Supporting information

Morphology-controllable bimetallic MOFs/ textile composite electrodes with high areal capacitance for flexible electronic devices

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2. Experiments

Supercapacitor assembly

The as prepared NiC/NiCo12MOF (1 cm×1 cm) and carbon cloth (1 cm×1 cm) were used as positive and negative electrode, respectively. Nonwoven was used as diaphragm. Potassium hydroxide (KOH) was used as electrolyte. Wet electrodes (immersed into the KOH solution for 1 h) were attached on both sides of the non-woven diaphragm. polyester film was used as packaging material to fabricate the sandwiched NiC/NiCo12MOF based supercapacitor.

Error estimation

In this work, each electrochemical performance test was carried out for three times. The data in the main article are the average values of the three tests.

Theoretical calculation

To understand the molecular models of the NiCoMOFs, plane-wave density functional theory (DFT + U) calculations of the electronic properties of the composite material were carried out using the CASTEP module in Materials Studio (MS). The GGA with a PBE functional was employed for DFT exchange correlation energy calculations, and a cut-off of 380 eV was assigned to the plane-wave basis set. The self-consistent field (SCF) tolerance was 1×10^{-5} eV. The periodic structure was created with a 20 Å vacuum slab to avoid artificial interaction effects between the slab and the mirror images. The Brillouin zone was sampled by a 1× 1× 1 k-point mesh. The core electrons were replaced with ultrasoft pseudopotentials. The bottom two layers were fixed and considered as a bulk structure. The geometrical configurations and charge density difference plots were illustrated using VESTA software.

Equations and the meaning of the letters in the formula

$$Q = \frac{i \cdot \Delta t}{S} \qquad (1)$$

$$E = \frac{I \cdot \int V dt}{S} \qquad (2)$$

$$P = \frac{3600E}{\Delta t} \qquad (3)$$

where Q (C cm^{-2}), i (mA cm^{-2}), Δt (s) are specific capacity, current density and charge time; S (cm^{-2}) are specific capacitance and area of electrode. E (Wh cm $^{-2}$) and P (W cm $^{-2}$) are energy density and power density.

$$i = a \times v^b \qquad (4)$$

$$\log(i) = b\log(v) + \log(a) \qquad (5)$$

$$i(V)/\sqrt{v} = k_1\sqrt{v} + k_2 \qquad (6)$$

Where i (mA) represents loop current; V, v are potential and scan rate; a, b, k_1 and k_2 are constants.

