

Supporting Information

Enhanced electrochemical performance of ammonium phosphomolybdate for symmetric and asymmetric supercapacitor in 2M H₂SO₄/0.025M KI redox additive electrolyte

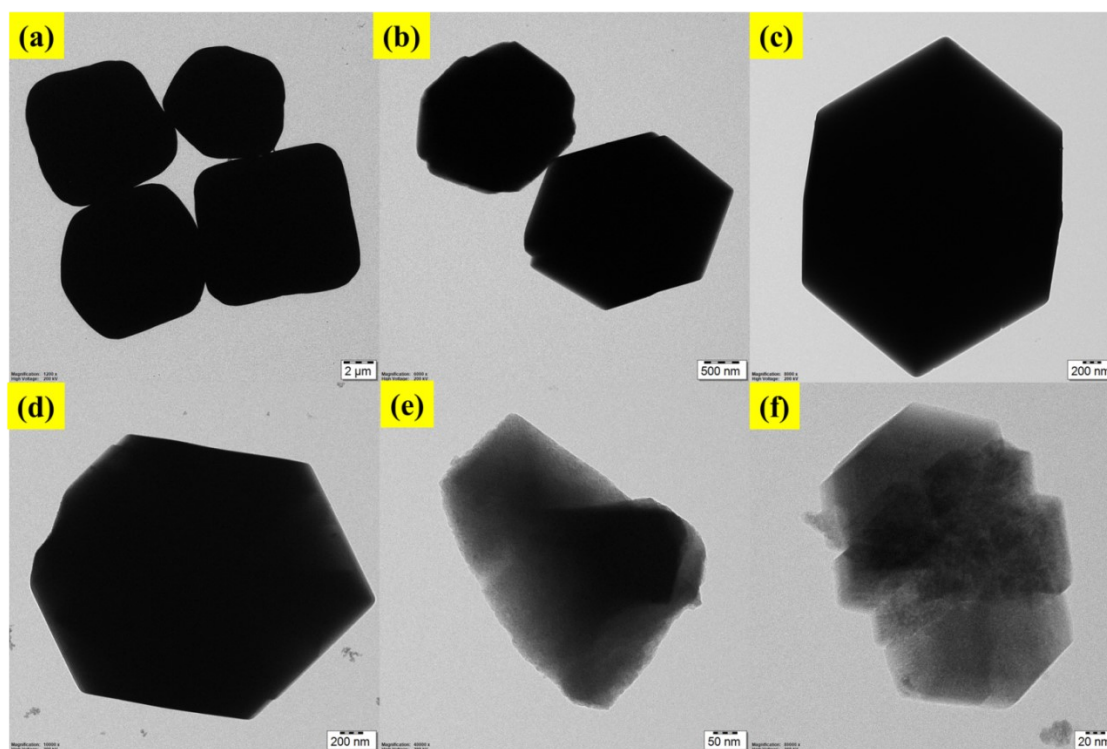


Figure (S1) TEM images of CA-APOMO other magnification, (a) 2 μm , (b) 500 nm, (c,d) 200 nm, (e) 50 nm, and (f) 20 nm

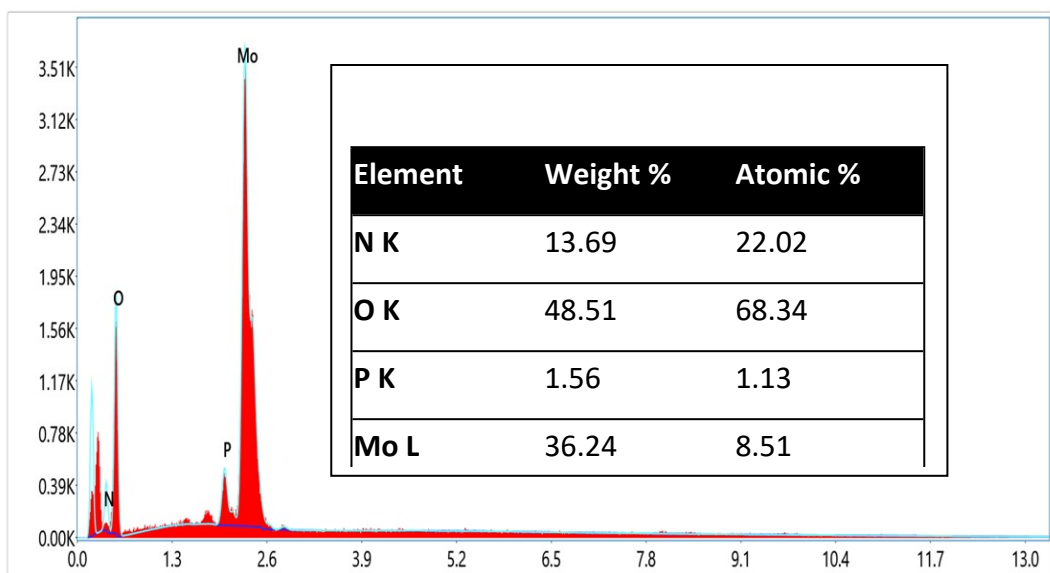


Figure (S2) EDAX analysis of CA-APOMO

Table (T1) Peak separation potential, charge concentration, and surface coverage area values of APOMO, OA-APOMO, and CA-APOMO

