Electronic Supplementary Information (ESI)

for

Cobalt oxide 2D nano-assemblies from infinite coordination polymer precursor mediated by multidentate pyridyl ligand

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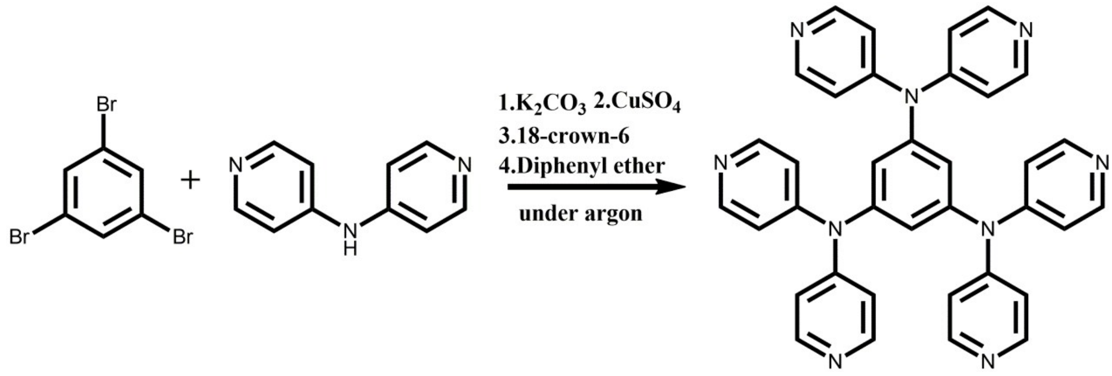
Section 1 The characterization of Hppd.