3. Results and discussion

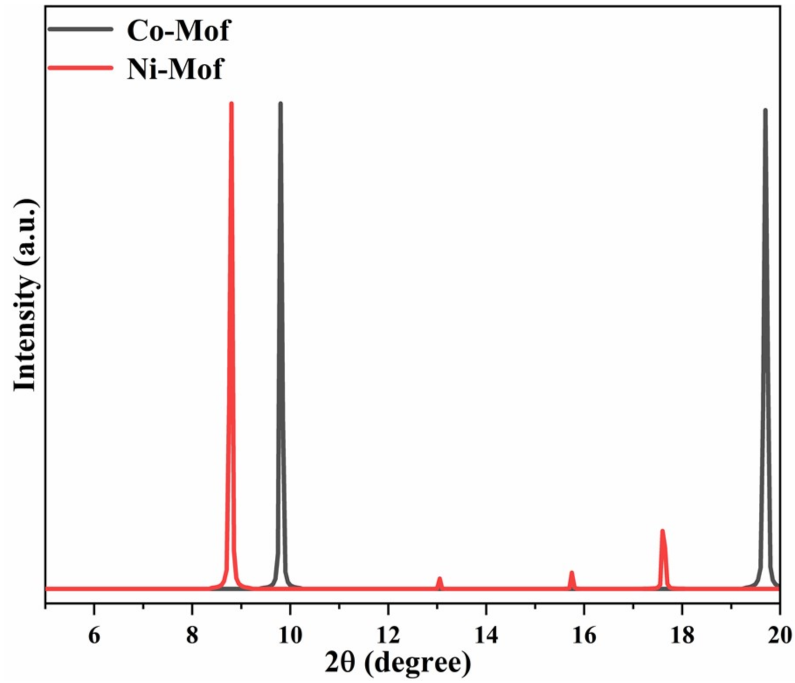

Fig. S1 Calculated XRD results for Co-MOF and Ni-MOFs

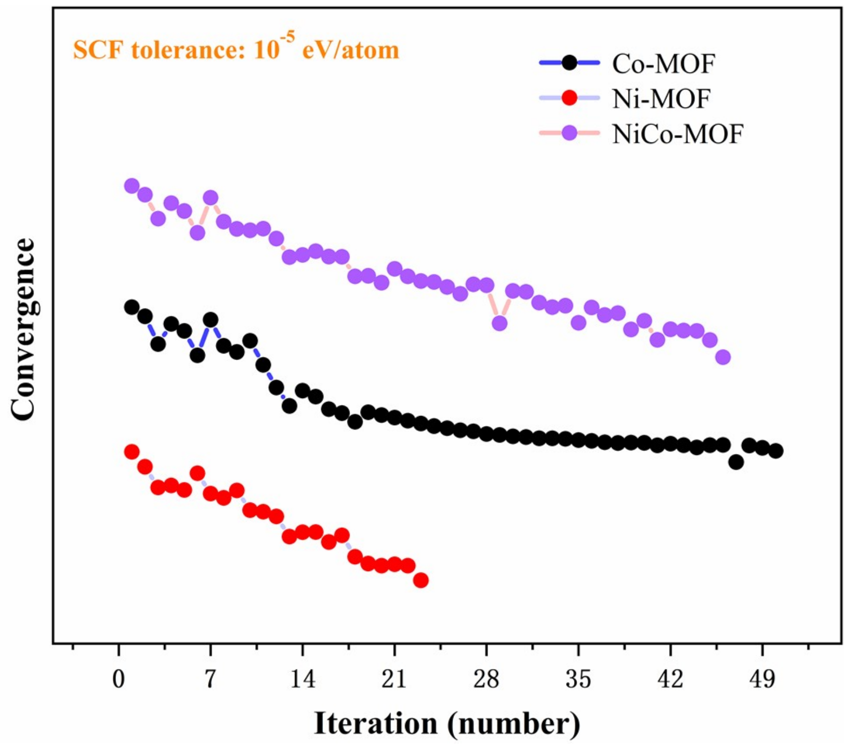

Fig. S2 The self-consistent field of the Ni-MOF, Co-MOF and NiCo-MOF.

