

Supplementary Information

1. Experimental Section

1.1 Details of electrode materials preparation

In this paper, NiCo-LDH was prepared by hydrothermal method. $\text{Ni}(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ (4 mmol), $\text{Co}(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ (2 mmol), HMTA (6 mmol) were dissolved in 60 ml deionized water. Put the solution on the magnetic mixer, set the appropriate number of revolutions, and through magnetic stirring for more than 5 minutes, make it fully mixed to get a clear solution mixed. Then the solution can be transferred to the lining of the washed reaction kettle, and the sealed reaction kettle is placed in the air-blast drying oven in an appropriate way for hydrothermal reaction, and the temperature is heated to 90 °C for 6 h. The cooled sample solution was then rinsed and centrifuged with deionized water for several times (set the centrifuge parameter at $8000 \text{ rad min}^{-1}$ and kept for 7 min) until the solution in the test tube was clarified and dark green precipitate was obtained. The solution was dried at 60 °C for 12 h and fully ground into powder by agate mortar. NiCoMn-LDH also prepared by hydrothermal method. During the preparation of NiCo-LDH, in the preparation of the precursor solution, manganese nitrate aqueous solution was added in proportion (0.025, 0.05, 0.01, 0.02, 0.03, 0.04 mmol) to replace the same molar mass of $\text{Co}(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ to obtain NiCoMn-LDH with different doping. Similarly, during the preparation of NiCoMn-LDH, in the preparation of the precursor solution, mesoporous carbon (30 mg) was added to obtain SAC@Ni₂Co_{0.95}Mn_{0.05}-LDH.

Fig. S1. Four-probe test results of $\text{Ni}_2\text{Co}_{0.95}\text{Mn}_{0.05}\text{-LDH}$ and $\text{SAC@Ni}_2\text{Co}_{0.95}\text{Mn}_{0.05}\text{-LDH}$, (a) Square resistance (b) Resistivity.

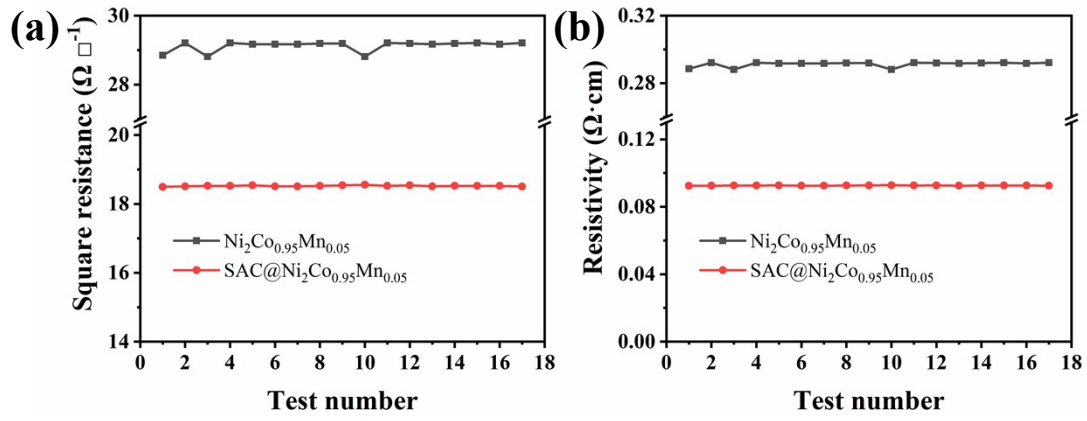


Fig. S2. The element contents of C, O, Ni, Co and Mn from EDS mapping.