Scheme S1 Synthetic route of **Hppd.**

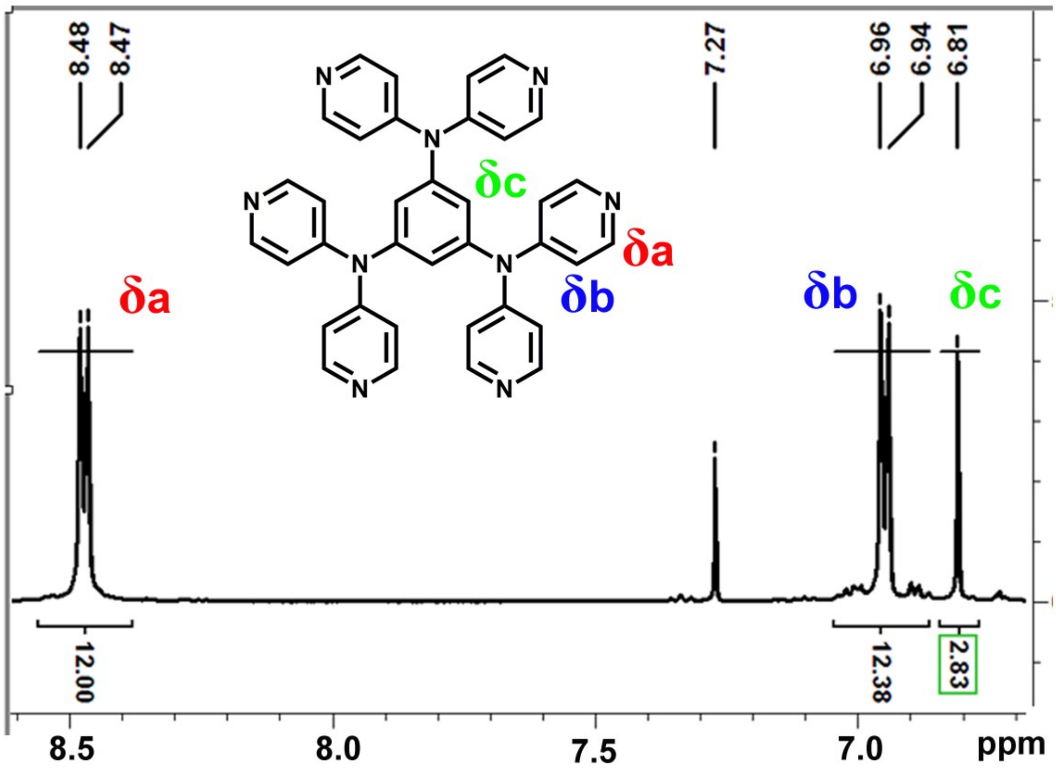


Fig. S1 The [1]H NMR of **Hppd.**

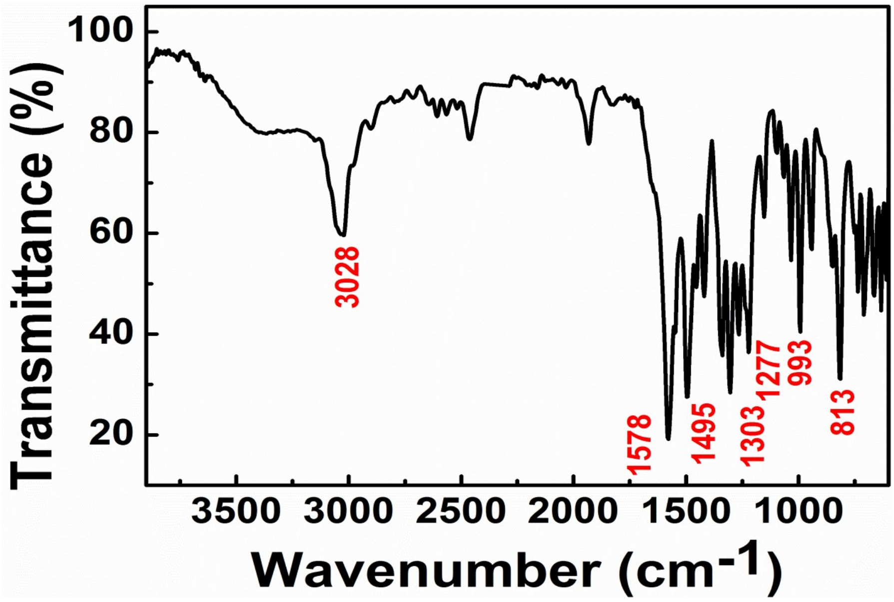


Fig. S2 The IR spectrum of **Hppd.**

Table S1. The EA analysis result of **Hppd.**

Type / Value	C	N	H
Calculation(%)	73.83	21.52	4.65
Experiment(%)	73.69	21.6	4.71

Section 2. The complementary characterization of Co 2D-ICPP.

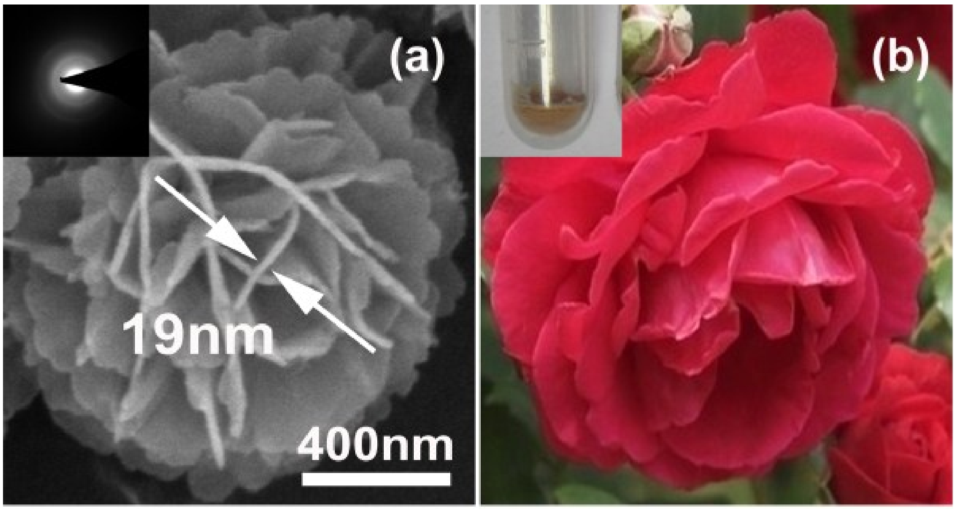


Fig. S3 (a) The SEM and SAED (inset) images of Co 2D-ICPP, (b) The picture of nature flower and optical photograph of Co 2D-ICPP.

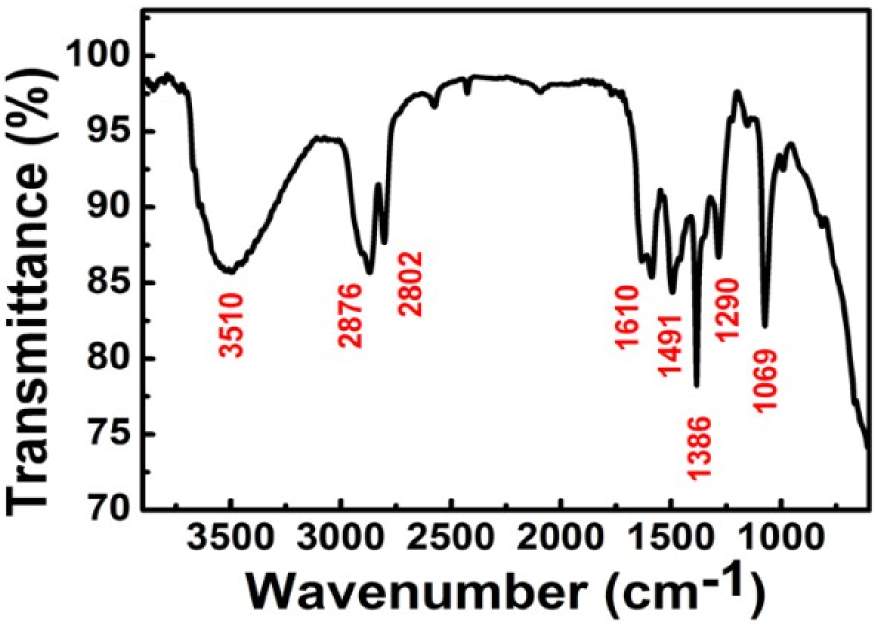


Fig. S4 The IR spectrum of Co 2D-ICPP.

