong, S. Li and Y. Zhang, *CrystEngComm*, 2019, **21**, 470-477.

5 R. Liang, S. Liu, J. Lin, J. Dai, J. Peng, P. Huang, J. Chen and P. Xiao, *RSC Adv.*, 2023, **13**. 33463-33470.

6 D. Zhang, J. Cao, X. Zhang, N. Insin, R. Liu and J. Qin, *ACS Appl. Energy Mater.*, 2020, **3**, 5949-5964.

7 G. Wang, Y. Li and Z. Jin, *New J. Chem.*, 2020, **44**, 7528-7540.

8 B. Zhang, Y. Yang, J. Cai, X. Hou, C. Yi, X. Liao, Y. Liu, C. Chen, D. Yu and X. Zhou, *Dalton Trans.*, 2023, **52**, 10557-10566.

9 X. L. Guo, J. M. Zhang, W. N. Xu, C. G. Hu, L. Sun and Y. X. Zhang, *J. Mater. Chem. A*, 2017, **5**, 20579-20587.

10 M. Li, F. Liu, X. B. Zhang and J. P. Cheng, *Phys. Chem. Chem. Phys.*, 2016, **18**, 30068-30078.