

# Ultrafine Co-species nanodots interspersed g-C<sub>3</sub>N<sub>4</sub> nanosheets and graphene as an efficient polysulfides barrier to enable enhanced Li-S batteries

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**Keywords:** Co-species nanodots; g-C<sub>3</sub>N<sub>4</sub> and graphene; Polysulfides barrier; Chemical adsorption; Catalytic conversion

### **Figures and Tables captions:**

Figure S1. TG curve of S/KB composite.

Figure S2. (a) XRD pattern in the appointed region of CoO@G sample. (b) N<sub>2</sub> adsorption-desorption curve of pure g-C<sub>3</sub>N<sub>4</sub>.

Figure S3. FE-SEM images of (a) g-C<sub>3</sub>N<sub>4</sub>, (b) Co@g-C<sub>3</sub>N<sub>4</sub>/G precursor, (c, d) g-C<sub>3</sub>N<sub>4</sub>/G sample.

Figure S4. XPS survey spectra of pure g-C<sub>3</sub>N<sub>4</sub> sample.

Figure S5. Charge-discharge profiles of Li-S cells with the Co@g-C<sub>3</sub>N<sub>4</sub>/G-PP based separators.

Table S1. Textural parameters of the corresponding samples.

Table S2. Electrochemical performance comparisons of Co@g-C<sub>3</sub>N<sub>4</sub>/G interlayer with other relevant interlayers in recent literatures.