Electrode material	Peak separation potential (mV)		Charge concentration (C)	Surface coverage area ($10^{-8} \text{ mol cm}^{-2}$)
APOMO	C1/A1	75	0.009	2.464
	C2/A2	112		
	C3/A3	126		
OA-APOMO	C1/A1	82	0.011	3.044
	C2/A2	128		
	C3/A3	136		
CA-APOMO	C1/A1	100	0.013	3.601
	C2/A2	141		

	C3/A3	143		
--	-------	-----	--	--

Table (T2) Specific capacity of APOMO, OA-APOMO, and CA-APOMO in 2M H₂SO₄ electrolyte

Electrode	Specific capacity (mAh g ⁻¹) @ 3 Ag ⁻¹
APOMO	260
OA-APOMO	388
CA-APOMO	399

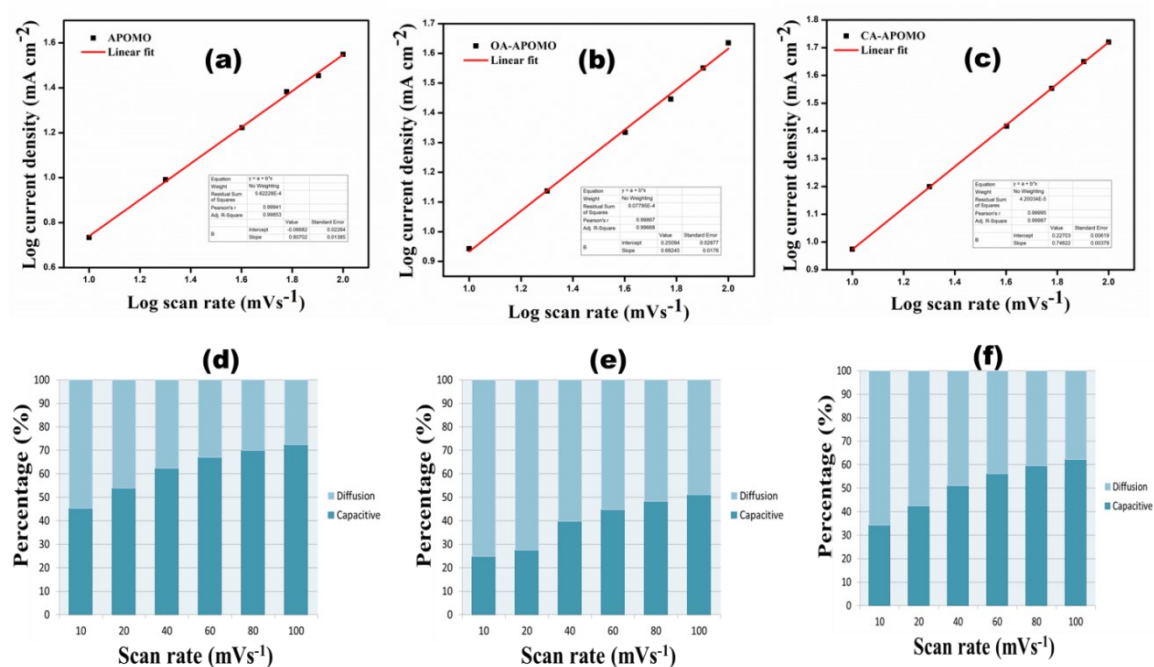


Figure (S3) The plot of log scan rate vs. log current density to calculate b value of (a) APOMO, (b) OA-APOMO, and (c) CA-APOMO in 2M H₂SO₄ electrolyte, and percentage of capacitive and diffusion controlled contribution for (d) APOMO, (e) OA-APOMO, and (f) CA-APOMO

