Additive-assisted oriented growth of cobalt oxide: controlled morphology and enhanced supercapacitor performance

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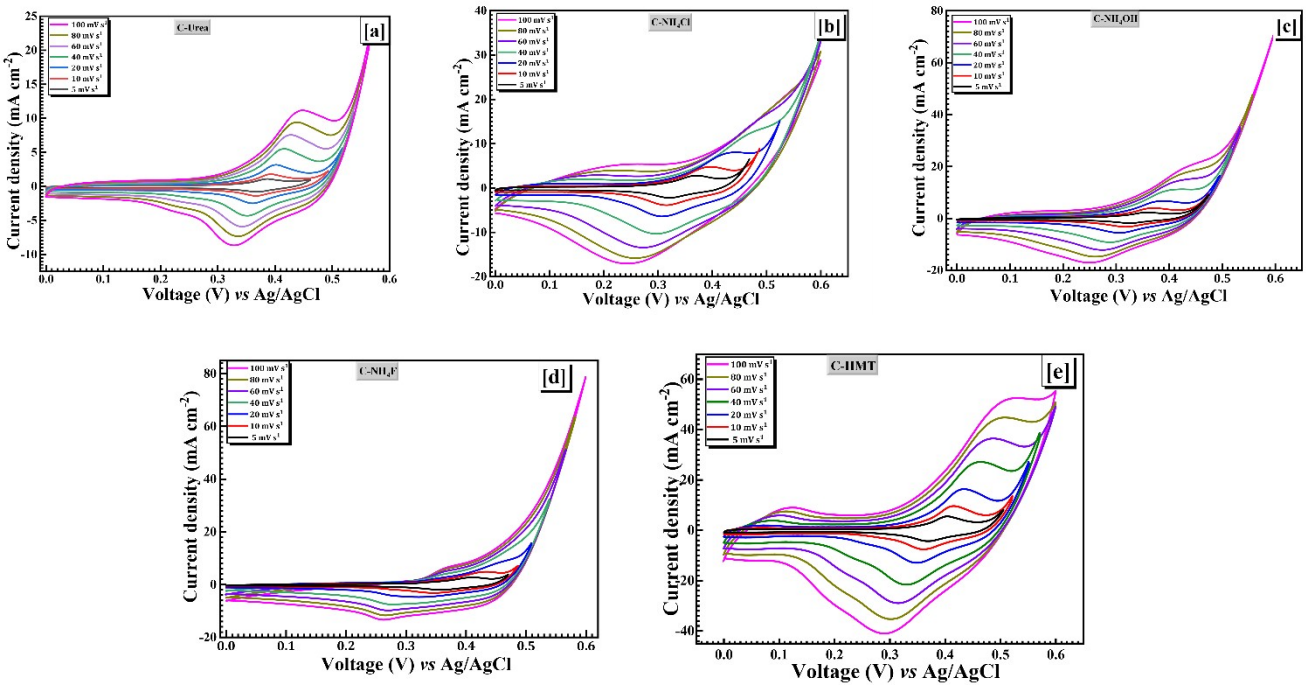

Fig. S1 CV analysis data of (a) C-Urea (b) C-NH_4Cl (c) C-NH_4OH (d) C-NH_4F and (e) C-HMT samples at different scan rates upon application of potential 0 to 0.6 V.