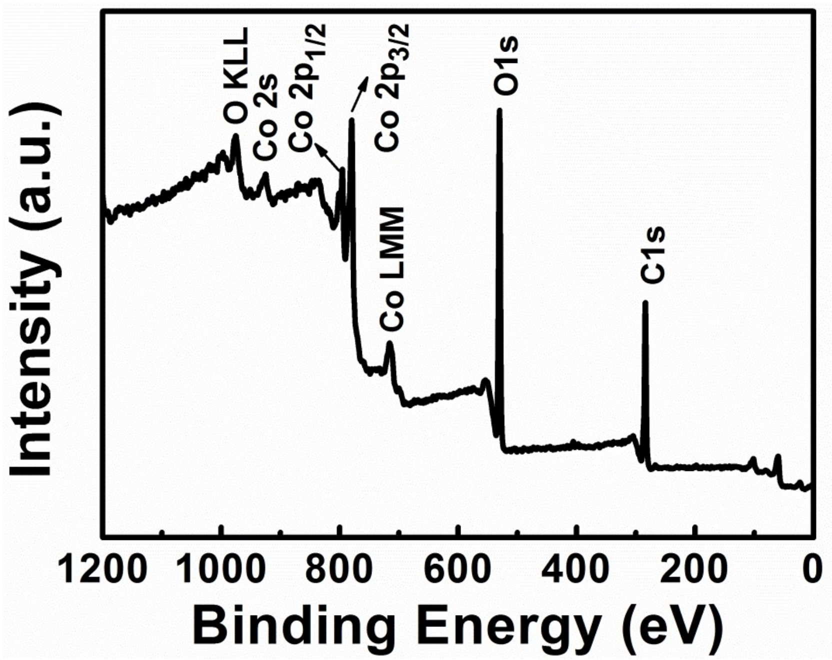


Fig. S5 The XPS spectrum of Co 2D-ICPP.

Table S2 the XRD peaks of Co 2D-ICPP.

Numbers	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
2theta(deg)	11.04	22.22	33.44	37.78	44.89	58.18	59.41	65.16	77.3

Table S3 the EA analysis result of Co 2D-ICPP.

Type / Value	C	N	H
Calculation(%)	13.12	2.86	3.54
Experiment(%)	13.10	2.81	3.53

Section 3 The complementary research of self-assemble mechanism.

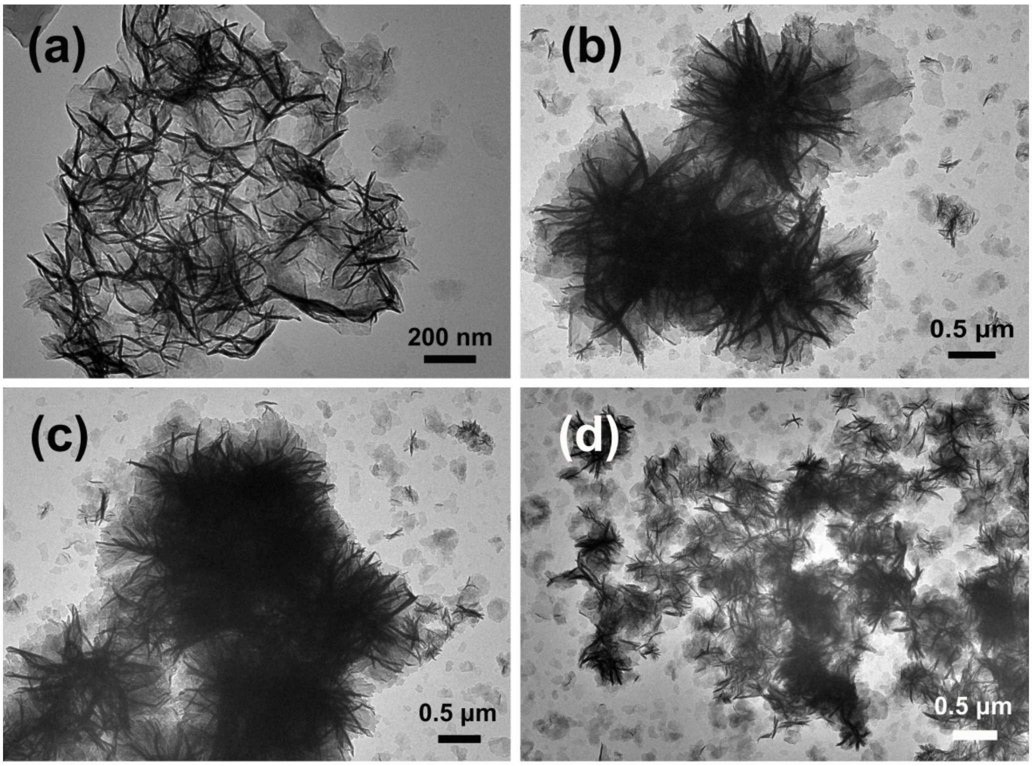


Fig. S6 (a) to (d) The TEM images of Co 2D-ICPP in 1 h, 4 h, 7 h and 12 h, respectively.