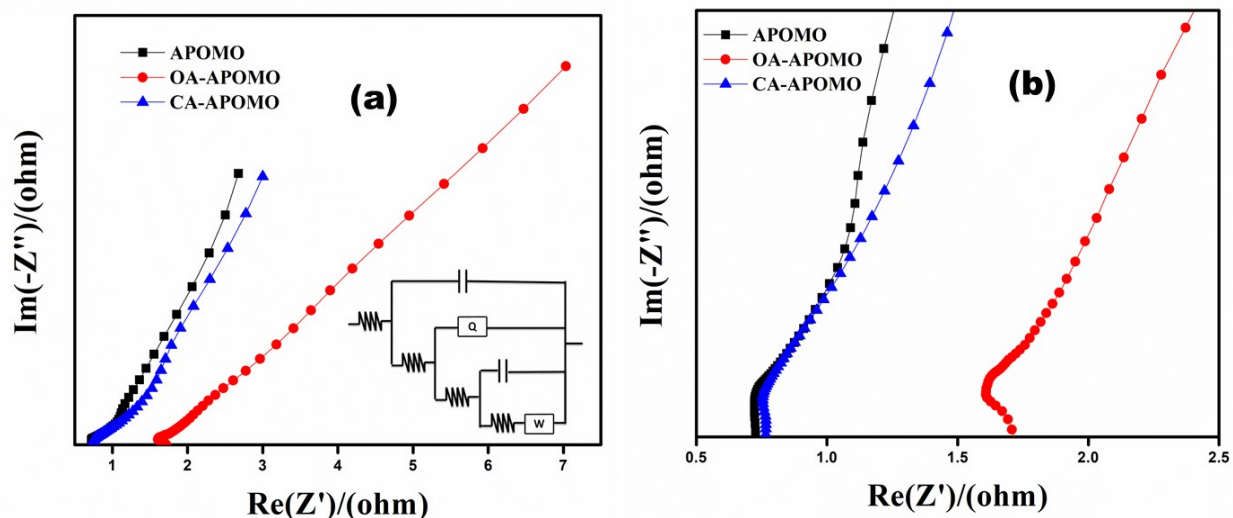


Figure (S4) Nyquist plot of APOMO, OA-APOMO, and CA-APOMO in 2M H₂SO₄ electrolyte (a) Full scale Nyquist plot, and (b) magnification Nyquist plot in higher frequency

Table (T3) Solution resistance and charge transfer resistance of APOMO, OA-APOMO, and CA-APOMO in 2M H₂SO₄ electrolyte

Electrode	2M H ₂ SO ₄ electrolyte	
	R_s (Ω)	R_{ct} (Ω)
APOMO	0.82	22.10
OA-APOMO	1.62	0.37
CA-APOMO	0.82	0.07

Table (T4) Specific capacity of APOMO, OA-APOMO, and CA-APOMO in 0.025 M KI + 2M H₂SO₄ electrolyte

Electrode	Specific capacity (mAh g ⁻¹) @ 3 Ag ⁻¹
APOMO	443

OA-APOMO	475
CA-APOMO	500

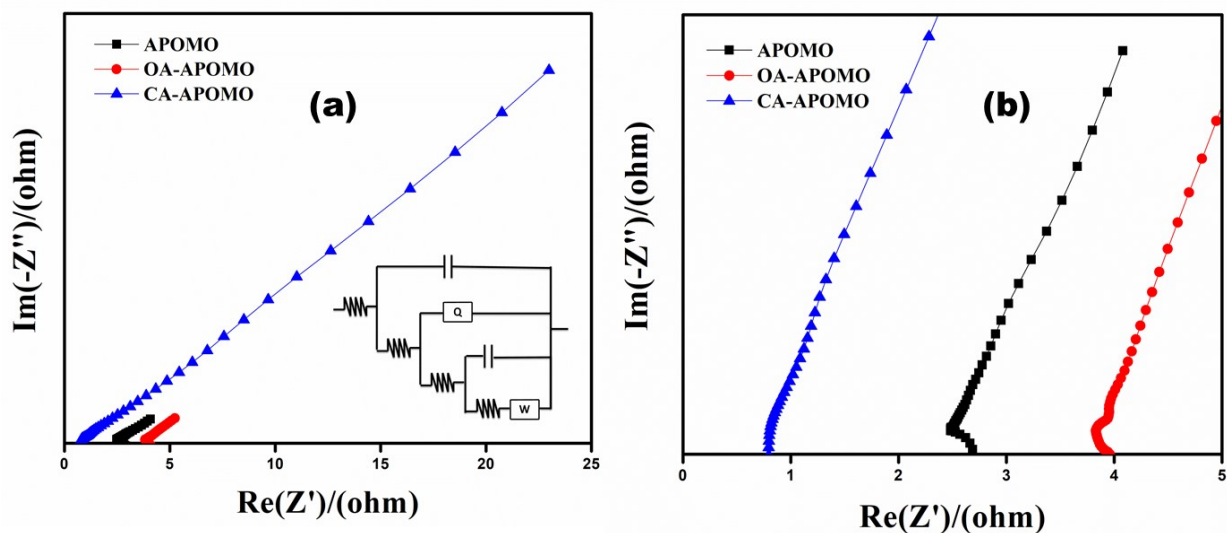


Figure (S5) Nyquist plot of APOMO, OA-APOMO, and CA-APOMO in 2M H₂SO₄ + 0.025M KI electrolyte (a) Full scale Nyquist plot, and (b) magnification Nyquist plot in higher frequency

Table (T5) Solution resistance and charge transfer resistance of APOMO, OA-APOMO, and CA-APOMO in 2M H₂SO₄+ 0.025M KI electrolyte

Electrode	2 M H ₂ SO ₄ + 0.025 M KI electrolyte	
	R _s (Ω)	R _{ct} (Ω)
APOMO	3.92	0.47
OA-APOMO	2.58	0.74
CA-APOMO	0.89	0.02

Table (T6) Specific capacity, energy density, and power density of symmetric device in 2M H₂SO₄ electrolyte

