Sequential Electrodeposition of Layered Co_3O_4/rGO/PANI Ternary nanocomposite Electrodes for High performance Supercapacitors

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Samples Scan rate (mV s^{-1})	Co_3O_4		Co_3O_4/rGO		Co_3O_4/rGO/PANI	
	Anodic peak current i_{pa}(mA/cm^2)	Cathodic peak current i_{pc} (mA/cm^2)	Anodic peak current i_{pa}(mA/cm^2)	Cathodic peak current i_{pc} (mA/cm^2)	Anodic peak current i_{pa}(mA/cm^2)	Cathodic peak current i_{pc} (mA/cm^2)
10	9.6478	-7.5351	24.080	-18.700	12.741	-16.492
20	16.3281	-12.8885	40.880	-32.090	25.265	-31.106
40	27.1808	-21.5865	55.180	-43.390	47.342	-55.308
60	36.5024	-28.9577	68.050	-53.340	71.682	-77.303
80	44.8136	-35.2725	80.120	-62.310	97.463	-96.814
100	52.5287	-40.9790	90.880	-70.720	127.272	-113.937

Table S_1 Analysis of anodic and cathodic peak values of Co_3O_4, Co_3O_4/rGO and Co_3O_4/rGO/PANI samples

Electrolyte Used to study Co_3O_4/rGO/PANI	Scan rate (V s^{-1})	Cs (F g^{-1}) From CV analysis	Current Density (A g^{-1})	Cs (F g^{-1}) From GCD analysis	Specific Capacity (mAh g^{-1})	Energy density (Wh kg^{-1})	Power density (W kg^{-1})
1 M H_2SO_4	0.1	1418.30					
	0.08	1439.70	1.7	1970.30	383.11	134.09	599.21
	0.06	1479.54	3.4	1951.60	379.48	132.82	1198.43
	0.04	1529.54	5.1	1861.54	361.97	126.69	1797.64
	0.02	1623.91	6.8	1846.65	359.07	125.68	2396.85
	0.01	1650.35	8.6	1837.68	357.33	125.07	2996.06
0.5 M Na_2SO_4	0.1	1013.32					
	0.08	1107.99	1.7	1409.81	313.30	125.32	684.81
	0.06	1201.38	3.4	1258.37	279.62	111.86	1369.63
	0.04	1309.93	5.1	1305.01	290.00	116.00	2054.44
	0.02	1469.86	6.8	1234.49	274.33	109.73	2739.26
	0.01	1526.58	8.6	870.92	193.54	77.41	3424.07

Table S_2 Comparison of specific capacitance, energy density, and power density for the ternary composite studied in acidic (1 M H_2SO_4) and neutral (0.5 M Na_2SO_4) aqueous media across various scan rates and current densities.

