Supporting Information

One-step hydrothermal growth of porous nickel manganese layered double hydroxide nanosheets film towards efficient visible-light modulation

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Supplementary Figures

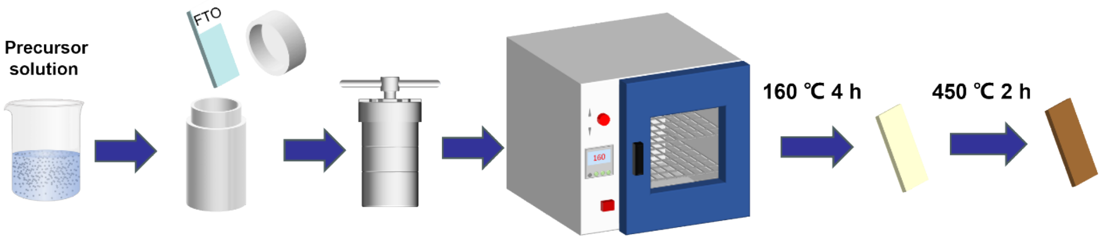

Fig. S1. Schematic diagram for the hydrothermal preparation process of NiMn-LDH film and subsequent annealing process.

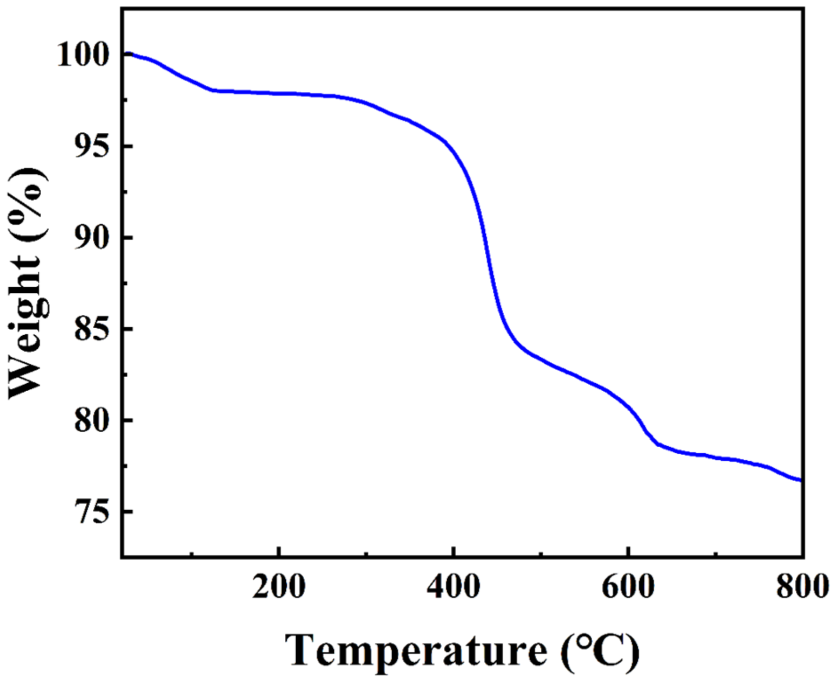

Fig. S2. TG curves of the NiMn-LDH powders.