Current density (Ag ⁻¹)	Specific capacity (mAh g ⁻¹)			Energy density (Wh Kg ⁻¹)			Power density (W Kg ⁻¹)		
	APOM O//APO MO	OA- APOM O//OA- APOM O	CA- APOM O//CA- APOM O	APOM O//APO MO	OA- APOM O//OA- APOM O	CA- APOM O//CA- APOM O	APOM O//APO MO	OA- APOM O//OA- APOM O	CA- APOM O//CA- APOM O
1	90.83	95.27	113.11	34.41	36.55	43.82	378.82	383.61	385.70
2	68.88	69.77	78.88	24.72	24.76	34.77	717.67	730.62	731.66
3	65.83	60.66	74.00	22.97	21.43	26.56	1046.73	1216.0 5	1062.40
4	50.00	47.77	58.88	17.21	16.50	20.86	1376.80	1381.3 9	1564.50
5	40.00	43.05	47.25	16.72	15.17	16.58	1672.00	1761.6 7	1755.50

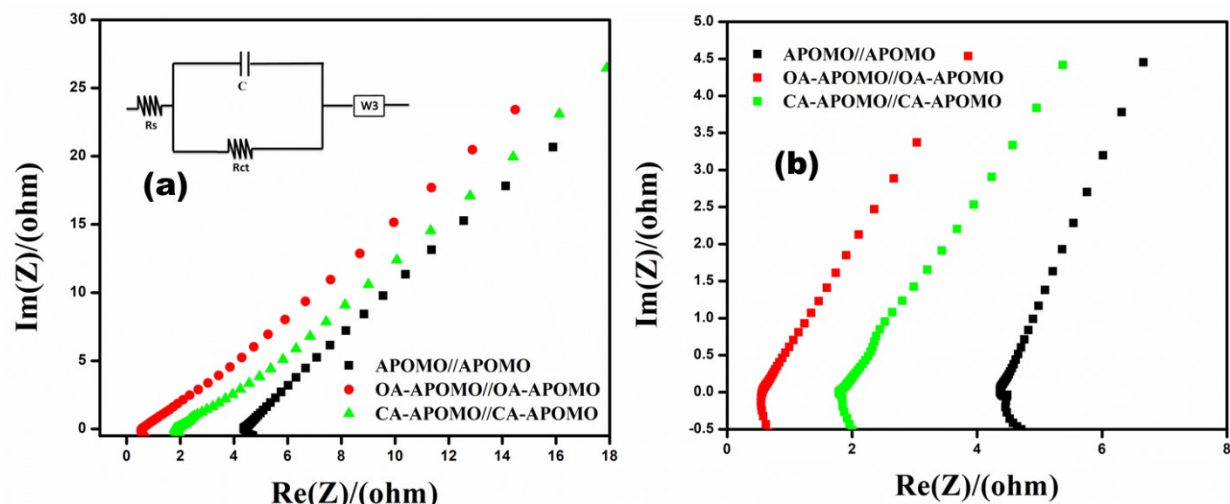


Figure (S6) Nyquist plot of APOMO//APOMO, OA-APOMO//OA-APOMO, and CA-APOMO//CA-APOMO (a) Full scale Nyquist plot, and (b) magnification Nyquist plot in higher frequency

Table (T7) Specific capacity, energy and power density of symmetry device in 2 M H_2SO_4 + 0.025 M KI electrolyte

Current density (Ag^{-1}) 1)	Specific capacity (mAh g^{-1})	Energy density (Wh Kg^{-1})	Power density (W Kg^{-1})
1	167.77	55.78	332.46
2	115.55	40.22	696.11
3	89.16	33.66	1132.48
4	82.22	29.77	1448.27
5	73.61	20.27	1621.60

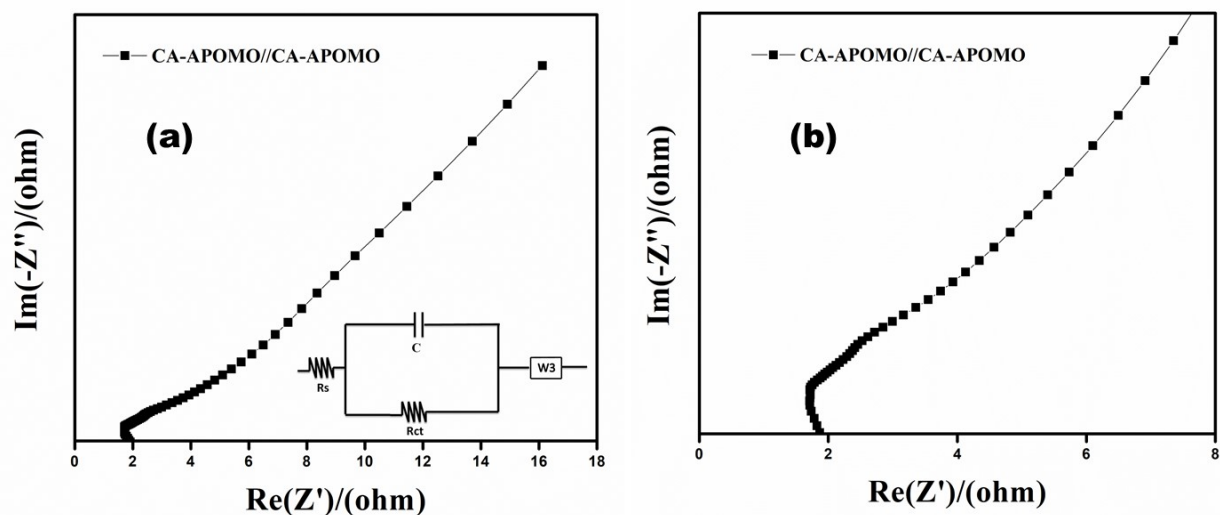


Figure (S7) Nyquist plot of CA-APOMO//CA-APOMO in 2M H₂SO₄+0.025M KI electrolyte (a) Full scale Nyquist plot, and (b) magnification Nyquist plot in higher frequency