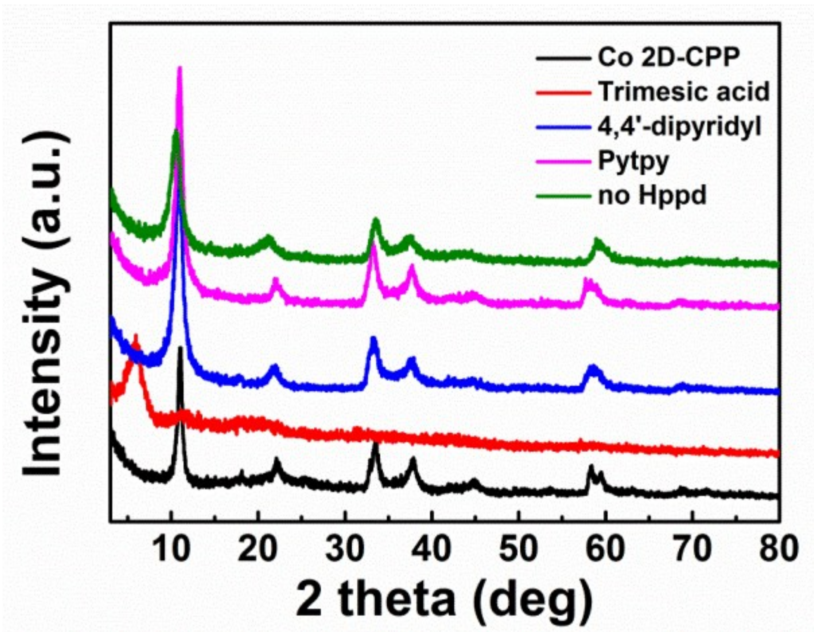


Fig. S7 The XRD patterns of the products obtained with different modulating agents.

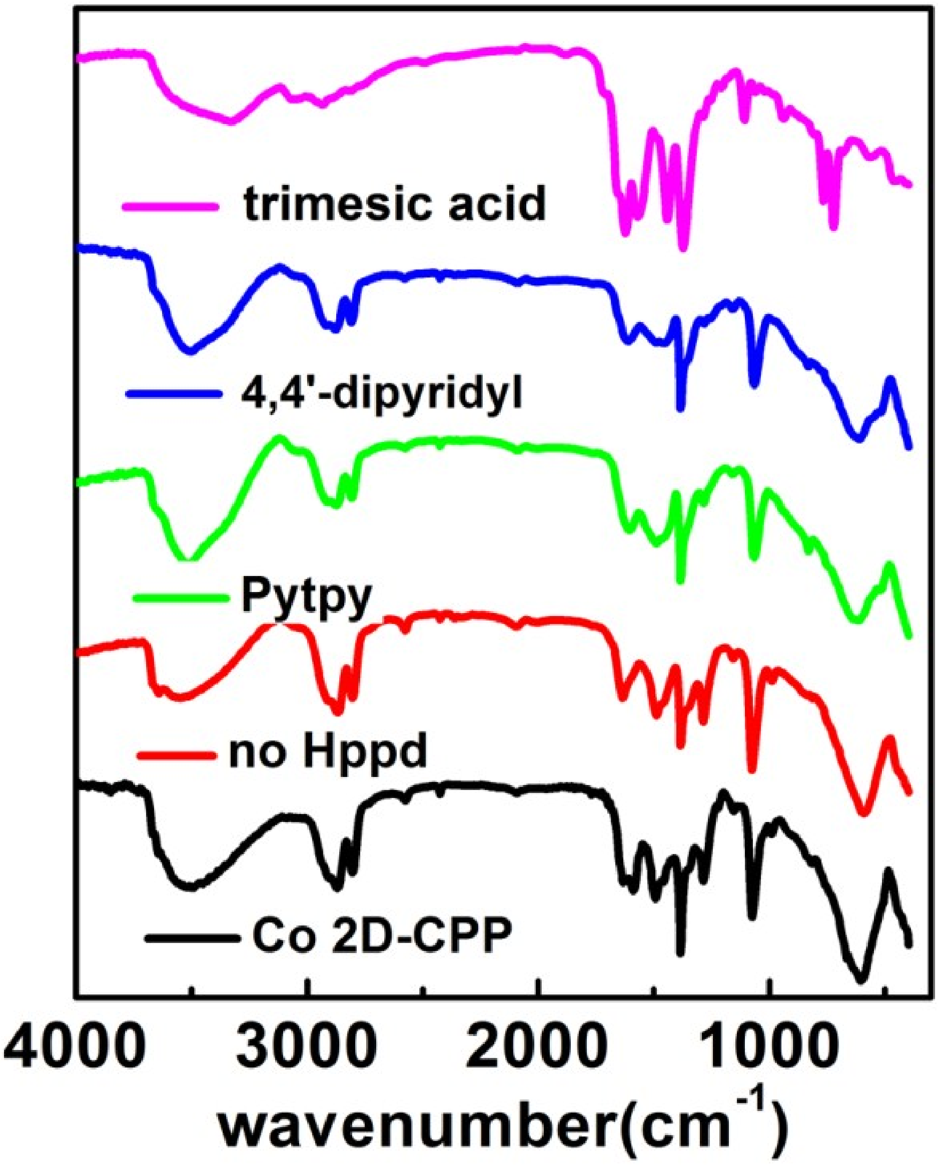


Fig. S**8** The IR spectra of the products obtained with different modulating agents.

Section 4 The supplementary information of Cobalt oxide 2D nano-assemblies, Co_3O_4/G nanocomposite and Co 2D-ICPP/G nanocomposite.