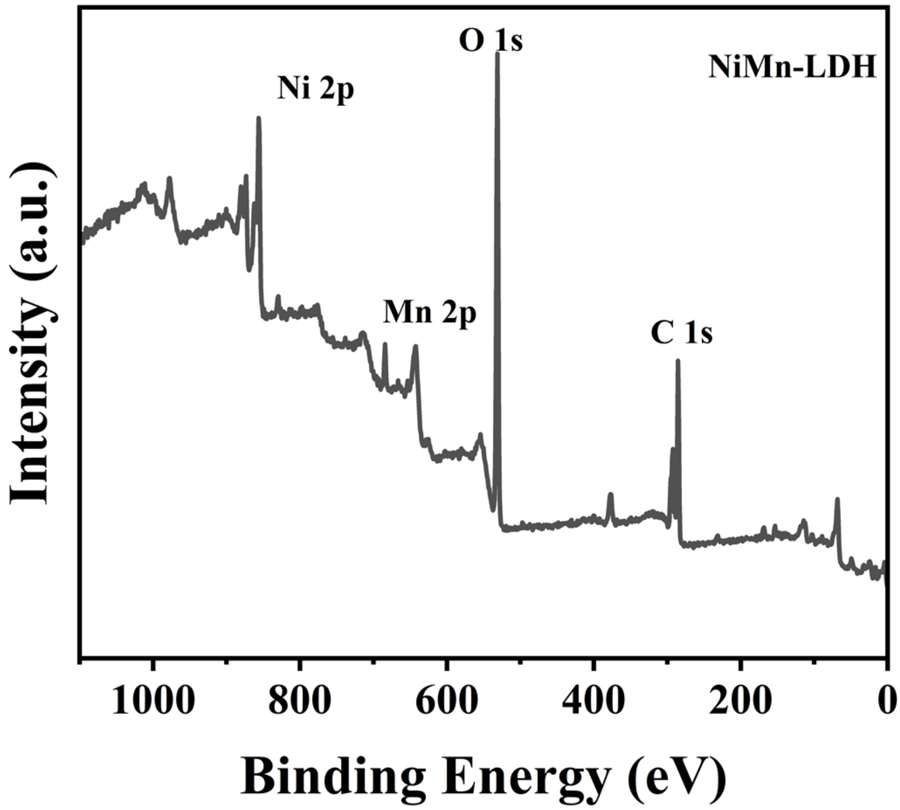

Fig. S3. The XPS survey spectrum of the as-grown NiMn-LDH film.

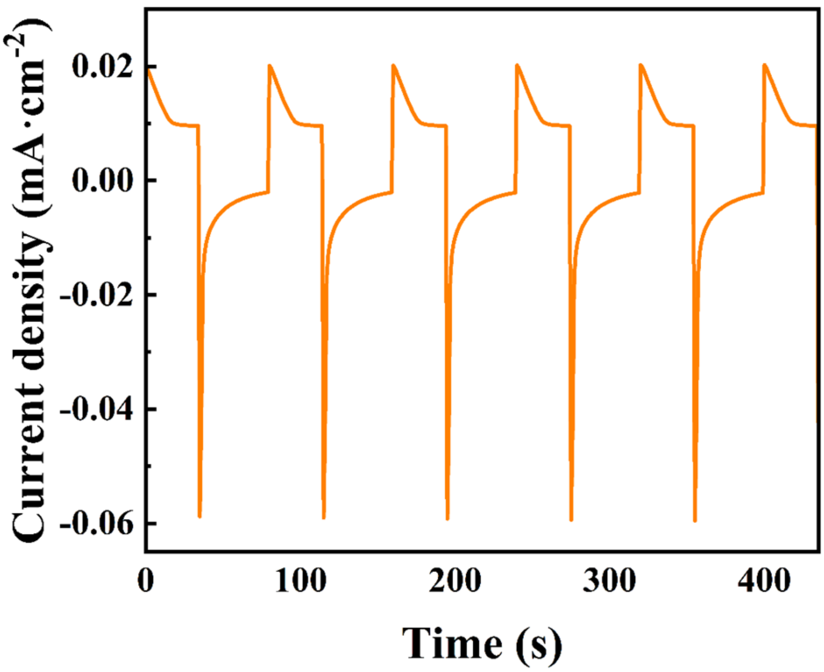

Fig. S4. Time-current curves of the NiMn-LDH film measured at -1.2 V for 45 s and 1 V for 35 s.