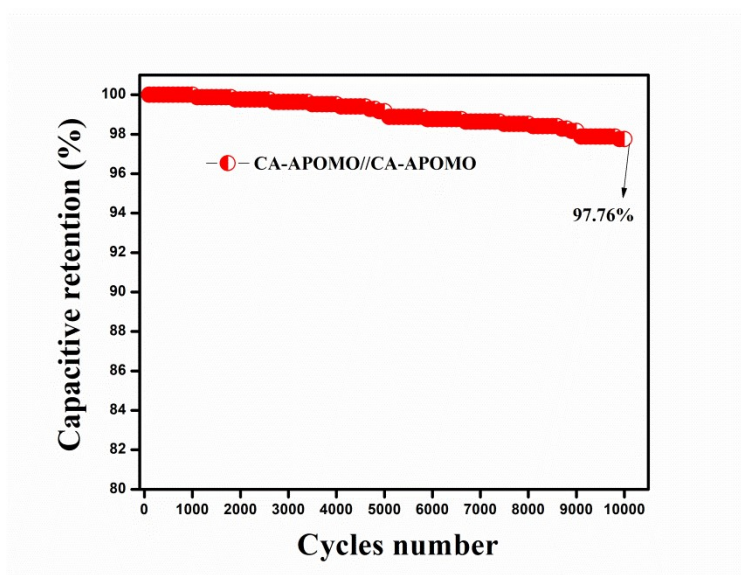


Figure (S8) Cycle stability of CA-APOMO//CA-APOMO in 2M H₂SO₄+0.025M KI electrolyte

Table (T8) Specific capacity, energy and power density of Asymmetric device in 2M H₂SO₄ electrolyte

Current	Specific capacity (mAh g ⁻¹)	Energy density (Wh Kg ⁻¹)	Power density (W Kg ⁻¹)

density (Ag⁻¹)	APOM O//MW CNT	OA- APOM O//MW CNT	CA- APOM O//MW CNT	APOM O//MW CNT	OA- APOM O// MWCN T	CA- APOM O// MWCN T	APOM O// MWCN T	OA- APOM O// MWCN T	CA- APOM O// MWCN T
3	61.66	73.33	84.16	41.70	48.55	59.65	2028.64	1986.1 3	2126.13
5	52.77	59.72	70.83	35.30	38.39	49.41	3344.21	3214.0 4	3487.76
10	41.66	41.66	52.77	25.75	26.87	35.94	6180.00	6448.8 0	6809.68
20	27.77	33.33	38.88	17.74	18.06	24.52	12772.8 0	10836. 00	12610.2 8
30	16.66	25.00	25.00	13.53	13.91	18.64	24354.0 0	16692. 00	22368.0 0

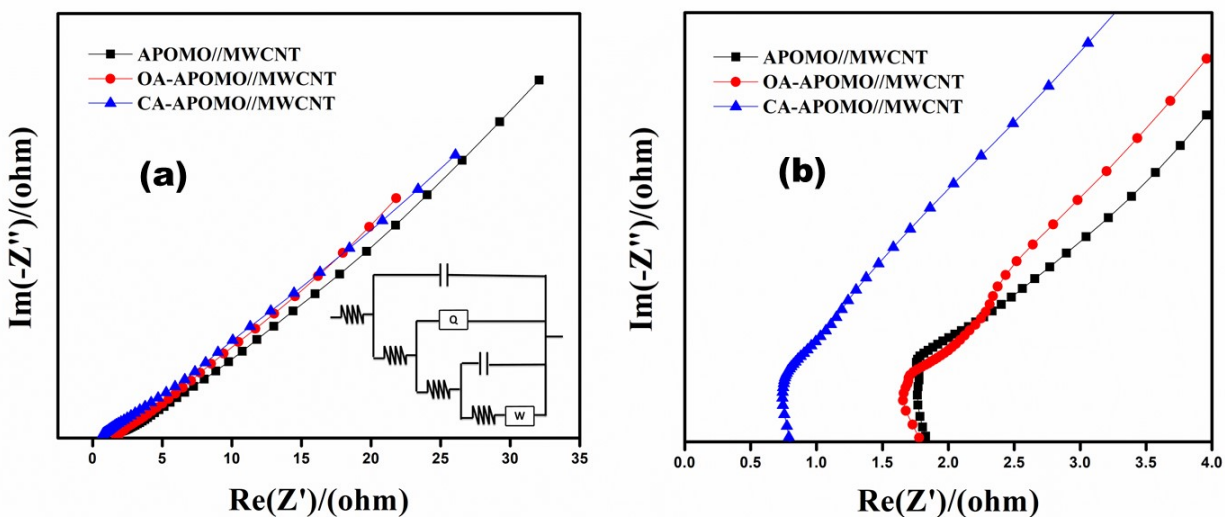


Figure (S9) Nyquist plot of APOMO//MWCNT, OA-APOMO// MWCNT, and CA-APOMO// MWCNT in 2M H₂SO₄ electrolyte (a) Full scale Nyquist plot, and (b) magnification Nyquist plot in higher frequency

