Supplementary Information (SI) for Sustainable Energy & Fuels.

Supporting Information

Flexible laser-induced graphene-based electrodes modified with cobalt-manganese hexacyanoferrate as cathode materials for asymmetric supercapacitors

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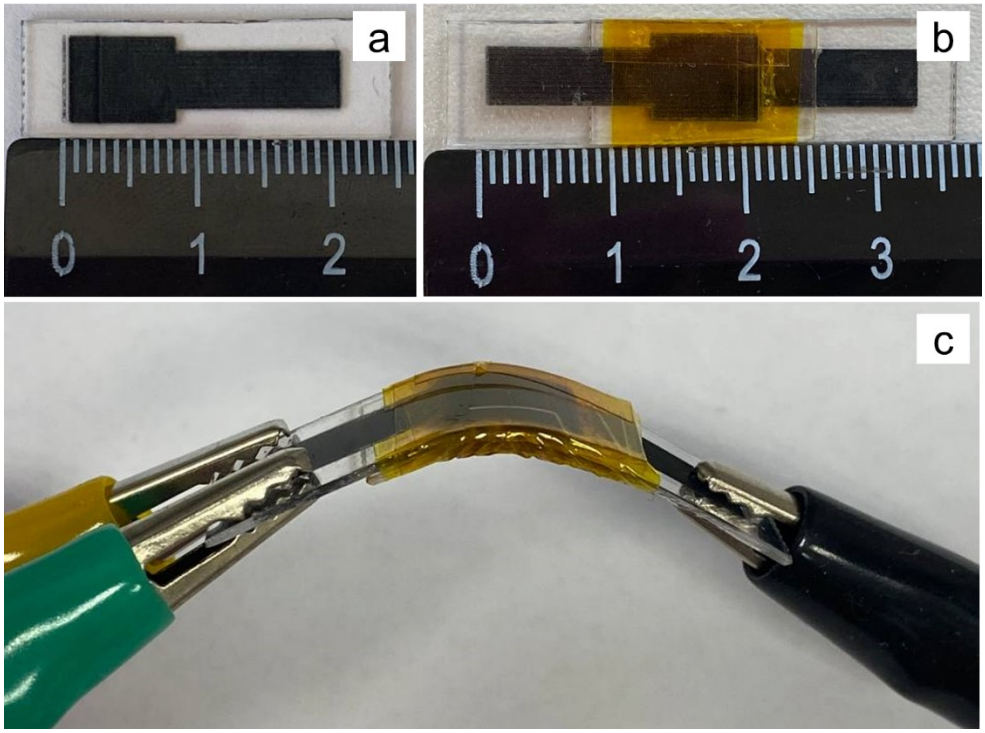

Fig. S1. (a) Photo of the LIMPc electrode, (b) FACS and (c) bending resistance of FASC.

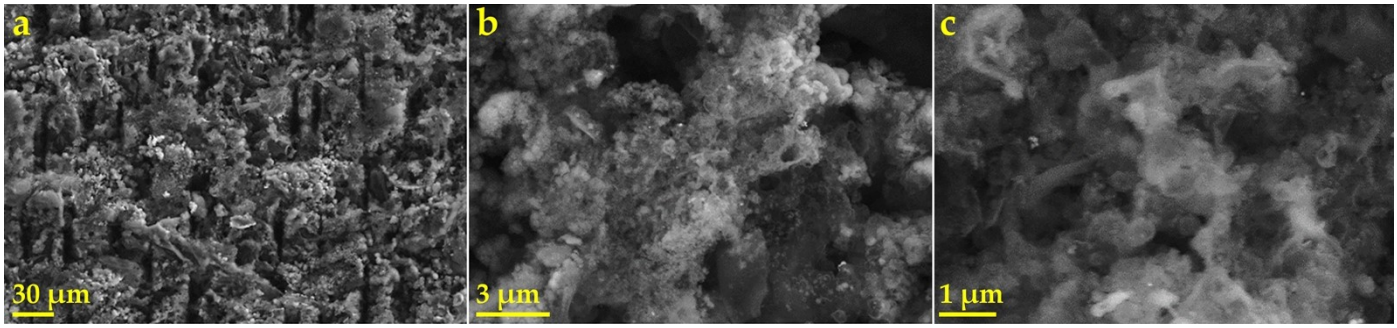

Fig. S2. SEM images of LIMPc electrode at various magnifications.