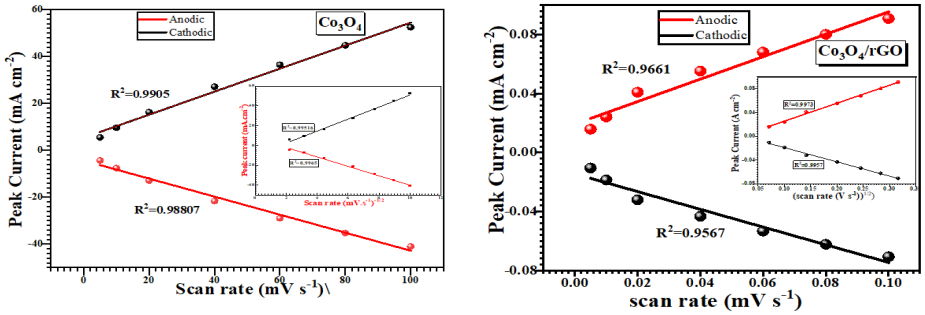
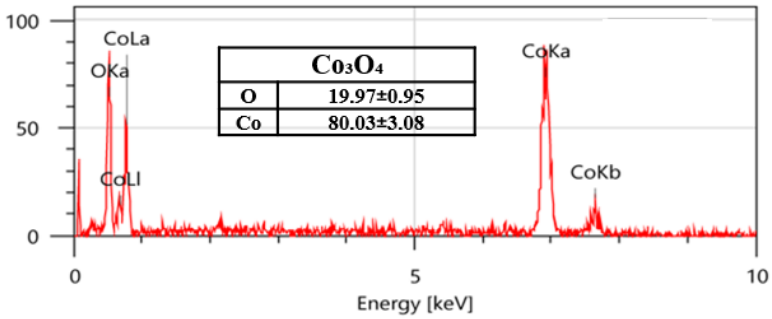
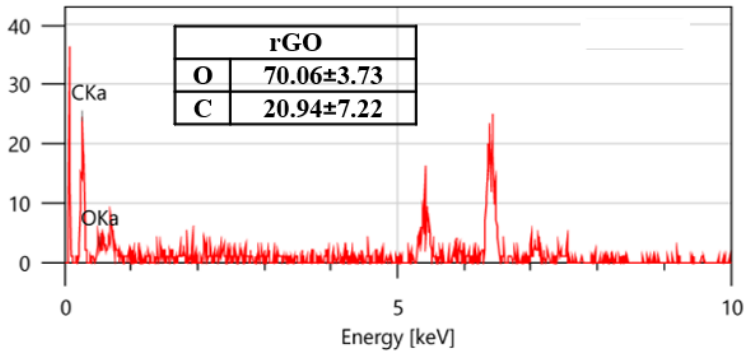


Fig. S_1 Plot of the anodic and cathodic peak current vs scan rate (inset: peak current vs square root of scan rate) for Co_3O_4 sample and that for Co_3O_4/rGO as reported in our previous literature[1]





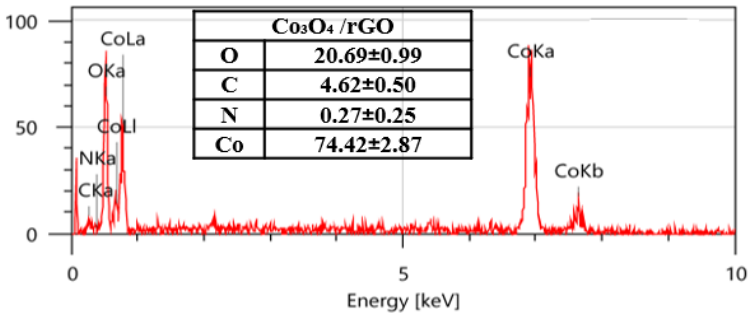


Fig. S_2 EDS analysis spectra of Co_3O_4, rGO and for Co_3O_4/rGO sample.

Scan Rate (v) (mV/s)	Anodic Capacitive %	Anodic Diffusion %	Cathodic Capacitive %	Cathodic Diffusion %
10	100%	0%	50.7%	49.3%
20	100%	0%	59.3%	40.7%
40	100%	0%	67.3%	32.7%
60	100%	0%	71.7%	28.3%
80	100%	0%	74.4%	25.6%
100	100%	0%	76.5%	23.5%

Table S_3 Based on the linear fit parameters (k_1 and k_2) as obtained from Fig. 10(c), the calculated capacitive and diffusion contributions for specific scan rates are given in table below:

Sample	Structure	Mean ± Standard Deviation (nm)
Co_3O_4	Nanowires	56.5 ± 46.7
PANI	Nanospheres	549.5 ± 395.8
rGO	Nanosheets	984.1 ± 2836.6
Binary (rGO/Co_3O_4)	nanowires/microcrystals anchored onto rGO sheet surfaces	454.3 ± 328.0
Ternary (rGO/Co_3O_4/PANI)	large crumpled sheet-like features	1662.1 ± 1581.6

Table. S_4 The average diameter of synthesized samples from SEM analysis.