Table (T9) Specific capacity, energy and power density of asymmetry device in 2 M H₂SO₄+ 0.025 M KI

Current density (Ag ⁻¹)	Specific capacity (mAh g ⁻¹)	Energy density (Wh Kg ⁻¹)	Power density (W Kg ⁻¹)
3	121.66	74.09	1826.87
5	102.77	61.65	2999.18
10	83.33	43.57	5228.40
20	44.44	19.55	8797.50
30	25.00	10.64	12768.00

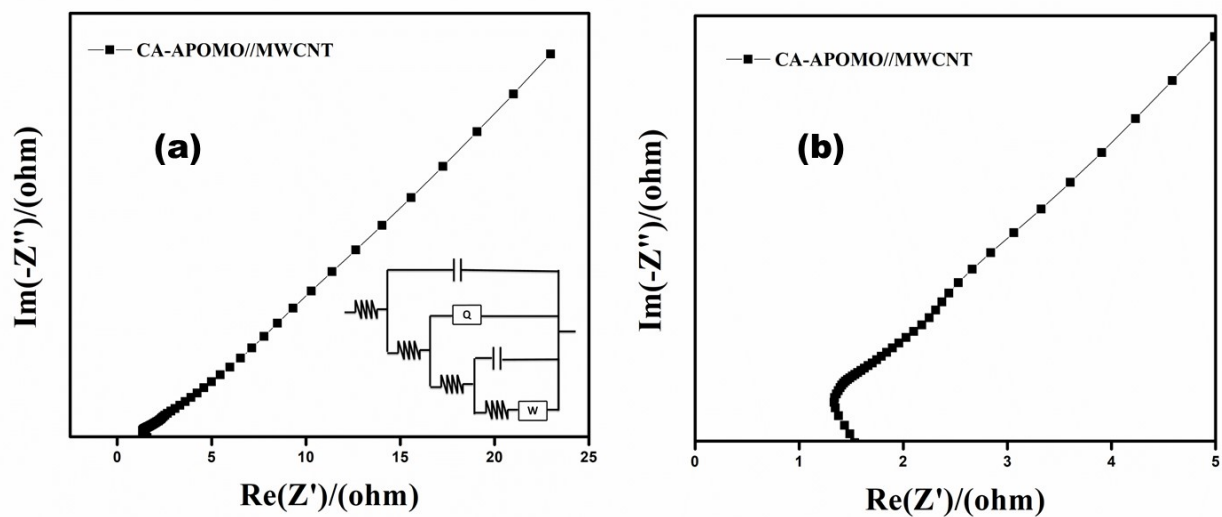


Figure (S10) Nyquist plot of CA-APOMO//MWCNT in 2M H₂SO₄+0.025M KI electrolyte (a) Full scale Nyquist plot, and (b) magnification Nyquist plot in higher frequency

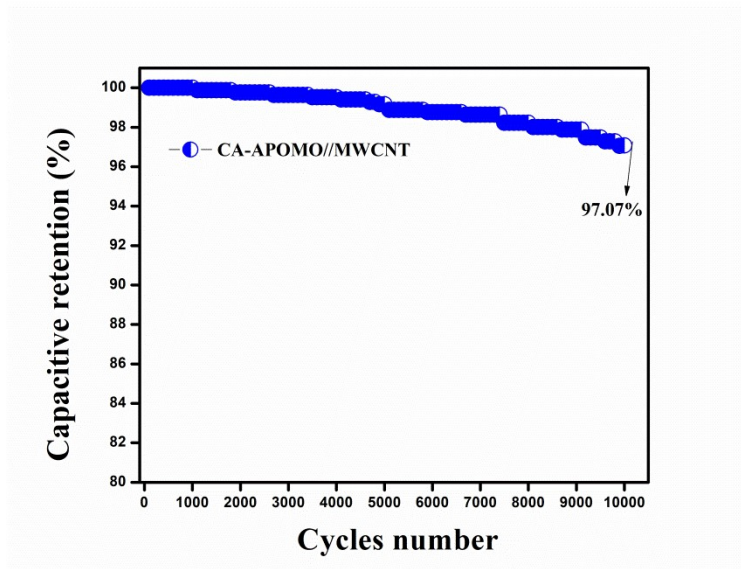


Figure (S11) Cycle stability of CA-APOMO//MWCNT in 2M H₂SO₄+0.025M KI electrolyte