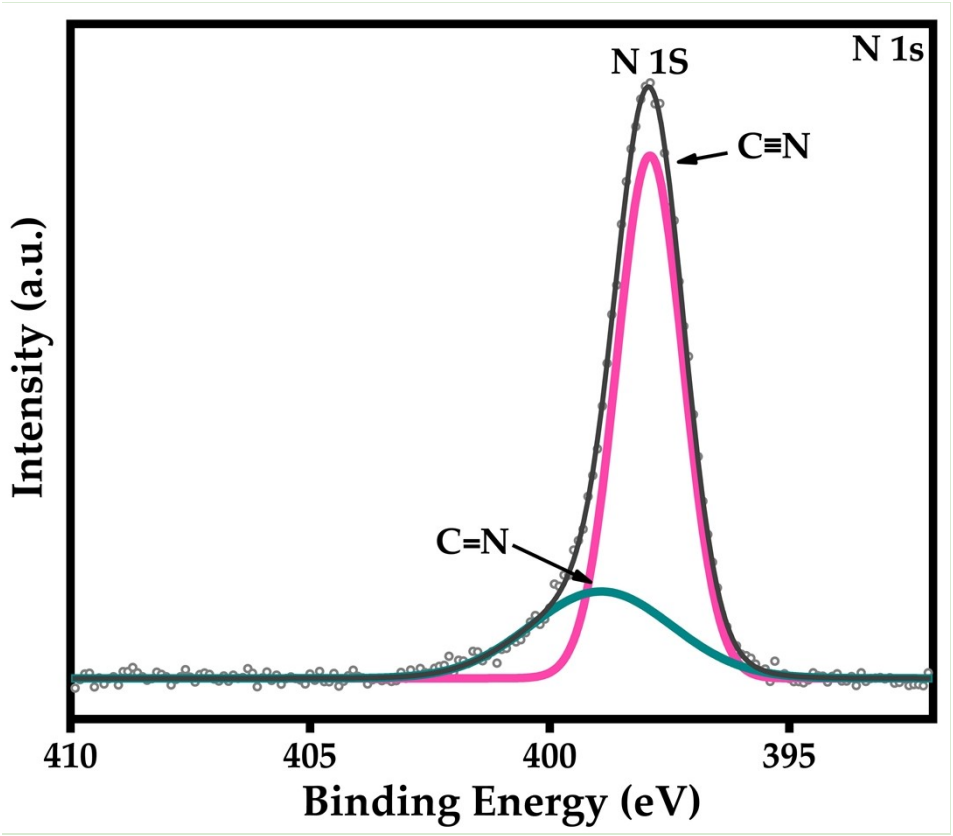

Fig. S3. X-ray photoelectron spectra of the N 1s.

the reaction for the $Fe^{3+}|Fe^{2+}$ couple (eq. 1)

$K_z{\cdot}Co_x^{3+}Mn_y^{3+}[\mathbf{Fe^{III}}(CN)_6]_2 + zNa^+ + ze^- = K_z{\cdot}Na_zCo_x^{3+}Mn_y^{3+}[\mathbf{Fe^{II}}(CN)_6]_2$ (1)

the reaction for the $Co^{3+}|Co^{2+}$ couple (eq. 2)

$K_z{\cdot}\mathbf{Co_x^{3+}}Mn_y^{2+}[Fe^{II}(CN)_6]_2 + zNa^+ + ze^- = K_z{\cdot}Na_z\mathbf{Co_x^{2+}}Mn_y^{2+}[Fe^{II}(CN)_6]_2$ (2)

the reaction for the $Mn^{3+}|Mn^{2+}$ couple (eq. 3)

$K_z{\cdot}Co_x^{2+}\mathbf{Mn_y^{3+}}[Fe^{II}(CN)_6]_2 + zNa^+ + ze^- = K_z{\cdot}Na_zCo_x^{2+}\mathbf{Mn_y^{2+}}[Fe^{II}(CN)_6]_2$ (3)

$z` + x + y = 3$

For the purpose of clarity and simplification, the hydration water and counter anions have been omitted.