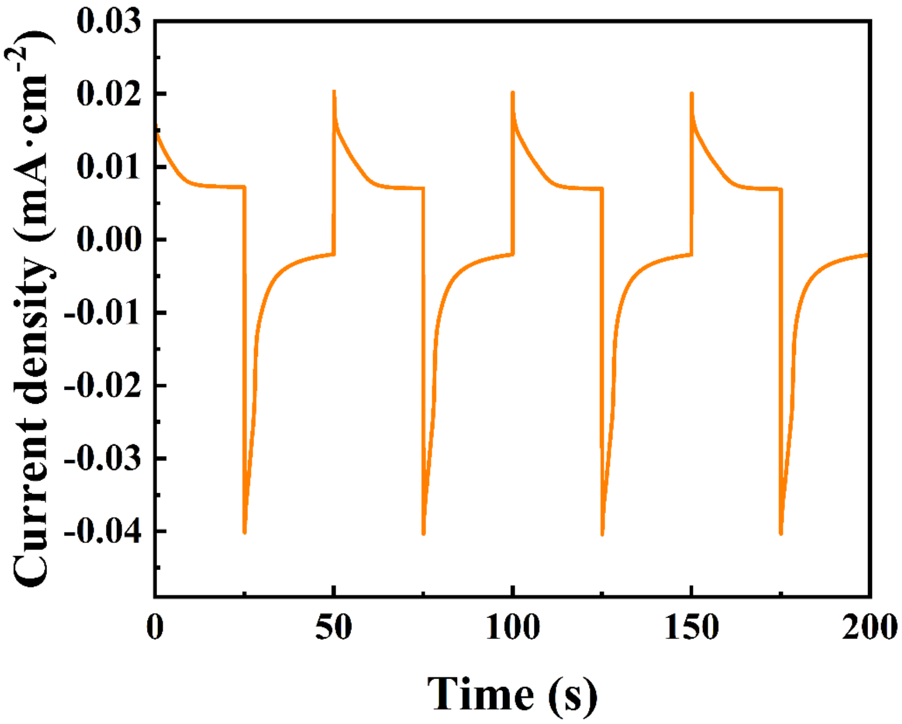

Fig. S5. Time-current curves of the Ni_6MnO_8 film measured at -1.2 V for 25 s and 1 V for 25 s.

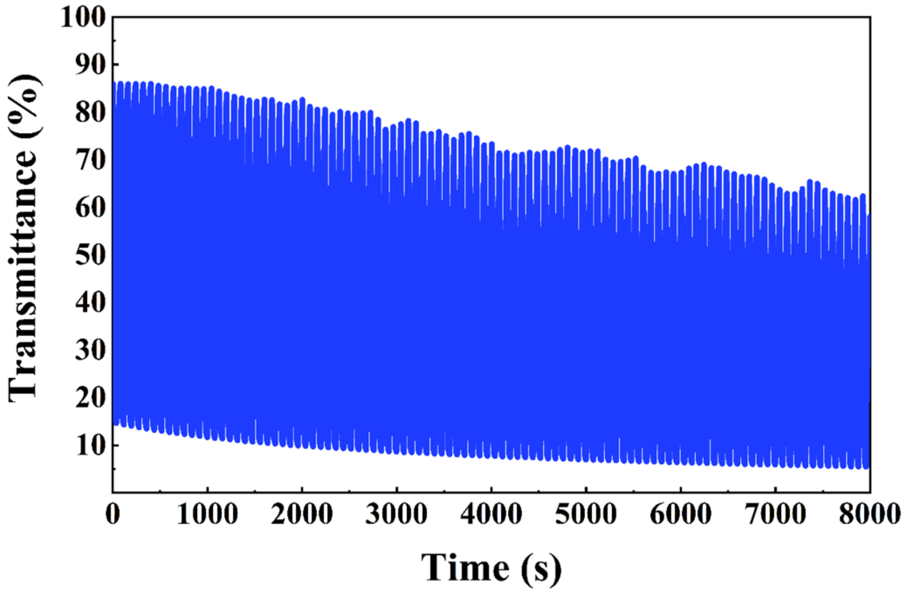

Fig. S6. Cycle performance of the NiMn-LDH film recorded at a wavelength of 550 nm.

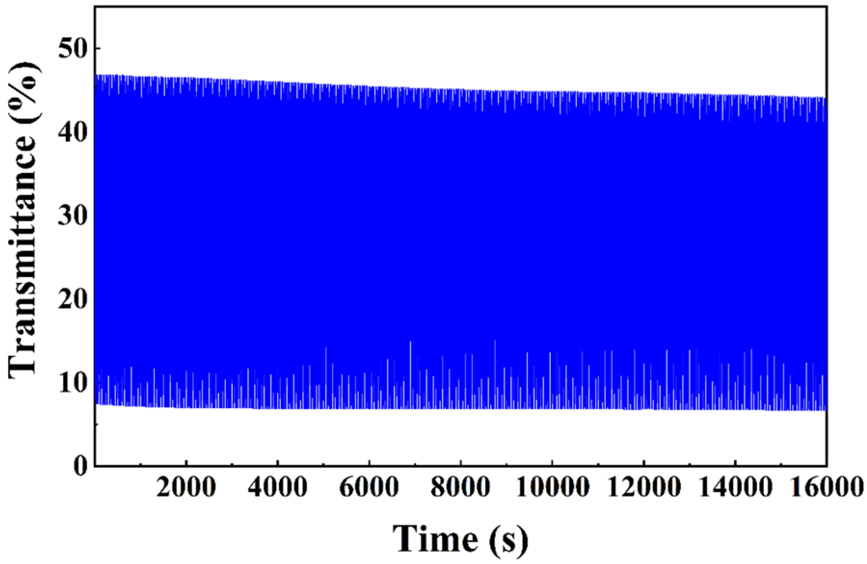

Fig. S7. Cycle performance of the Ni_6MnO_8 film recorded at a wavelength of 550 nm.

