Supplementary Information
Low Dimensional High Entropy Oxide $(FeCoCrMnNi)_3O_4$ for Supercapacitor Application

Yi Yin [a], Wei-Bin Zhang[*] [a], Xian-Li Zhang [a], Myat Myintzu Theint [a, b], Jing-Lei Yang [a], Ze-Qin Yang [a], Jia-Jun Li [a], Shan Liang [a], Xue-Jing Ma [a]

[a] College of Materials and Chemistry & Chemical Engineering, Chengdu University of Technology, Chengdu 610059, China

[b] Mineral Development Section for International Relation, Department of Mines and Ministry of Natural Resources and Environmental, Nay Pyi Taw 15011, Myanmar

[*] Corresponding Author. E-mail: zhangweibin17@cdut.edu.cn

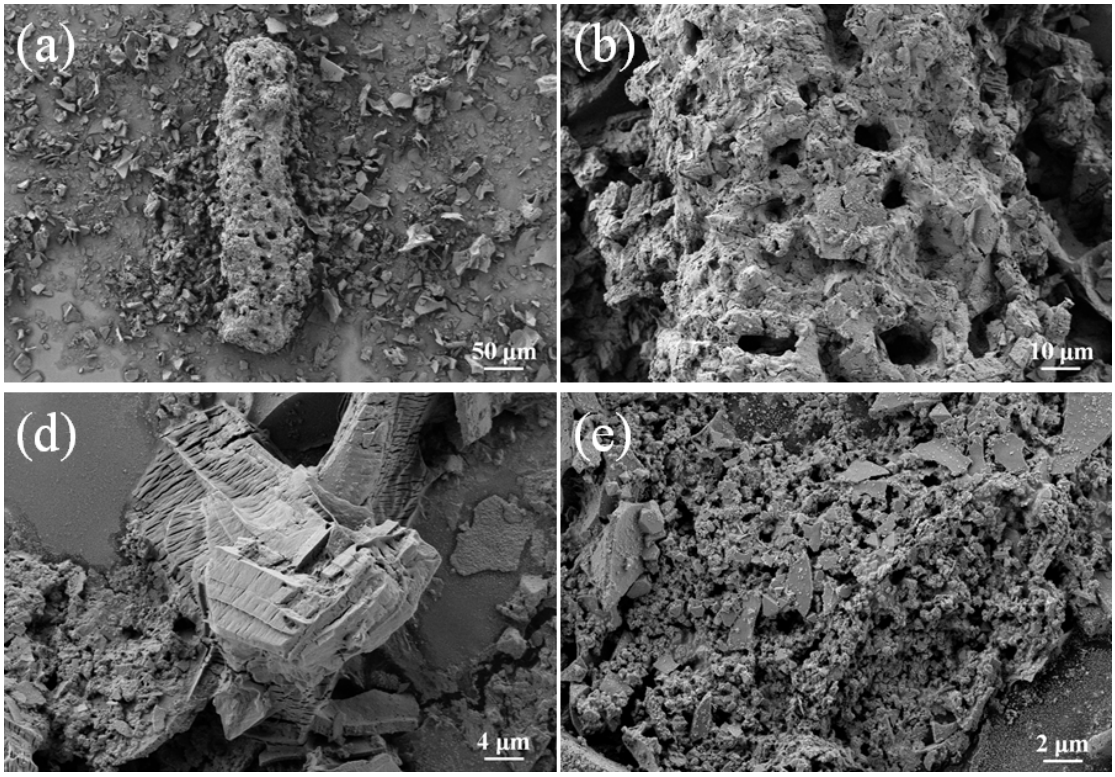

Fig. S1. The SEM images of other parts of the HEO-2. (a) and (d) SEM images at low magnification; (b) and (e) SEM images at high magnification.

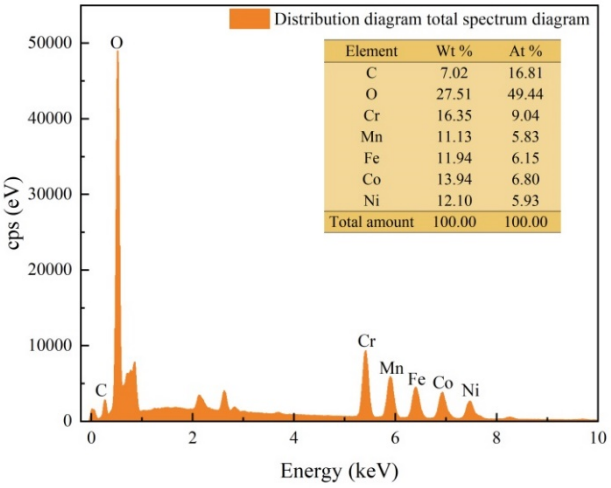

Fig. S2. The total spectrum of the distribution map of the HEO-2.