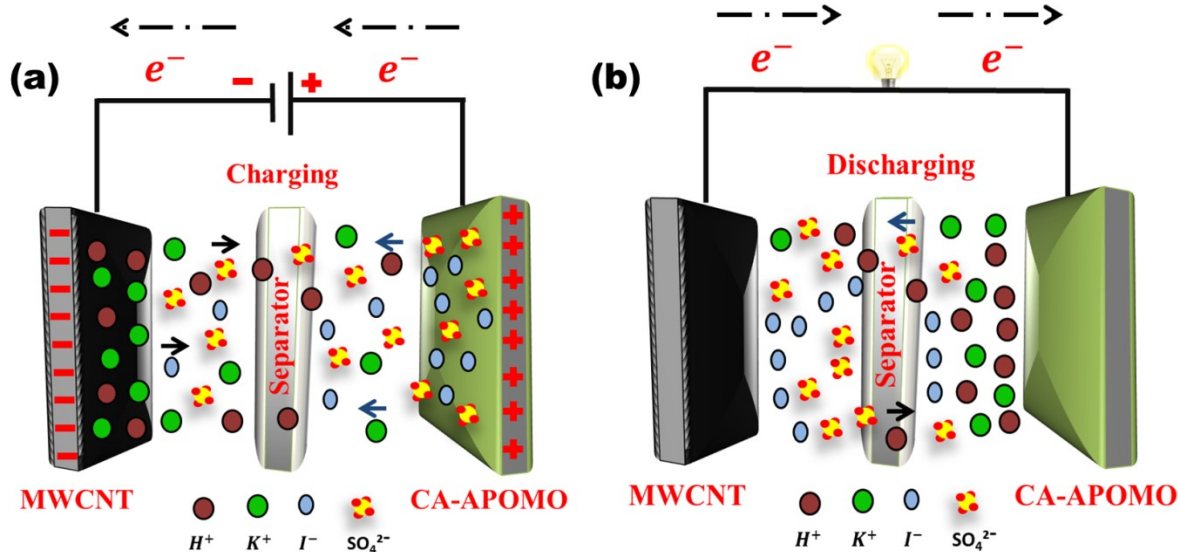


Figure (S12) (a) Charging, (b) Discharging electron transfer mechanism of CA-APOMO//MWCNT asymmetric device in 2M H₂SO₄+0.025M KI electrolyte

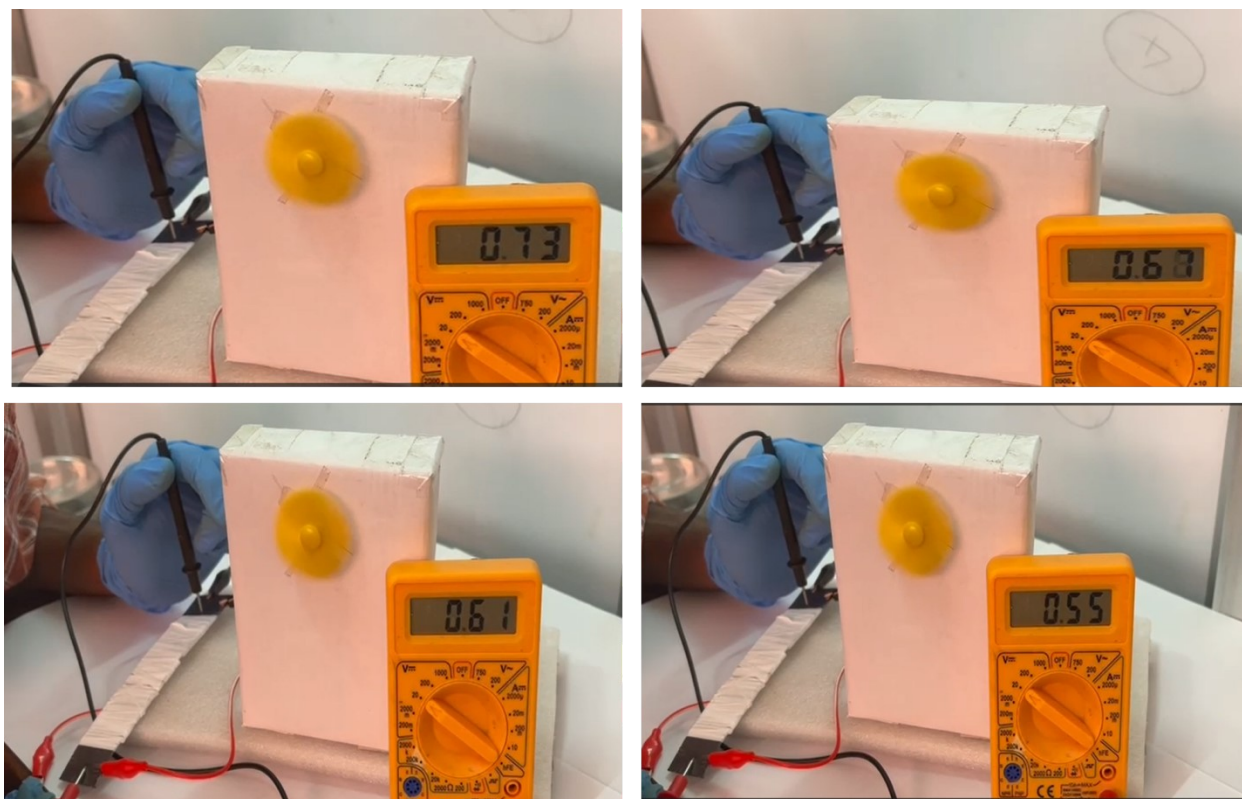


Figure (S13) Fabricated asymmetric device CA-APOMO//MWCNT setup for Real time application