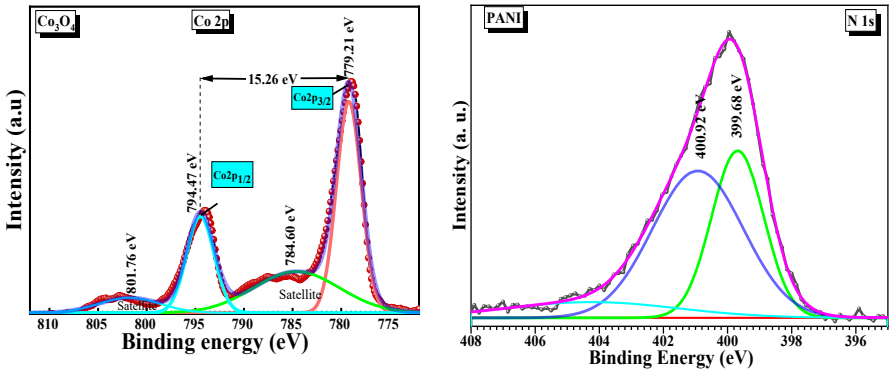


Fig. S_3 XPS spectra of pristine Co_3O_4 (Co 2p)[2] and PANI (N 1s)[3]

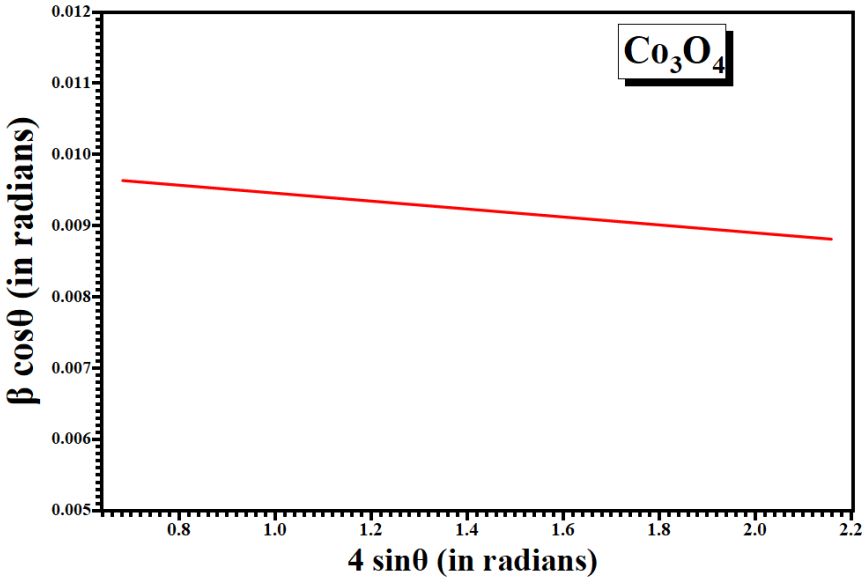


Fig. S_4 W-H plot ($\beta\ cos\theta\ vs\ 4\ sin\theta$) for synthesized Co_3O_4 electrode

Specific Power (W kg^{-1})	Specific Energy (Wh kg^{-1})	Synthesized electrode	Reference
800	33.5	Co_3O_4/polyaniline/graphene	17
895.02	106.95	$SrSnO_3$/rGO/PANI	64
697.72	49.81	PANI/Co_3O_4/Graphene	21
9560	27.98	rGO/Co_3O_4/PANI	26
3.8	54.5	Graphene/PANI/ Co_3O_4	22
359.19	47.24	GO/PANI/Co_3O_4	23
114.2	126.8	CuO/PANI/rGO	5
846.9	87.9	Mn_3O_4/$NiMnO_3$ /rGO	65
250	13.4	graphene/Co_3O_4/PPY	66
497	75.5	PEDOT/GO/Co_3O_4	67
2996	125.07	Co_3O_4/rGO/PANI	This work

Table S_5 Ragone plot showing the specific energy and specific power of synthesized ternary nanocomposite electrode and devices.