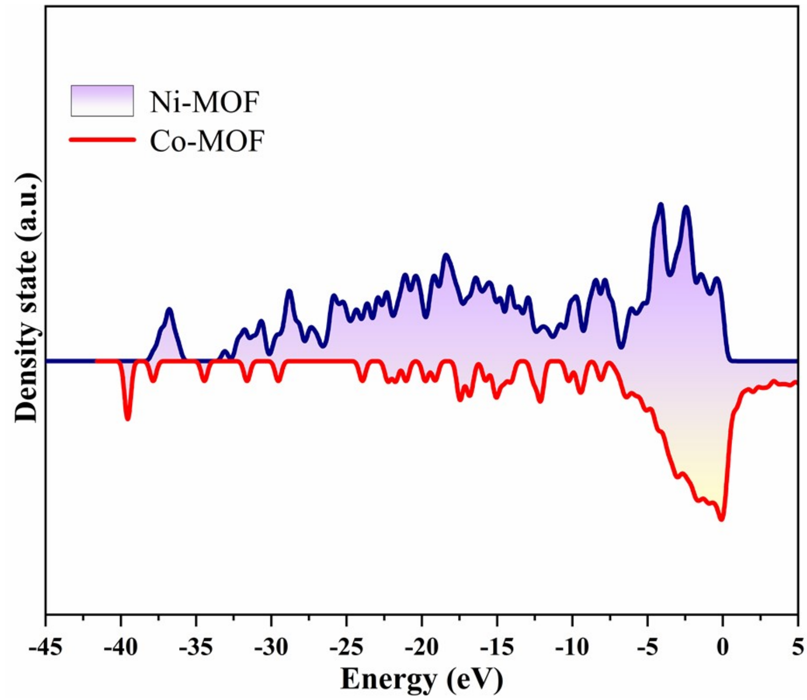

Fig. S3 Total density of state of the Ni-MOF and Co-MOF

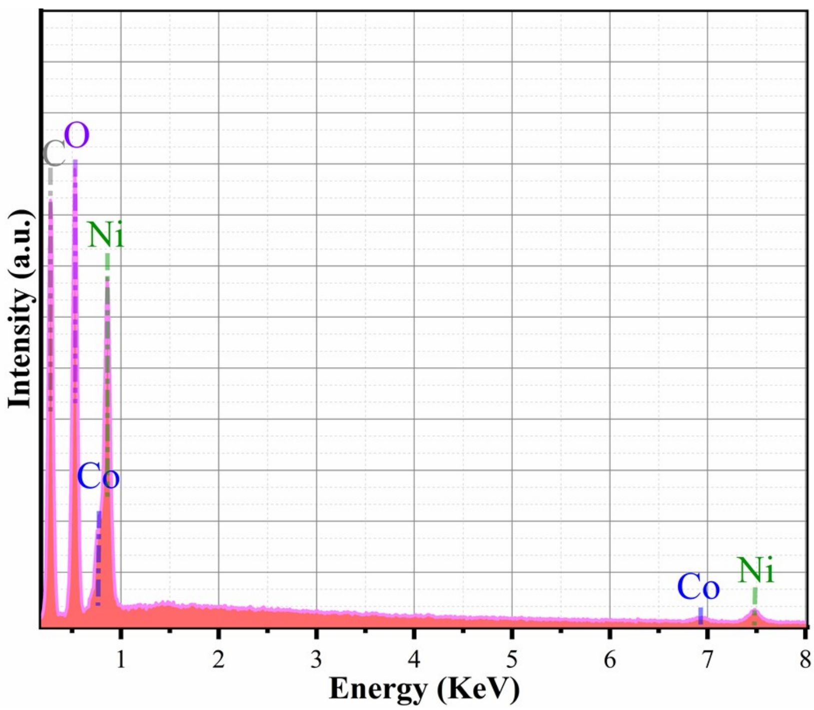

Fig. S4 EDS spectrum of NiC/NiCo21MOF

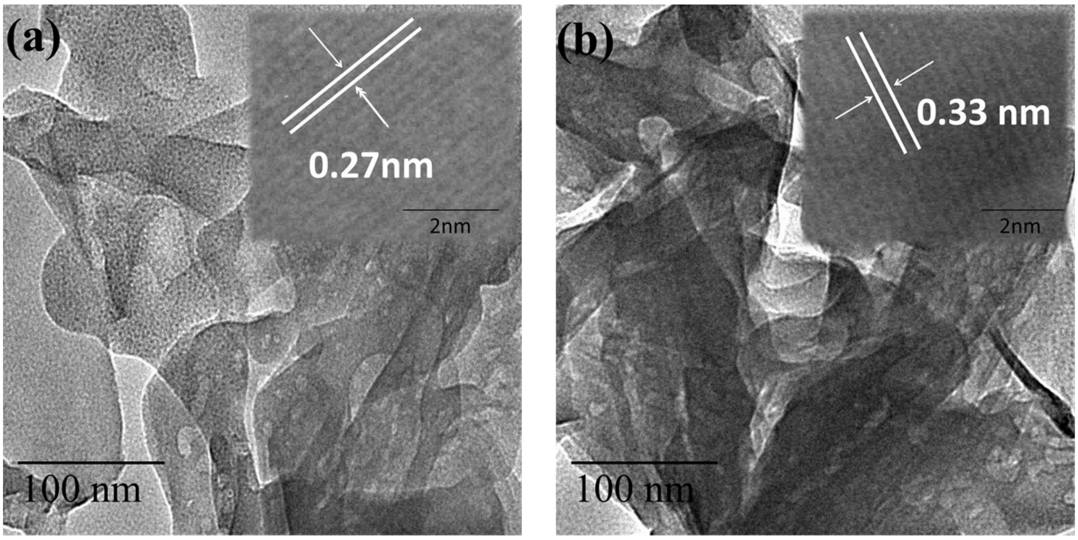