Figure S1

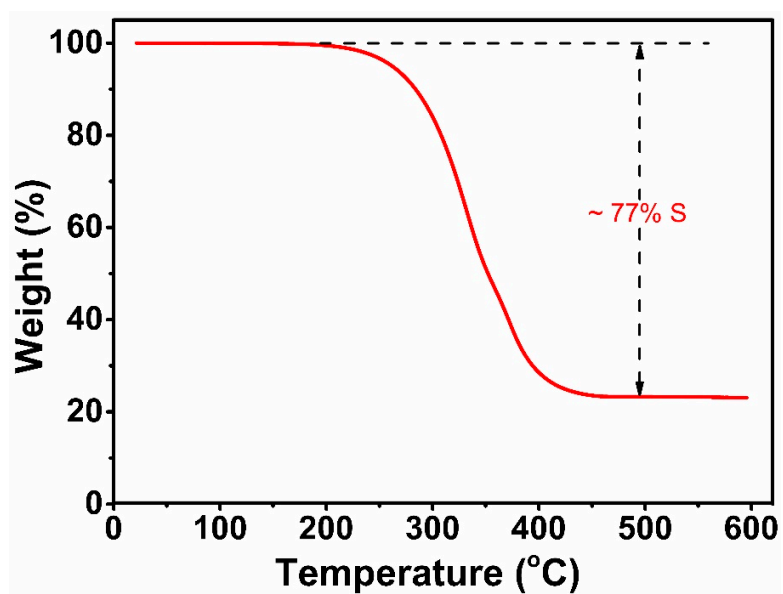


Figure S2

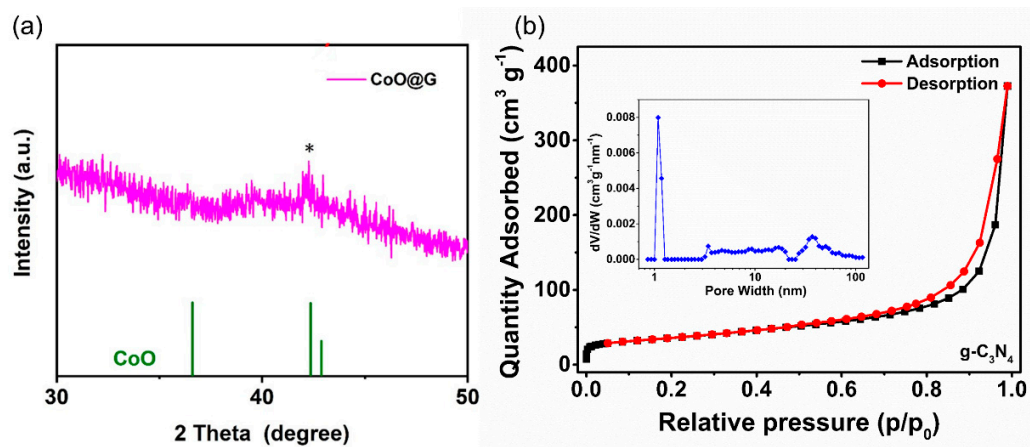


Figure S3

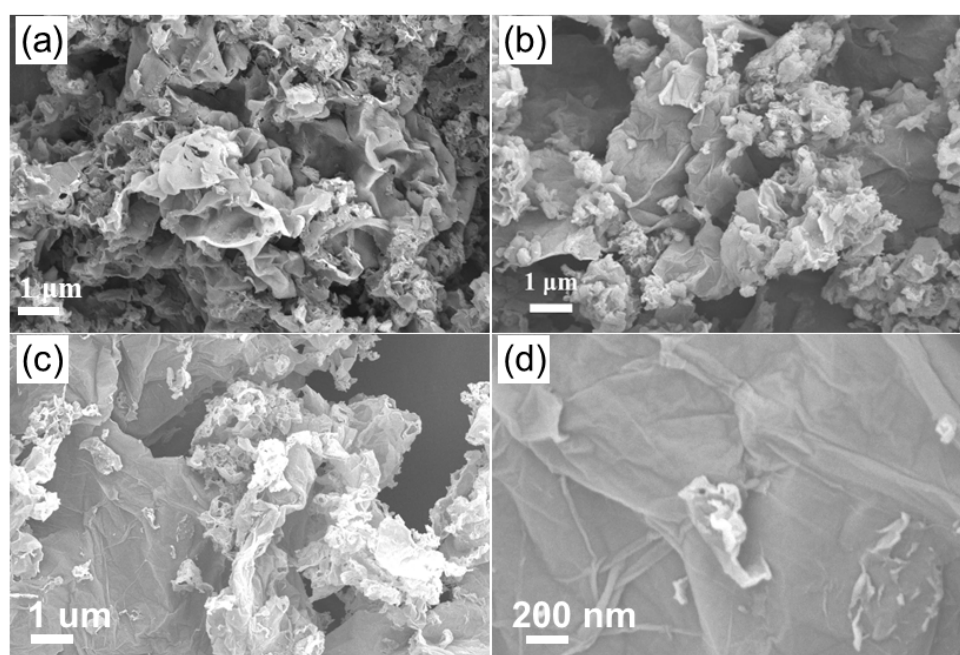


Figure S4

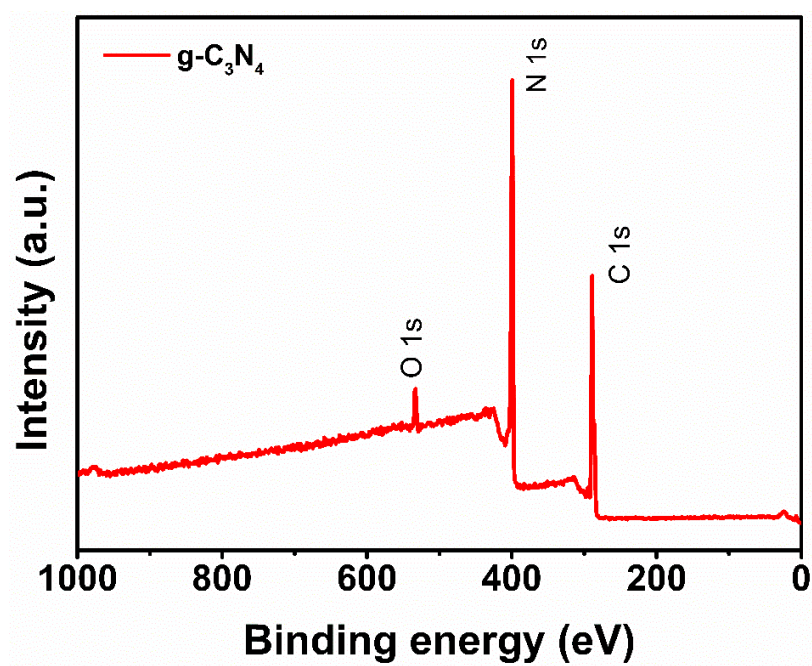


Figure S5

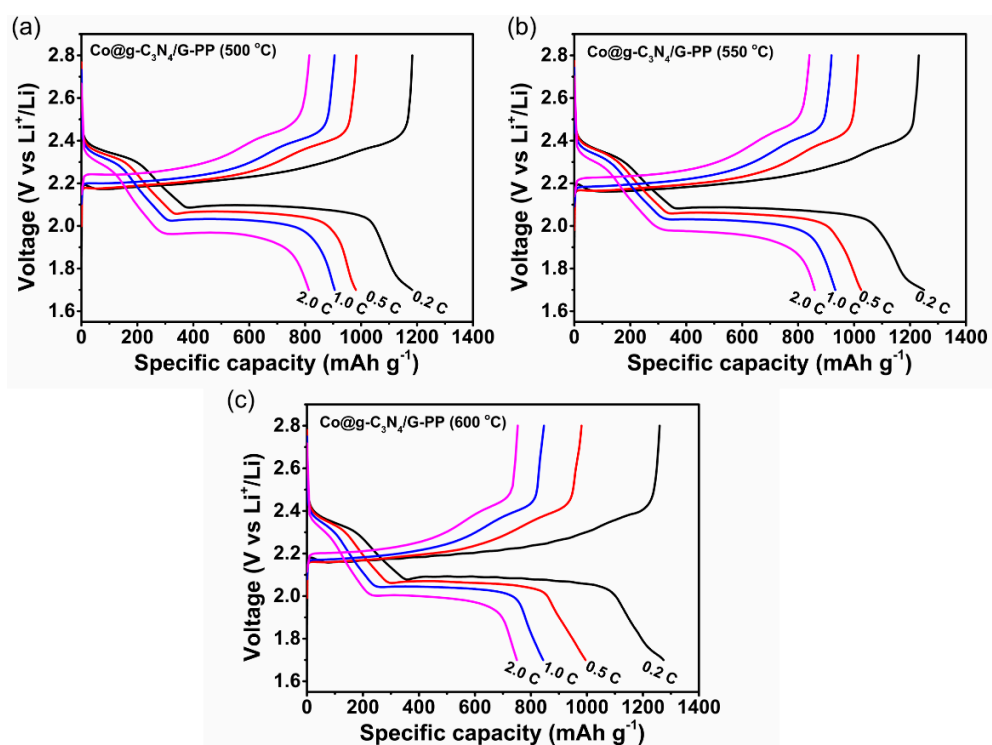


Table S1

<b>Elements Samples</b>	<b>C</b>	<b>N</b>	<b>O</b>	<b>Co</b>
<b>g-C<sub>3</sub>N<sub>4</sub></b>	18.94 %	75.02 %	6.04 %	–
<b>g-C<sub>3</sub>N<sub>4</sub>/G</b>	83.9 %	8.7 %	7.4 %	–
<b>Co@g-C<sub>3</sub>N<sub>4</sub>/G</b>	83.08 %	7.12 %	8.43%	1.37 %



Table S2

Materials	Sulfur final content in cathode	Sulfur coating (mg/cm <sup>2</sup> )	Interlayer coating (mg/cm <sup>2</sup> )	Electrochemical performance (mAh/g)
<b>Co@g-C<sub>3</sub>N<sub>4</sub>/G (This work)</b>	70 wt%	1.3-1.5	0.2	<b>785 after 100 cycles at 0.2 C (3.0 mg/cm<sup>2</sup>)</b> <b>657 after 400 cycles at 1.0 C (0.067 %)</b> <b>815 after 350 cycles at 0.5 C (0.035 %)</b> <b>928 after 250 cycles at 0.2 C (0.043 %)</b>
g-C <sub>3</sub> N <sub>4</sub> /CNT <sup>[S1]</sup>	60 wt%	1.4	0.45	870 after 100 cycles at 0.2 C (0.112 %) 800 after 500 cycles at 1.0 C (0.030 %)
G@g-C <sub>3</sub> N <sub>4</sub> /C/KB <sup>[S2]</sup>	72 wt%	1.0	0.35	770 after 100 cycles at 0.2 C (0.230 %) 475 after 800 cycles at 1.0 C (0.050 %)