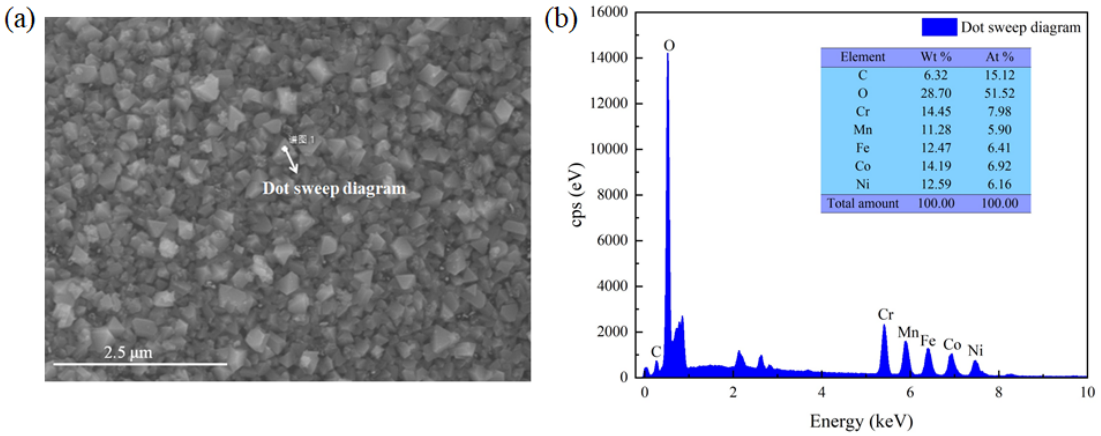

Fig. S3. The selected point on the HEO-2 which was scanned (a) The selected point on HEO-2. (b) Dot sweep diagram.

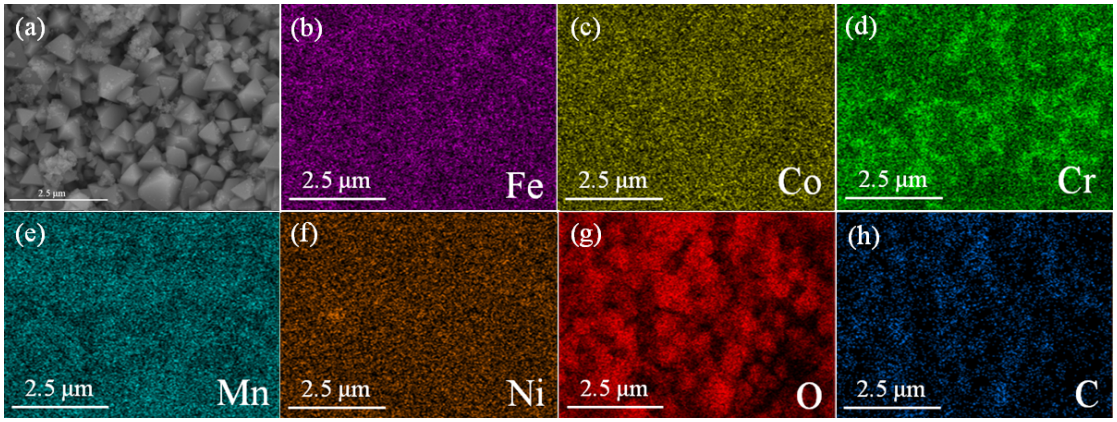

Fig. S4. Micromorphology of HEO-4 calcined at 600 °C. (a) HAADF image of selected area; (b-h) EDS mapping of element Fe, Co, Cr, Mn, Ni, O, C.