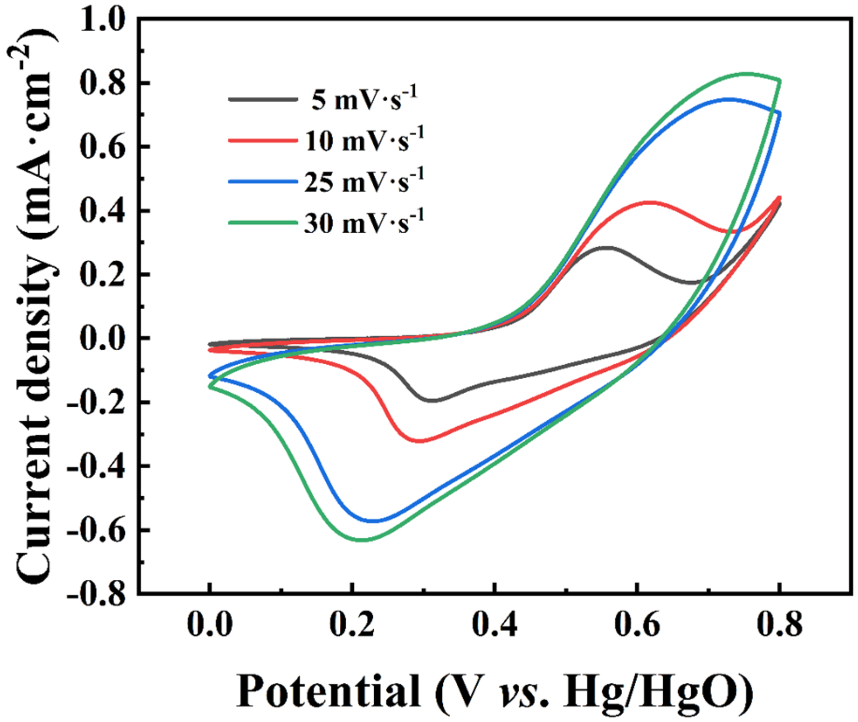

Fig. S8. CV curves of the NiMn-LDH film at different scan rates.

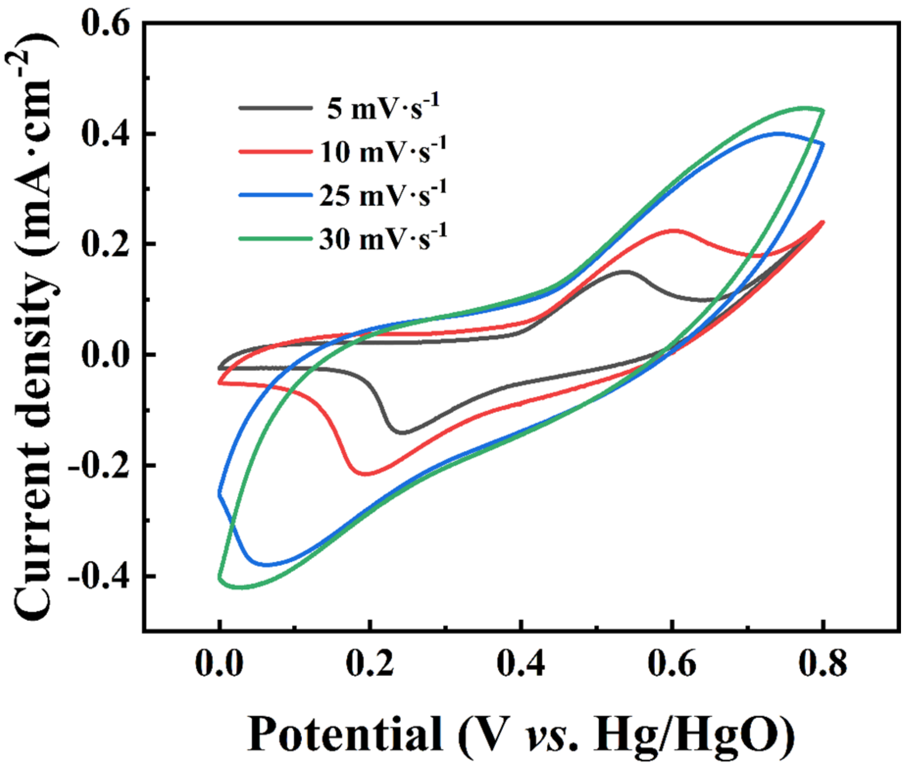

Fig. S9. CV curves of the Ni_6MnO_8 film at different scan rates.