Scheme S1. The possible chemical equations for redox processes in CoMnHCF.

Table S1. Impedance parameters obtained by data fitting with the electrical equivalent circuit and calculation.

	LIMPc	CoHCF	MnHCF	CoMnHCF	CoMHCF after 10000 cycles
R_S	8.1	7.5	8.6	7.4	8.75
R_{CT}	6.7	2.2	5.4	1.7	22.25

Table S2. Characteristics of cathode materials and ASCs

Cathode material	Areal capacitance (mF/cm²)		Electrolyte	Retention	Method synthesis	Ref.
	Cathode	ASC				
WO_3/WS_2	55.3 at 5 mV/s	32.5 at 5 mV/s 31 at 1 mA/cm²	0.1 M Na_2SO_4	100% after 10 000 cycles	electrochemical deposition and chemical vapor deposition	[89]
rGO/MnO_2	274 at 2 mV/s	152 at 2 mV/s	0.5 M Na_2SO_4	-	hydrothermal method	[9]
CuO/MnO_2	261.4 at 1 mA/cm²	152.7 at 1 mA/cm²	1 M Na_2SO_4	90% after 1000 cycles	electrodeposition method and SILAR	[90]
$CC/MoO_2/Au/MnO_2$	112 at 5 mV/s	-	1 M Na_2SO_4	95% after 3000 cycles	electrodeposition method	[91]
Ag/V_3O_7	274.5 F/g at 0.3 A/g	322.5 at 0.5 mA/cm²	1 M Na_2SO_4	90.8% after 5000 cycles	screen printing, template–solvothermal route	[92]
CoMnHCF_90/LIMP	224.5 at 0.5 mA/cm²	142.3 at 0.25 mA/cm²	1 M Na_2SO_4	93% after 1000 cycles	laser-assisted integration and SILAR	This article

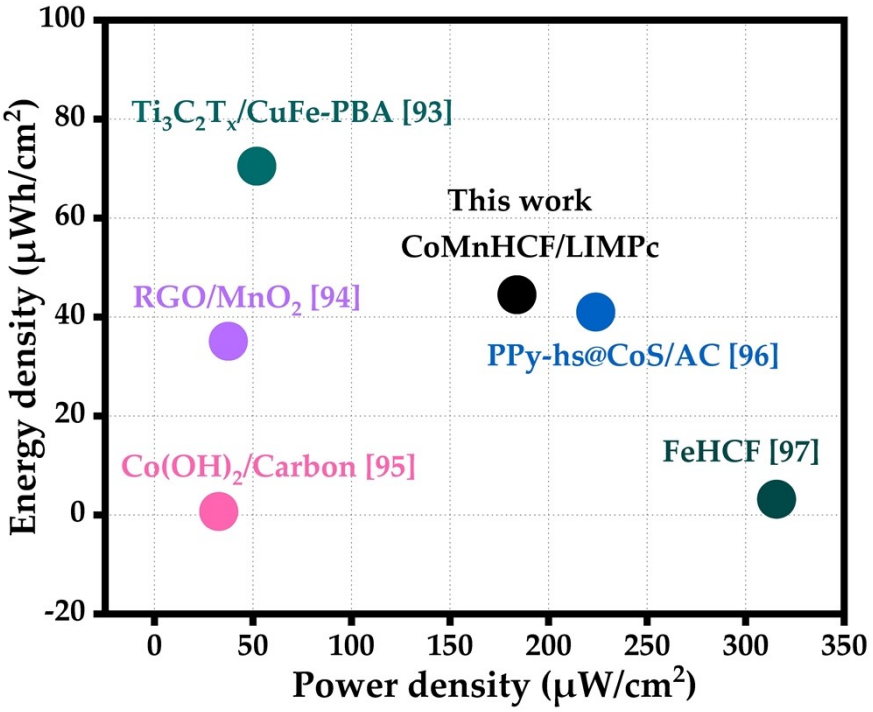

Fig. S4. Ragone plot of the CoMnHCF/LIMPc FASC compared with the reported supercapacitors

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