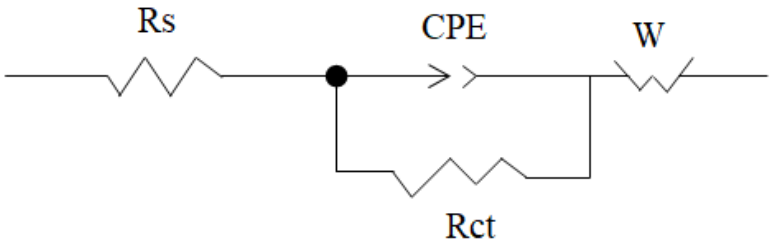

Fig. S5. Equivalent circuit fitting diagram.

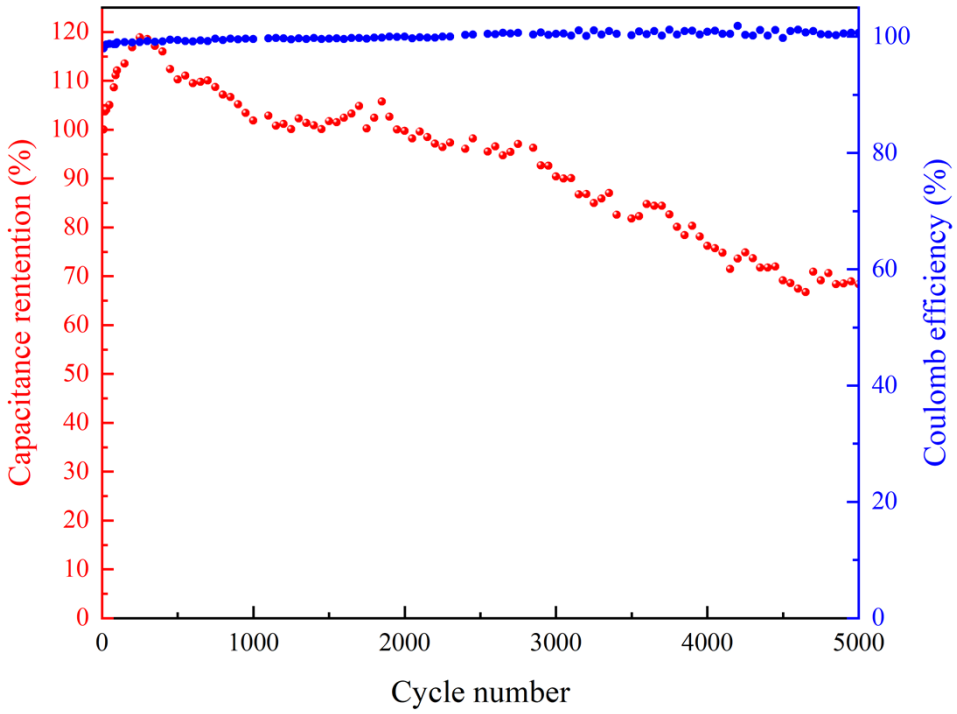

Fig. S6. Cycling stability and coulomb efficiency of HEO-2 after 5,000 cycles.