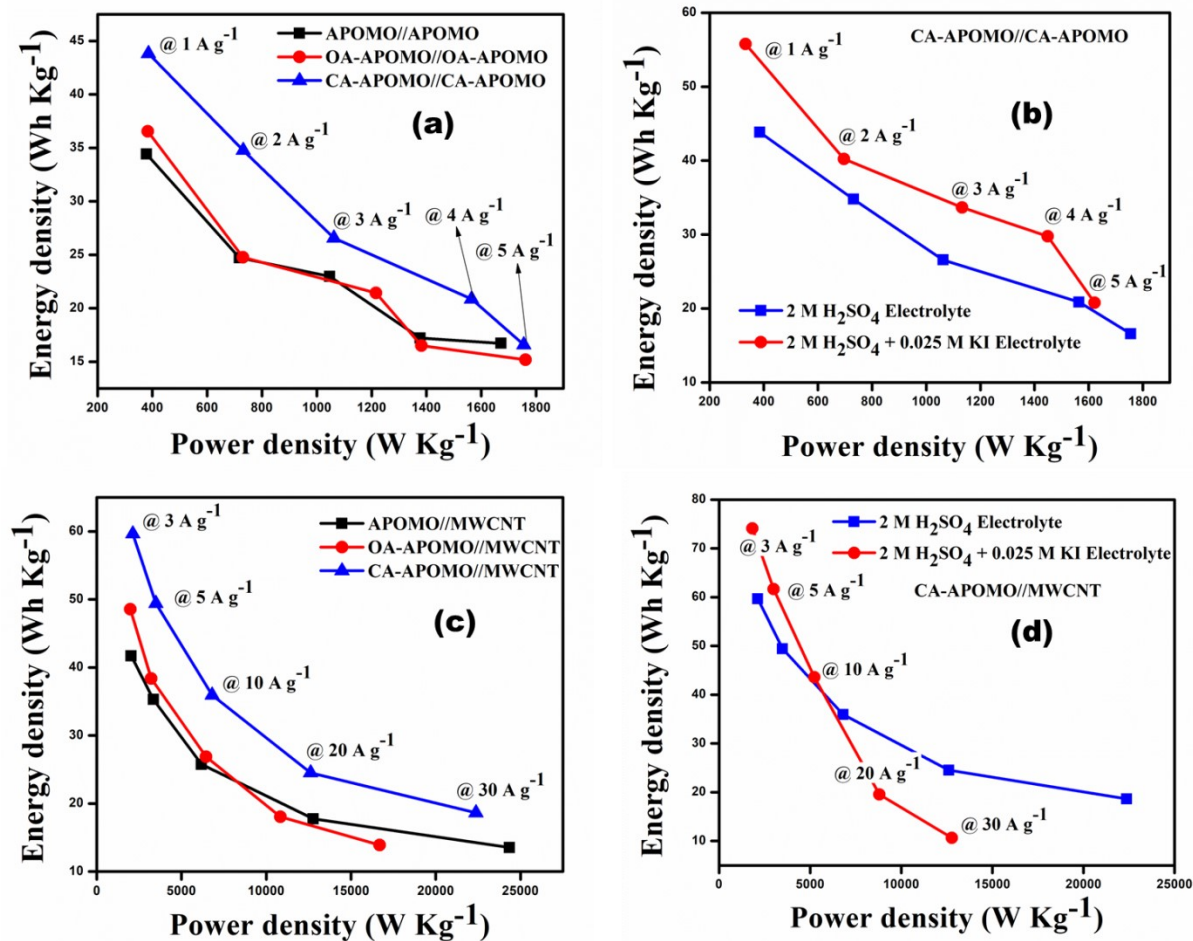


Figure (S14) Ragone plot of symmetric device (a) APOMO//APOMO, OA-APOMO//OA-APOMO, and CA-APOMO//CA-APOMO in 2 M H₂SO₄ electrolyte, (b) CA-APOMO//CA-APOMO device Comparison analysis of 2 M H₂SO₄ (optimized electrode) and 2 M H₂SO₄ + 0.025 M KI electrolyte, Asymmetric device performance (c) APOMO//MWCNT, OA-APOMO//MWCNT, and CA-APOMO//MWCNT in 2 M H₂SO₄ electrolyte, (d) CA-APOMO//MWCNT device Comparison analysis of 2 M H₂SO₄ (optimized electrode), 2 M H₂SO₄ + 0.025 M KI electrolyte