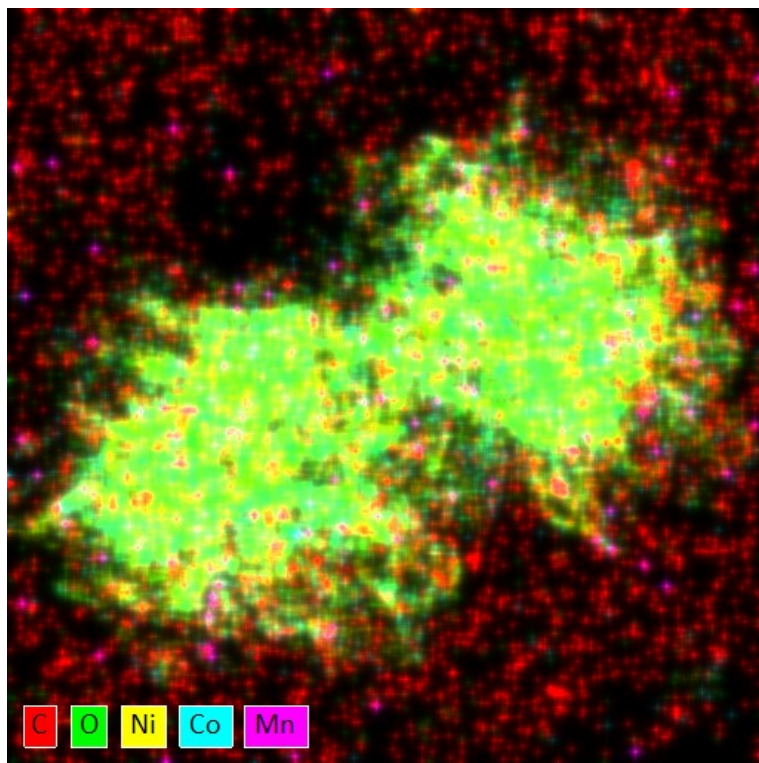
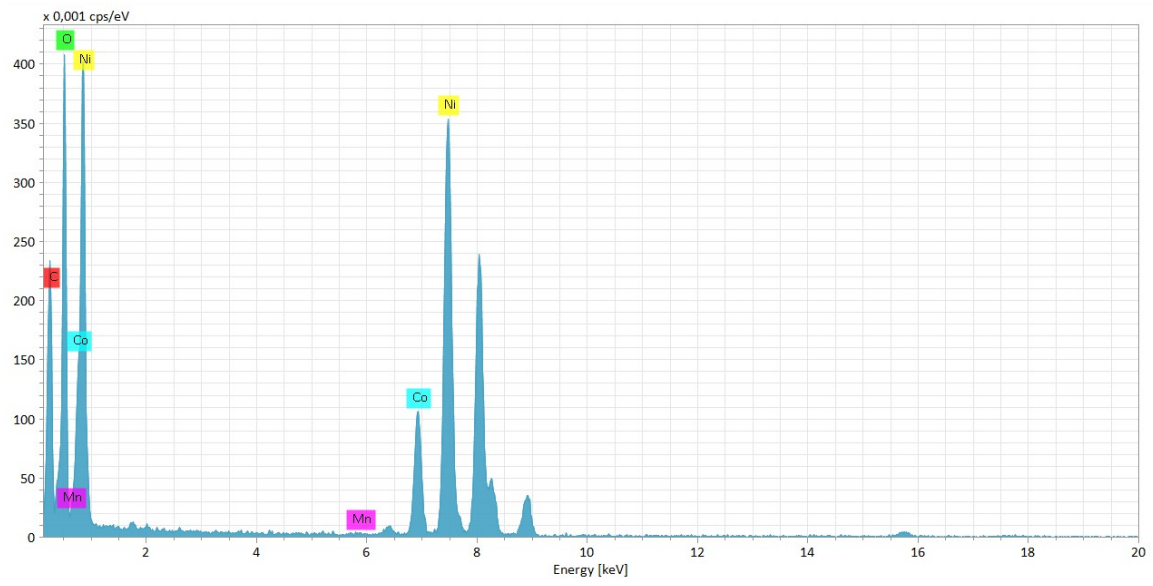


Fig. S3. The XPS spectra of SAC@NiCoMn-LDH Mn 3p.

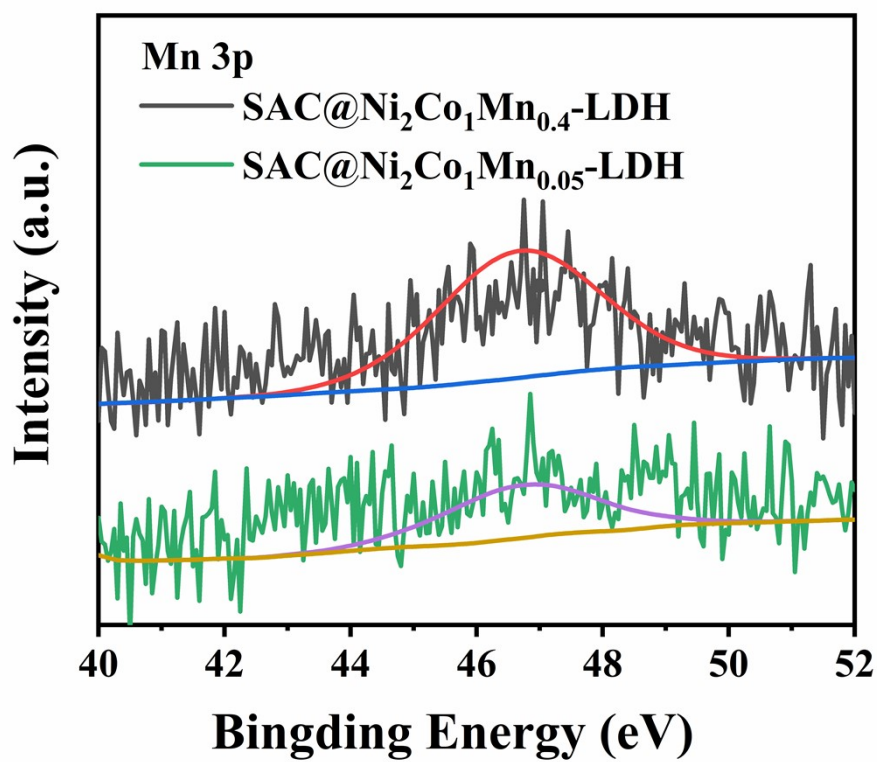


Table S1. The element contents of C, O, Ni, Co and Mn from EDS mapping.

Element	Mass Norm (%)
C	26.56
O	20.08
Ni	40.51
Co	12.6
Mn	0.10

Table S2. The element contents of Ni, Co and Mn from ICP.

Element	Mass Norm (%)
Ni	39.91
Co	10.92
Mn	0.14