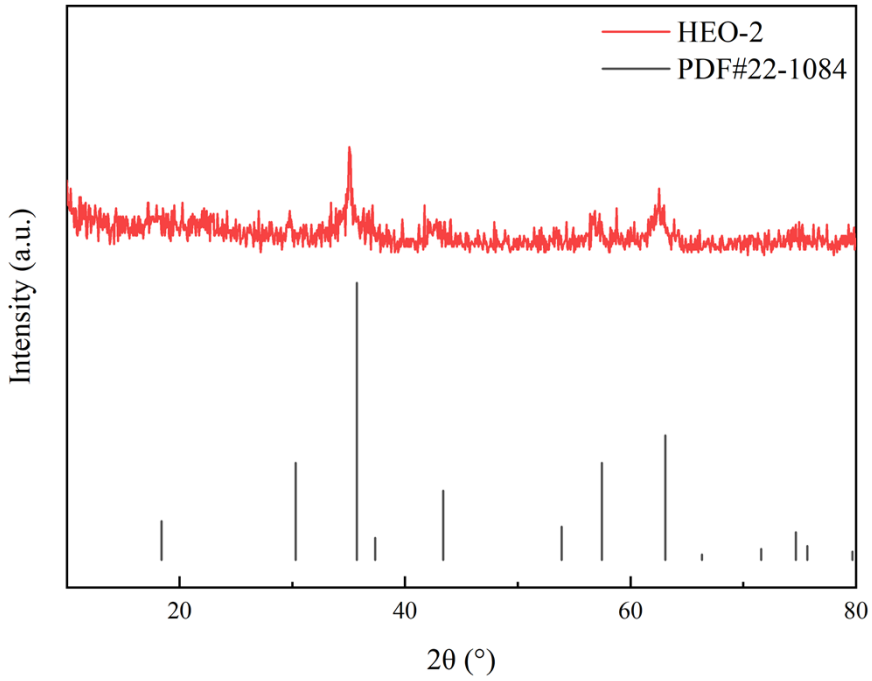

Fig. S7. XRD patterns of HEO-2 after 5,000 cycles.

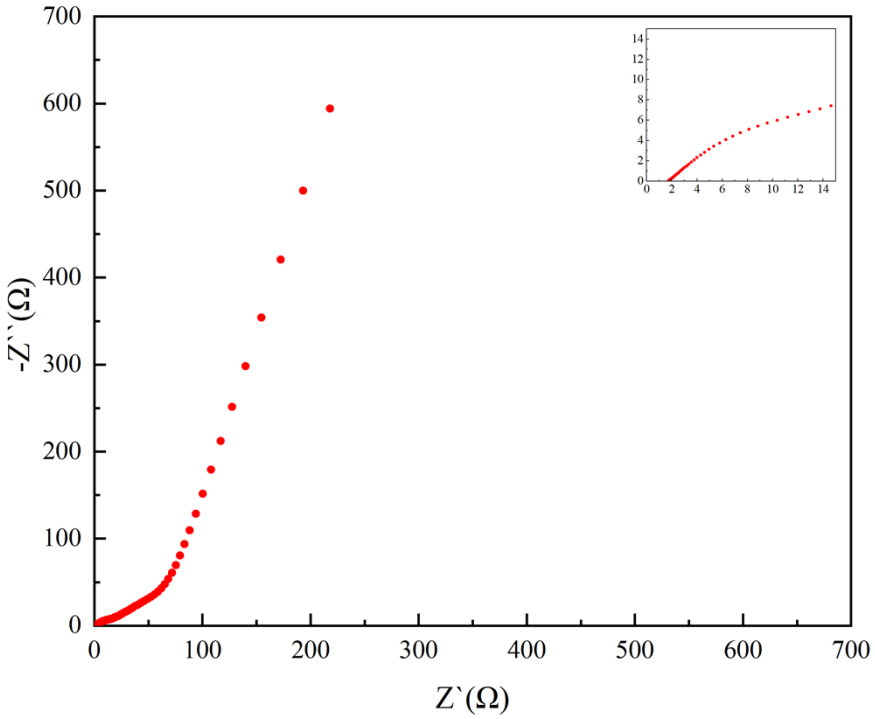

Fig. S8. Nyquist plot of HEO-2 after 5,000 cycles.