Fig. S5 TEM and HRTEM of NiC/NiCoMOF01 and NiC/NiCoMOF10

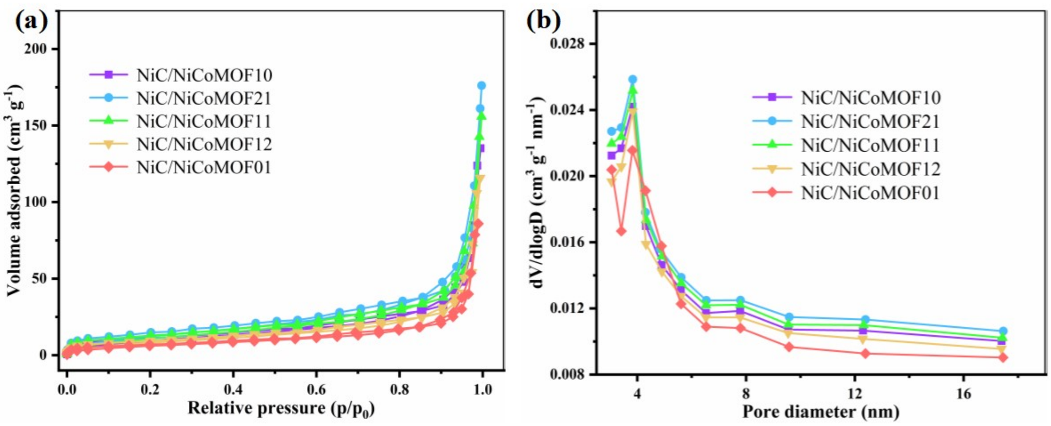

Fig. S6 (a) N2 adsorption–desorption isotherms of the samples; (b) Pore size distribution