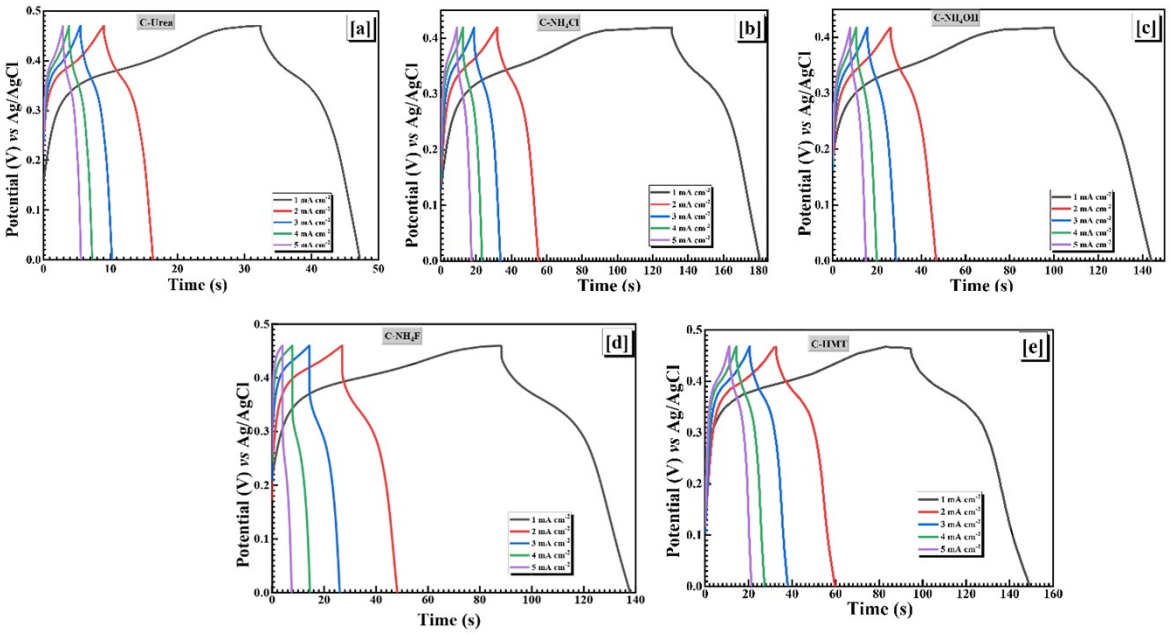

Fig. S$_2$ GCD analysis data of (a) C-Urea (b) C-NH_4Cl (c) C- NH_4OH (d) C-NH_4F and (e) C-HMT samples at different current densities.

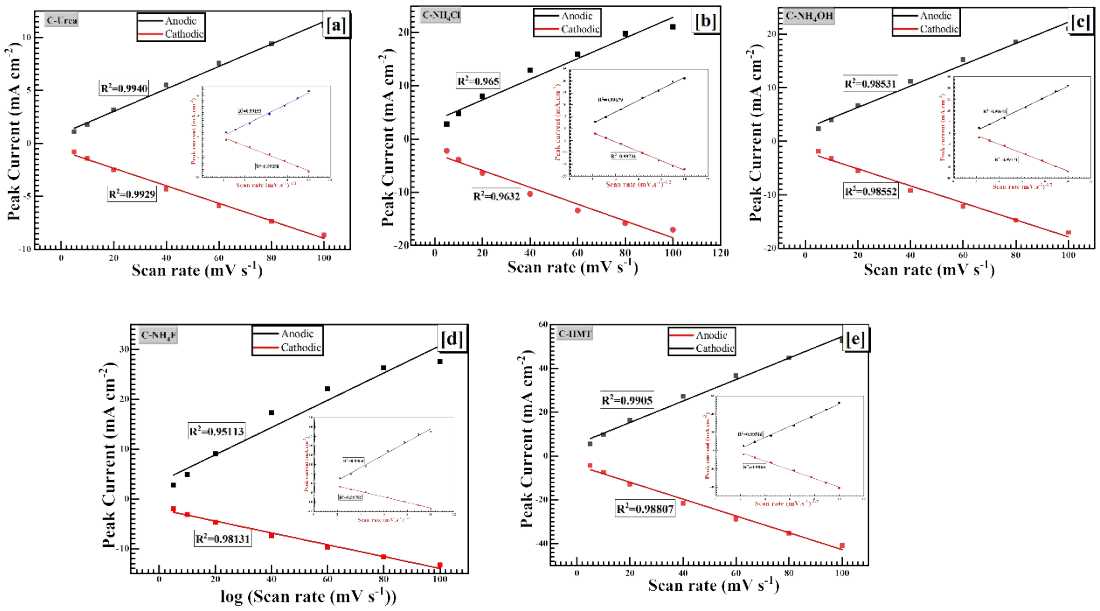

Fig. S$_3$ Dependence of redox peak current on the scan rate for the synthesized sample and inset redox peak current *vs* square root scan rate.