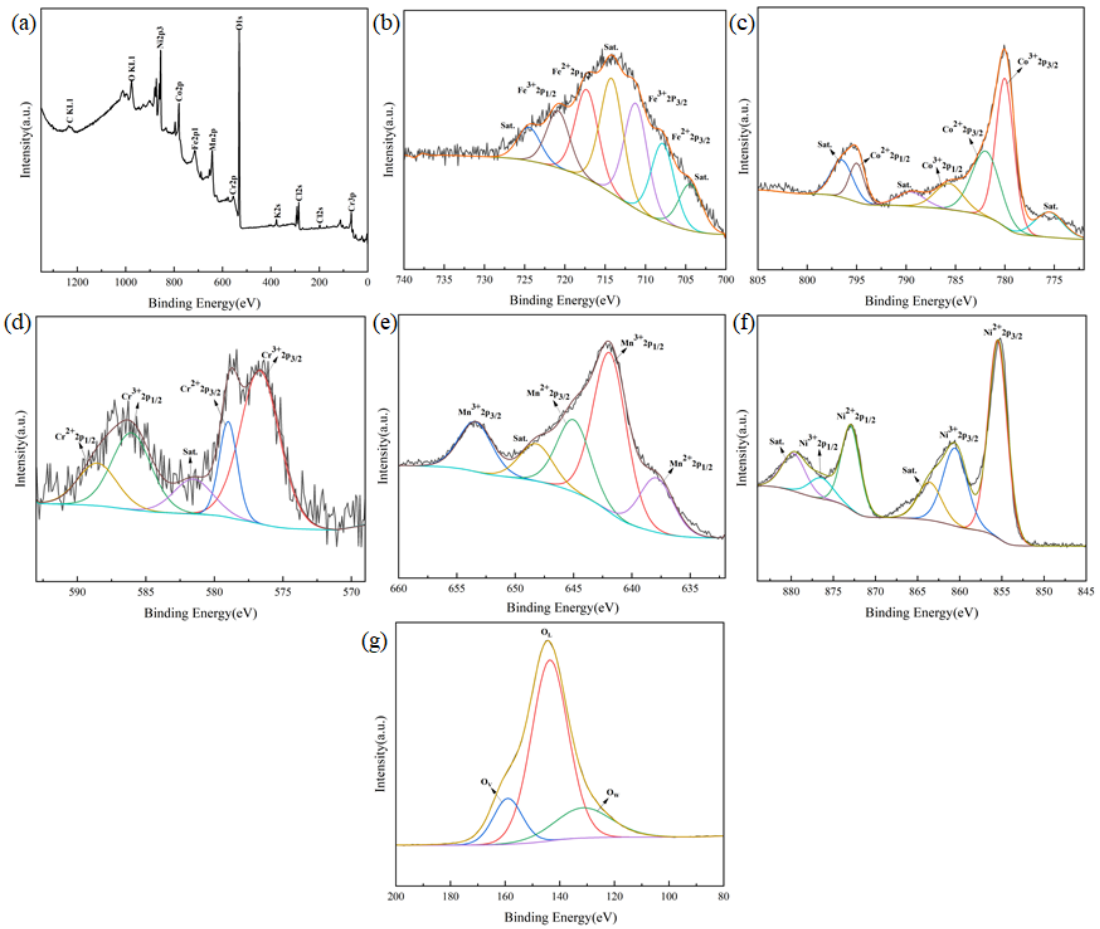

Fig. S9. XPS spectra of HEO-2 after 5,000 cycles. (a) Full spectrum; (b) Fe 2p; (c) Co 2p; (d) Cr 2p; (e) Mn 2p; (f) Ni 2p; (g) O 1s.

Tab. S1. EIS data after equivalent circuit fitting.

Samples	R_s (Ω)	R_{ct} (Ω)	*CPE-P*	*W* (Ω)
HEO-1	1.736	1.815	0.69225	0.53972
HEO-2	1.77	11.8	0.59535	0.29583
HEO-3	0.27427	5.16	0.97168	0.52345
HEO-4	1.766	1.133	0.5483	0.6925

Tab. S2. EIS data after equivalent circuit fitting of HEO-2 after 5,000 cycles.

Samples	R_s (Ω)	R_{ct} (Ω)	*CPE-P*	*W* (Ω)
HEO-2	1.8	14.39	0.66122	0.41444

Tab. S3. Energy density comparison of various high entropy ceramic materials.

Materials	Electrolyte	Window of potential	Capacitance	Energy density	References
(CrMoVZrNb)N	1 M KOH	(-1, 0)	78 F g^{-1} at 100 mV s^{-1}	10.8 W h kg^{-1}	[14]
$(CoCrFeMnNi)_3O_4$	2 M KOH	(0, 0.45)	239 F g^{-1} at 0.5 A g^{-1}	6.7 W h kg^{-1}	[15]
$(FeCoCrMnMg)_3O_4$	1 M KOH	(0.2, 0.55)	193.7 F g^{-1} at 1 A g^{-1}	3.3 W h kg^{-1}	[16]
$La(Co_{0.2}Cr_{0.2}Fe_{0.2}Mn_{0.2}Ni_{0.2})O_3$	1 M KOH	(0, 0.5)	154.8 F g^{-1} at 1 A g^{-1}	5.4 W h kg^{-1}	[17]
$(FeCoCrMnZn)_3O_4$	1 M KOH	(0, 0.5)	340.3 F g^{-1} at 1 A g^{-1}	11.8 W h kg^{-1}	[18]
$(FeCoCrMnNi)_3O_4$	1 M KOH	(-1, 0.6)	332.2 F g^{-1} at 0.3 A g^{-1}	103.8 W h kg^{-1}	This work