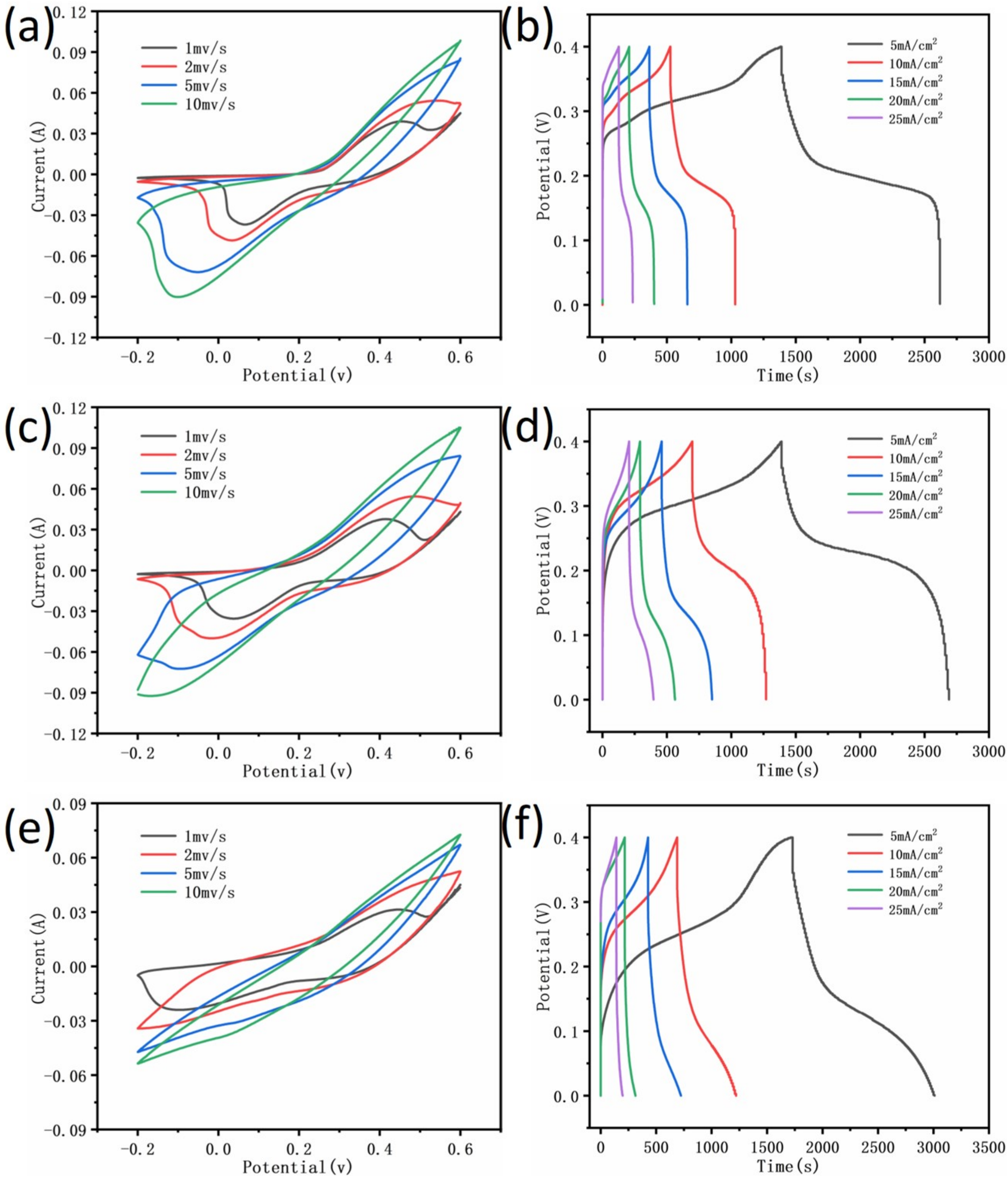

Fig. S7 CV and GCD curves of (a-b) NiC/NiCo10MOF; (c-d) NiC/NiCo11MOF; (e-f) NiC/NiCo12MOF

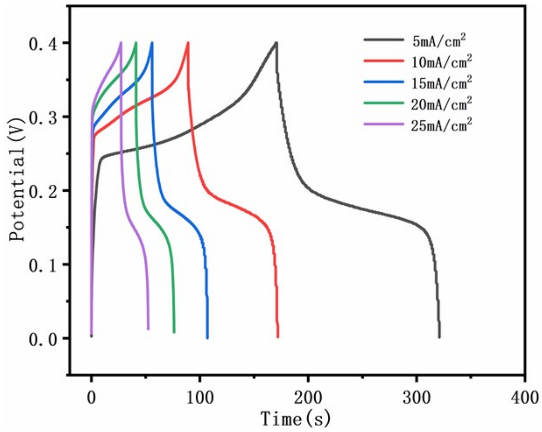

Fig. S8 GCD curves of NiC

Table S1 The comparison of the mass of samples before and after the reactions

samples	The mass of the sample before reaction (NiC)	The area of the samples	The mass of the sample after reaction (NiC/NiCo-MOF)	The mass loading of the samples(NiCo-MOF on NiC)
NiC/NiCoMOF10	244 mg	3 cm × 3 cm	261 mg	1.9 mg cm^{-2}
NiC/NiCoMOF11	236 mg	3 cm × 3 cm	254 mg	2.0 mg cm^{-2}
NiC/NiCoMOF12	239 mg	3 cm × 3 cm	259 mg	2.2 mg cm^{-2}
NiC/NiCoMOF21	242 mg	3 cm × 3 cm	261 mg	2.1 mg cm^{-2}
NiC/NiCoMOF01	232 mg	3 cm × 3 cm	248 mg	1.8 mg cm^{-2}

Table S2 The sheet resistance of the samples

samples	Sheet resistance (Ω/□)
Cotton	Insulation
Cotton/Ni	3.2
NiC/NiCoMOF10	27.5
NiC/NiCoMOF11	25.6
NiC/NiCoMOF12	25.3
NiC/NiCoMOF21	26.1
NiC/NiCoMOF01	25.1