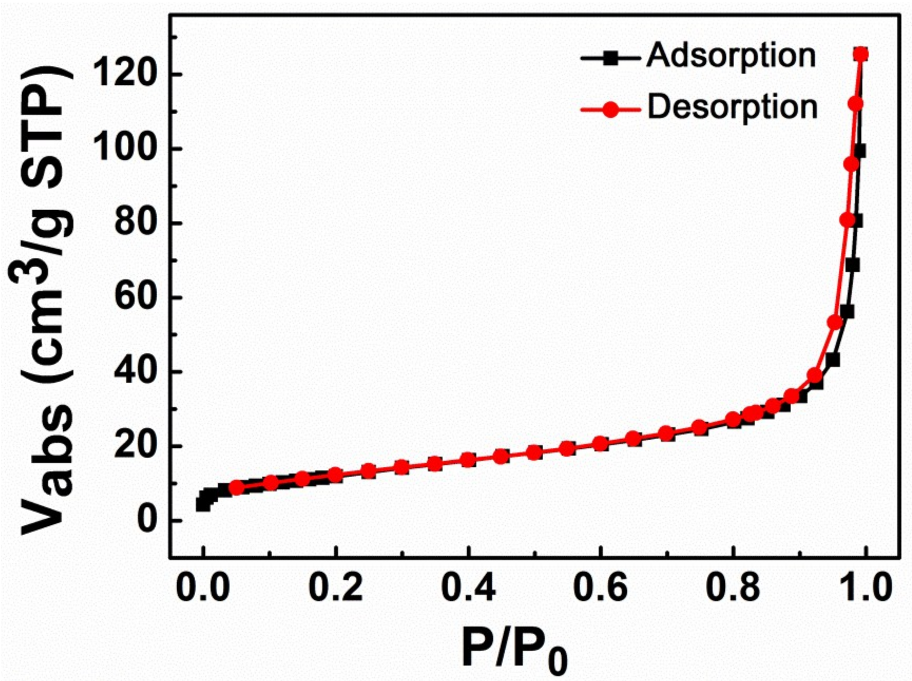


Fig. S9 N_2 adsorption-desorption isotherms of Co_3O_4.

The Co_3O_4/graphene (Co_3O_4/G) nanocomposite can be obtained by the calcination of Co 2D-ICCP/graphene composite precursor. As shown in Fig. S10 (a) and (b), the 2D rose-like assembles morphology of Co_3O_4/G can be remained well after calcination. The Co_3O_4/graphene nanoparticles distribute on the graphene uniformly. The degree of crystallization of the graphene can be relatively determined by the I_D/I_G ratio in the Raman spectroscopy. The low I_D/I_G ratio (Fig. S10(d)) corresponds to a high crystallization degree of the Co_3O_4/G nanocomposite.

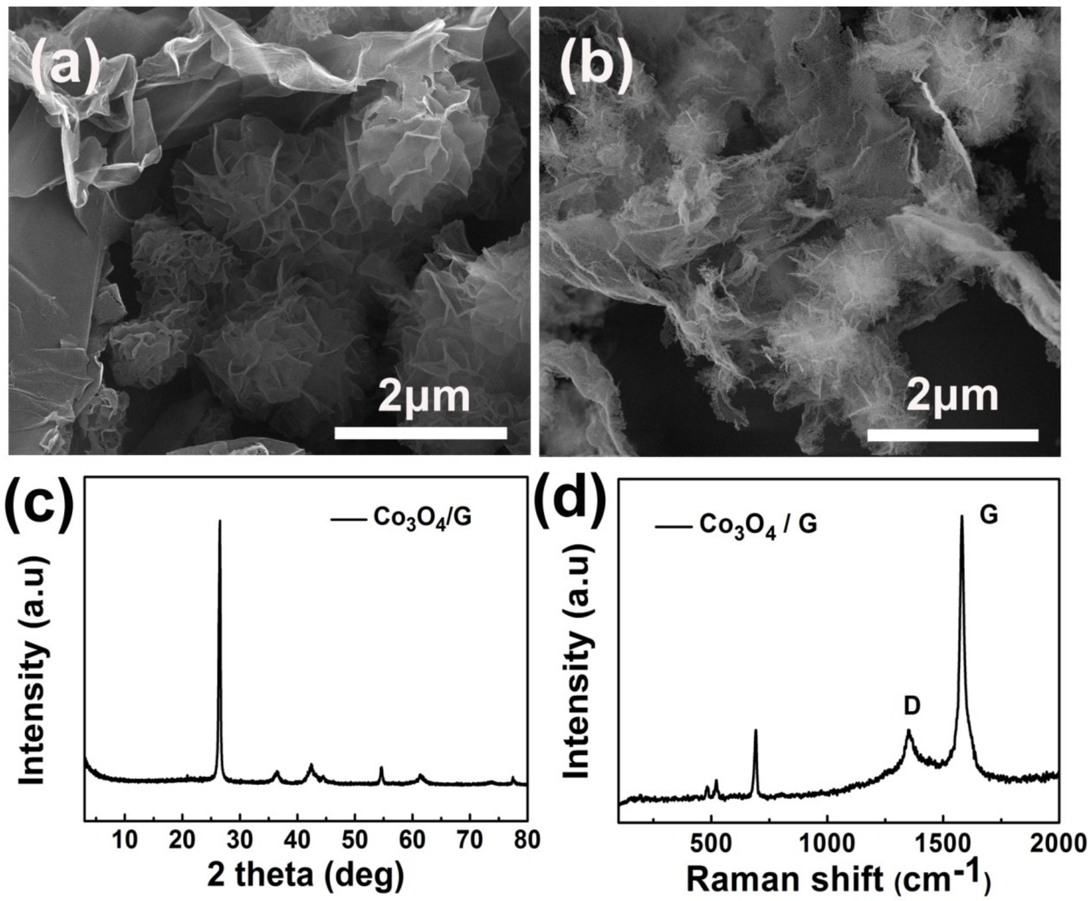


Fig. S10 (a) and (b) The SEM images of Co_3O_4/G before calcination and after calcination, respectively; (c) The XRD pattern of Co_3O_4/G; (d) The Raman spectrogram of Co_3O_4/G.