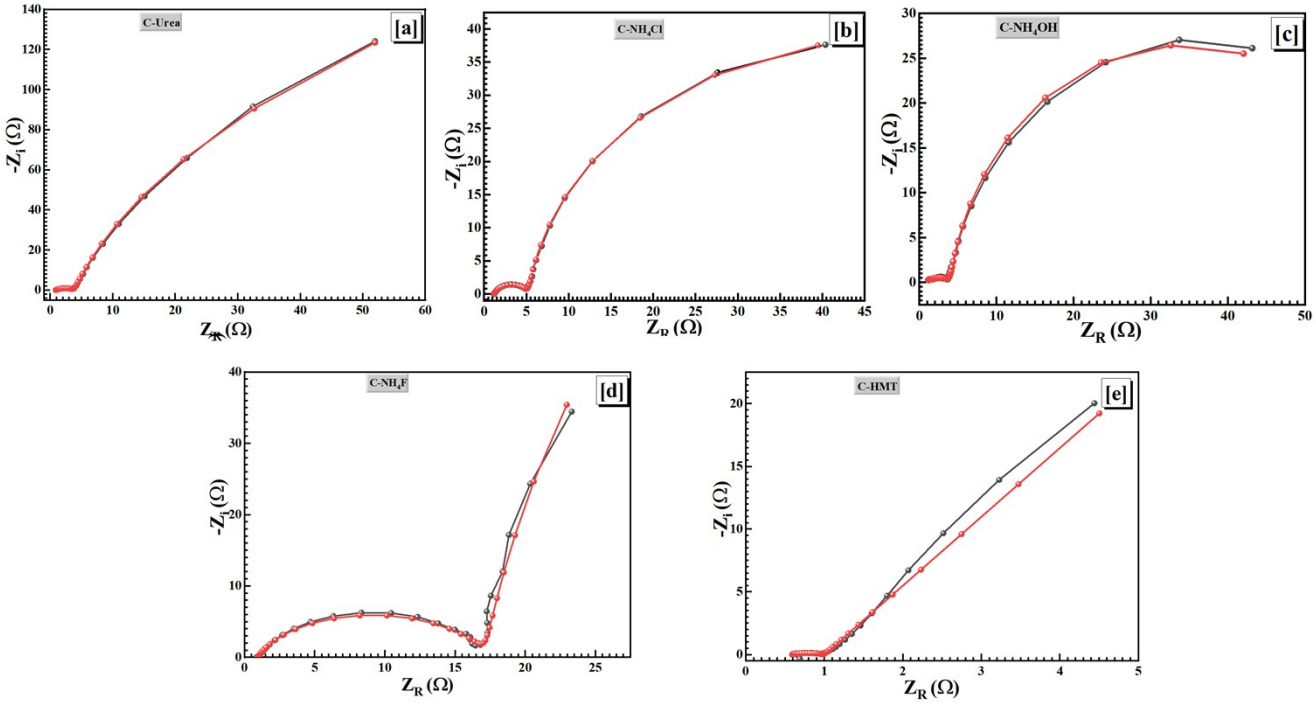

Fig. S$_4$ Nyquist plot of (a) C-Urea (b) C-NH_4Cl (c) C-NH_4OH (d)C-NH_4F and (e) C- HMT samples

Table S$_1$ Analysis of CV measurements of all synthesized samples.

Samples / Scan rate	C-Urea		C- NH_4Cl		C- NH_4OH		C- NH_4F		C-HMT	
	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)	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)
5 mV s^{-1}	1.0999	-0.7944	2.8120	-2.2182	2.3246	-1.8353	2.7507	-1.9405	5.5345	-4.3018
10 mV s^{-1}	1.7750	-1.3956	4.7834	-3.8716	3.9528	-3.2539	4.8647	-3.1554	9.6478	-7.5351
20 mV s^{-1}	3.1762	-2.4856	8.0422	-6.3984	6.6847	-5.5391	9.0382	-4.7065	16.3281	-12.8885
40 mV s^{-1}	5.5277	-4.3143	12.8688	-10.3023	11.2236	-9.1747	17.2542	-7.4926	27.1808	-21.5865
60 mV s^{-1}	7.5811	-5.9031	15.9275	-13.4162	15.3020	-12.1580	22.0945	-9.7683	36.5024	-28.9577
80 mV s^{-1}	9.4031	-7.3456	19.7650	-15.8179	18.5915	-14.7481	26.2622	-11.6597	44.8136	-35.2725
100 mV s^{-1}	11.1593	-8.6544	21.0319	-17.0440	21.0559	-17.0293	27.5618	-13.3235	52.5287	-40.9790

Table S_2. Literature data on pristine Co_3O_4 thin film on a steel substrate.

Deposition technique	Morphology	Capacitance	Energy density, power density, and coulombic efficiency	Cycle stability	Electrolyte	Ref.
single-step solution precursor plasma spray route.	Nanoparticle (10–50 nm)	~162 F g^{-1} at 2.75 A g^{-1}	-	72.2% after 1000 cycles	6 M KOH	[4]
Potentiodynamic electrodeposition method	nanoflakes	365 F g^{-1} at 5 mV s^{-1}.	64 Wh kg^{-1}, 21.53 kW kg^{-1}, and 99 %	92 % of initial capacity over 2,000 cycles	1M KOH	[5]
potentiodynamically synthesized cobalt oxide	agglomeration of granular micro-particles	441.17 F g^{-1} 2 mV s^{-1}	-	87.88% stability after 1000 cycles at 40 mA/cm^2.	1 M KOH	[6]
low-temperature wet chemical synthesis strategy	nano-needles	66.40 mAh g^{-1} at 1 mA cm^{-2}	-	-	NaOH, KOH and Na_2SO_4	[7]
potentiostatically	nanoparticles	284.4 F g^{-1} at 5 mV s^{-1}	4.325 Wh kg^{-1}, 3 kW kg^{-1}, 53.75 %	-	1 M Na_2SO_4	[8]
Hydrothermal	urchin	536 F g^{-1} at 4 A g^{-1}		23% after 5000 charge–discharge cycles current density of 4 A g^{-1}	3 M KOH	[34]
Electrodeposition	nanoplates	393.6 F g^{-1} at 1 A g^{-1}		96.5% after 500 charge-discharge cycles	1 M KOH	[43]
Electrodeposition	nanoflakes	315 F g^{-1} at 5 mV s^{-1}			0.5 M Na2SO4	[44]
Hydrothermal	nanoflakes	454 F g^{-1} at 2 A g^{-1}		High capacitance retention after 2500 charge-discharge cycle	2 M KOH	[45]
Hydrothermal synthesis	Nanosheets	468.68 F g^{-1} at a 5 mV s^{-1}		98.31 % of its initial capacitance after 10000 cycles	2 M KOH	This work