MnCo <sub>2</sub> O <sub>4.5</sub> @g-C <sub>3</sub> N <sub>4</sub> /AB <sup>[S3]</sup>	63 wt%	1.3-1,4	-	791 after 100 cycles at 0.2 C (0.250 %) 632 after 400 cycles at 0.5 C (0.096 %) 553 after 500 cycles at 2.0 C (0.032 %)
Co-CN/Super P <sup>[S4]</sup>	60 wt%	1.0	0.3	640 after 250 cycles at 2.0 C (0.020 %) 719 after 100 cycles at 0.2 C (3.0 mg/cm <sup>2</sup> )
g-C <sub>3</sub> N <sub>4-x</sub> /CNT <sup>[S5]</sup>	58.6 wt%	-	-	755 after 100 cycles at 0.2 C (0.310 %) 567 after 500 cycles at 1.0 C (0.067 %)
CoS@g-C <sub>3</sub> N <sub>4</sub> /KB <sup>[S6]</sup>	70 wt%	1.3-1.5	0.07	600 after 250 cycles at 0.1 C (4.0 mg/cm <sup>2</sup> ) 572 after 500 cycles at 1.0 C (0.03%)
Ni-C <sub>3</sub> N <sub>4</sub> /C <sup>[S7]</sup>	64 wt%	2.8	0.5	893 after 300 cycles at 0.3 C (0.035%)
FeOOH/C <sub>3</sub> N <sub>4</sub> /KB <sup>[S8]</sup>	64 wt%	1.2-1.5	0.6	444 after 900 cycles at 1.0 C (0.055 %) 570 after 500 cycles at 1.0 C (0.080 %)
N-C-Co film <sup>[S9]</sup>	60 wt%	1.5	0.24	660 after 250 cycles at 1.0 C (0.101 %) 735 after 250 cycles at 1.0 C (0.133 %)
BCN/CB <sup>[S10]</sup>	52.5 wt%	1.2	0.5-0.6	553 after 500 cycles at 1.0 C (0.090 %) 760 after 300 cycles at 0.5 C (0.110 %)

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