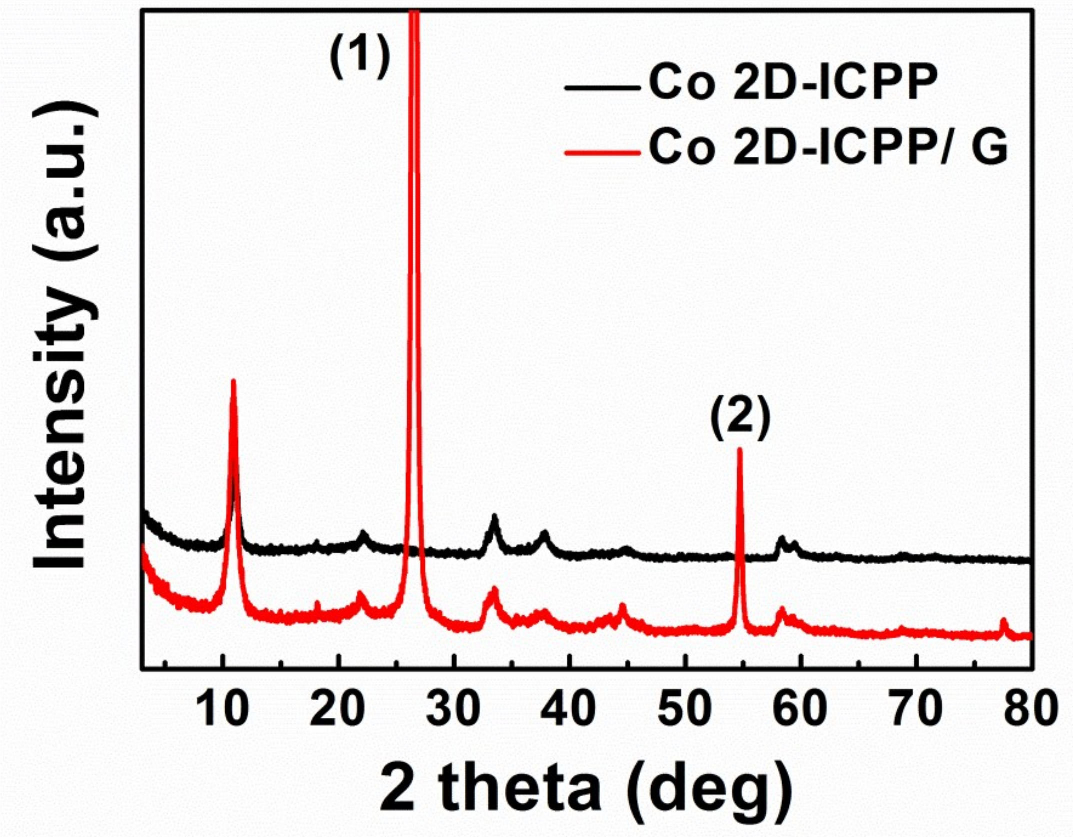


Fig. S11 The XRD patterns of Co 2D-ICPP and Co 2D-ICPP/G.

As the graphene have persistent weight loss when the temperature is increasing,[1,2] we could hardly caculate the weight percent of Co 2D-ICPP from the TGA curve directly. We figure out the Co 2D-ICPP is about 30% via the weight percent of Co_3O_4 11.5% in Fig. S12, and the weight percent of graphene is about 70%.

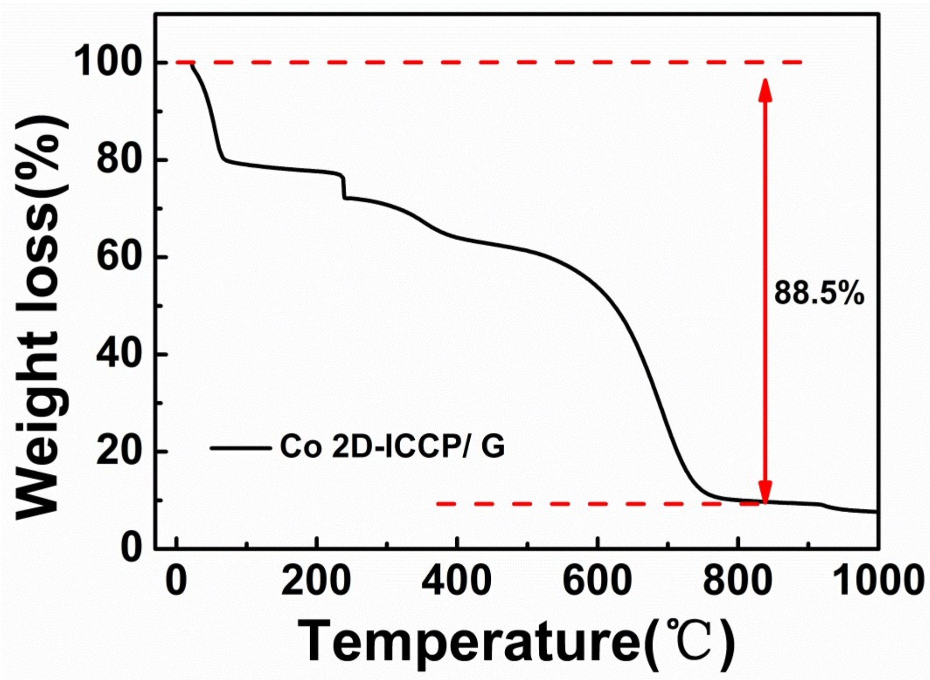


Fig. S12 The TGA curve of Co 2D-ICPP/G.