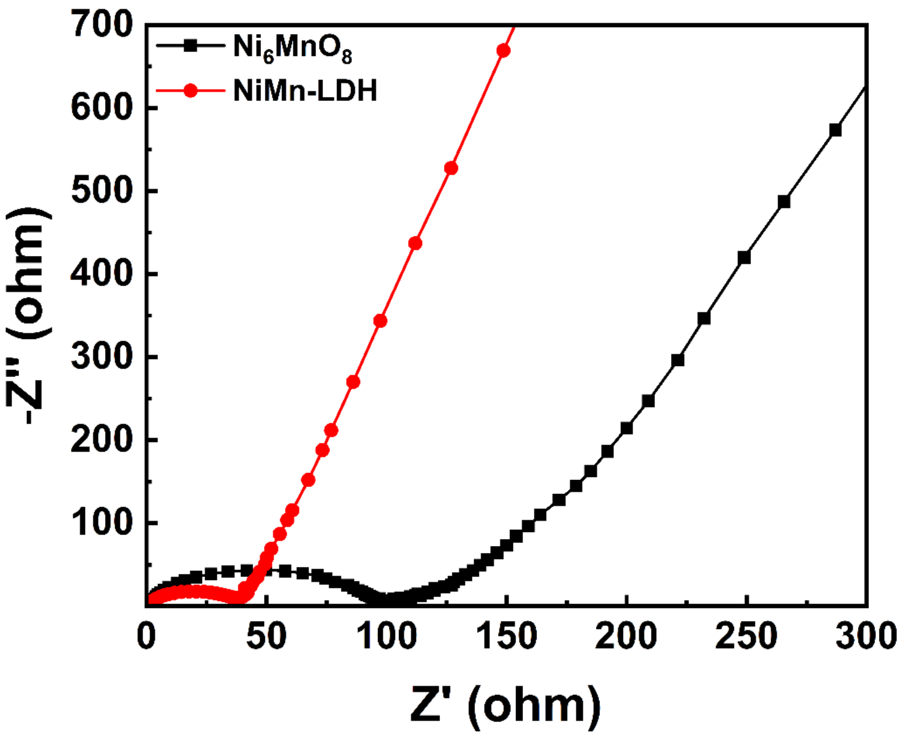

Fig. S10. EIS curves of (a) the NiMn-LDH film and (b) Ni_6MnO_8 film.

Electrochemical impedance spectroscopy (EIS) was conducted to estimate the conductivity of the as-prepared film electrodes. Fig. S10 shows the resulting Nyquist plots of NiMn-LDH and Ni_6MnO_8 film electrodes. The EIS curves of both electrodes consist of a straight line and a semicircle. The typical semicircle in the high-frequency region is attributed to the charge transfer resistance (R_{ct}) caused by a faradic reaction that occurred at the active material surface.[1,2] Accordingly, the calculated R_{ct} for the NiMn-LDH and Ni_6MnO_8 film electrodes are 19.8 Ω and 49.1 Ω, respectively.

Supplementary Tables

Table S1. Microstructural parameters of different samples

Samples	Average crystallite size (D) nm	Dislocation density ($\delta\times10^{15}$) m^{-2}	Strain ($\varepsilon\times10^{-2}$) nm^{-2}
NiMn-LDH	22.6	0.0021	0.42
Ni_6MnO_8	9.9	0.0037	0.76

"Various microstructural parameters are calculated from the XRD data and 2θ values of the diffraction peaks. The average crystallite sizes of the two samples are calculated by using Sherrer's equation as follows:

$$(D)= \frac{0.9⍰\lambda}{\beta cos\theta}$$

where λ denotes the wavelength of Cu Kα line (1.54 Å), β corresponds to full-width at half maximum, and θ is the Bragg's angle.[6] The lattice strain (ε) and dislocation density (δ) are also calculated by using the following equation:[7,8]

$$(\varepsilon) = \frac{\beta cot\ \theta}{4}$$

$$(\delta) = \frac{1}{D^2}$$

The calculated above parameters for NiMn-LDH and Ni_6MnO_8 are summarized in Table S1."

Table S2. Electrochromic properties of the different LDH films.

Film	ΔT (%)	t_c (s)	t_b (s)	CE ($cm^2 \cdot C^{-1}$)	Ref.
ZnO@Ni/Co-LDH	56.0% (550 nm)	0.7	2.7	——	[1]
NiAl-LDH	69.0% (400 nm)	45	45	30	[2]
PEDOT:PSS/LDH	32.0% (650 nm),	0.27	0.18	159	[3]
NiMn-LDH	68.5% (550 nm)	14.2	26.1	56.2	This work

References

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