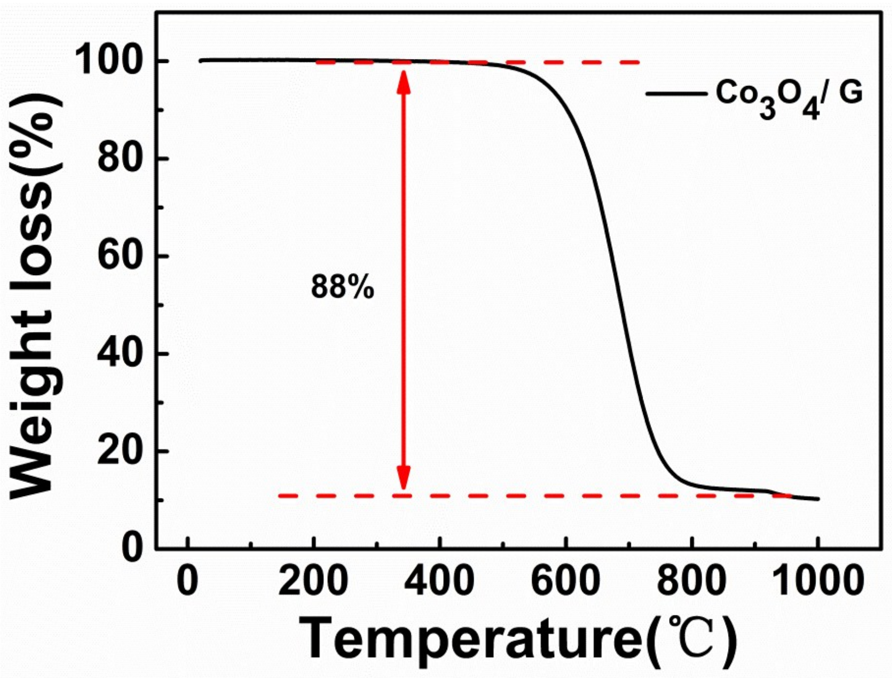


Fig. S13 The TGA curve of Co_3O_4/G.

Section 5 Cobalt oxide 2D nano-assemblies used as lithium anode material.

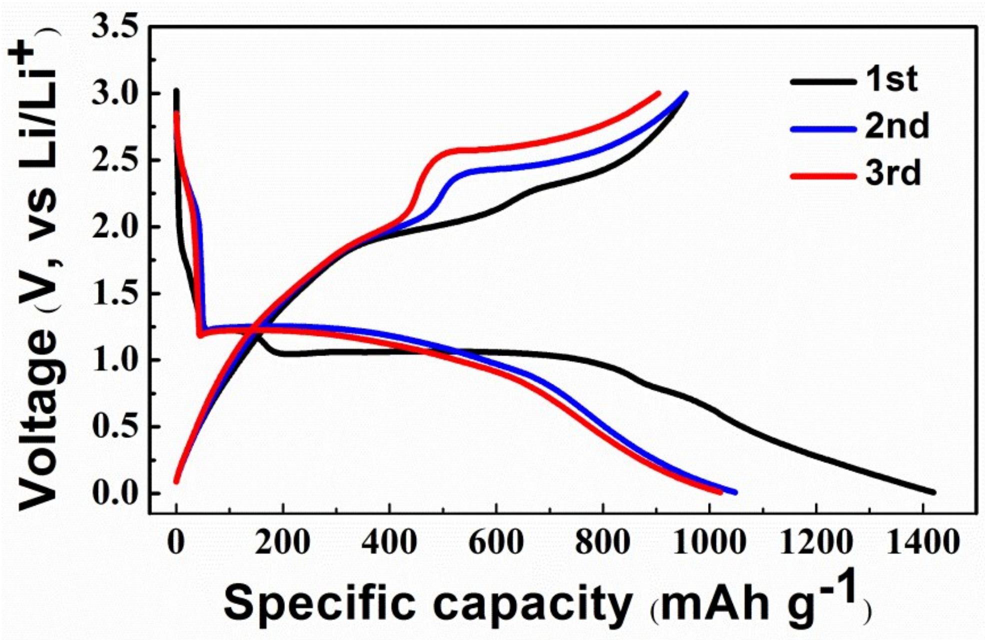


Fig. S14 The charge-discharge voltage profiles of Co_3O_4 2D nano-assemblies in the voltage range 0.01-3 V at a current density of 50 mA g^{-1}.

Section 6 Co_3O_4/G nanocomposites with other pyridyl modulators used as lithium anode material.

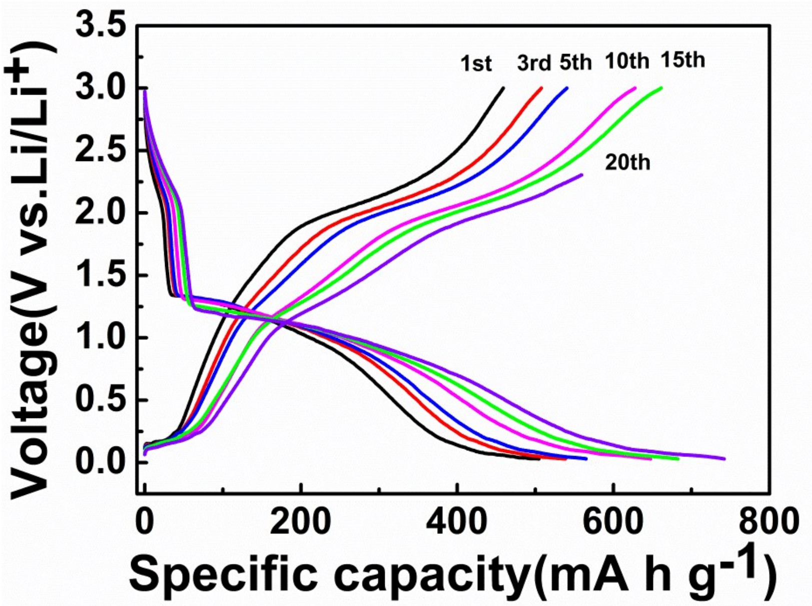


Fig. S15 The charge-discharge voltage profiles of Co_3O_4/G nanocomposite with 4,4'-dipyridyl as modulator in the voltage range 0.01-3 V at a current density of 50 mA g^{-1}.

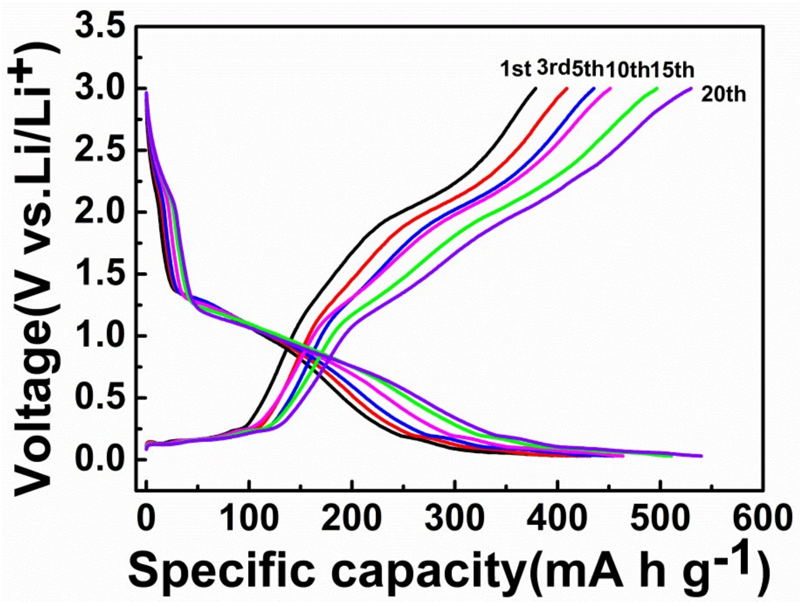


Fig. S16 The charge-discharge voltage profiles of Co_3O_4/G nanocomposite with Pytpy as modulator in the voltage range 0.01-3 V at a current density of 50 mA g^{-1}.

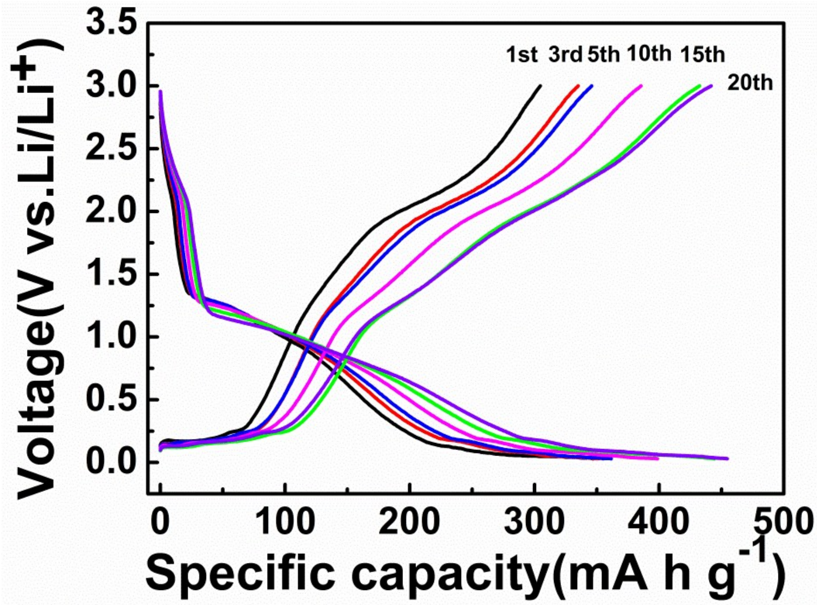


Fig. S17 The charge-discharge voltage profiles of Co_3O_4/G nanocomposite with no modulator in the voltage range 0.01-3 V at a current density of 50 mA g^{-1}.

References

1. M. Fang, K. Wang, H. B. Lu, Y. L. Yang, and S. Nuttb, *J. Mater. Chem.***,** 2010**, 20,** 1982.

2. J. F. Shen, Y. Z. Hu, C. Li, C. Qin, M. Shi, and M. X. Ye, *Langmuir*, 2009, **25**, 6122.