Electronic Supplementary Information

Graphene sheets decorated with SnO_2 nanoparticles: in-situ synthesis and highly efficient material for cataluminescence gas sensor

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I Experimental Section

The Preparation of Graphite oxide:

Graphite oxide was synthesized from graphite powder (SP grade, Tianjin Guangfu Fine Chemical Research Institute) by a modified Hummers method.[1 2] The graphite was first pretreated in order to fully oxidize it to graphite oxide (GO). To accomplish this $K_2S_2O_8$ (2.5 g) and P_2O_5 (2.5 g) were added to concentrated H_2SO_4 (12 ml) preheated to 353 K with stirring until all of the reactants were completely dissolved. Graphite powder (3g) was then added to the H_2SO_4 solution resulting in bubbling which subsides within 30 minutes. The mixture was kept at 353 K for 4.5 hours using a water bath after which the mixture was cooled and diluted with 0.5 L of DI water and left overnight. The following day the mixture was filtered and washed using a 0.22 micron Nylon Millipore filter to remove all traces of acid. The solid is transferred to a drying dish and allowed to dry in air overnight. For the oxidation step, H_2SO_4 (120ml) was chilled to 273 K using an ice bath. The pretreated graphite was then added to the acid and stirred. $KMnO_4$ (18 g) was added slowly and allowed to dissolve with the aid of stirring, while the temperature was closely monitored so as to control the temperature of the mixture below 283 K. This mixture is then allowed to react at 308 K for 2 hours after which distilled water (250ml) is added, initially with dropwise addition. Since the addition of the water causes the temperature of the mixture to rise rapidly, water addition was carried out in an ice bath so that the temperature does not climb above 323 K. After adding the 250 ml DI water, the mixture was stirred at 348 K for 2 hours at which time 0.7 L DI water was added. Shortly after the dilution with 0.7 L DI water, 30ml 30% H_2O_2 was added to the mixture resulting in a brilliant yellow color along with bubbling. The mixture was allowed to settle for at least a day after which the clear supernatant is decanted. The remaining mixture filtered and washed using a 0.22 micron Nylon Millipore with a total of 1 L of 10% HCl solution followed by 1 L of DI water to remove the acid. The resulting solid was dried in air and diluted to make a 0.5 mg/L dispersion that was put through dialysis for 2 weeks to remove any remaining metal, then the dispersion was filtered and the product was dried in the vacuum at room temperature for 12 h.

□ O 1s XPS Analysis

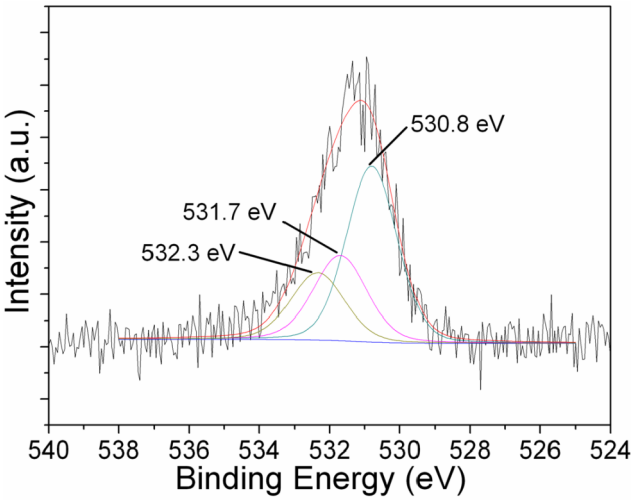

Figure S1: O 1s XPS spectra of SnO_2/graphene composite

□ CTL Response Profiles

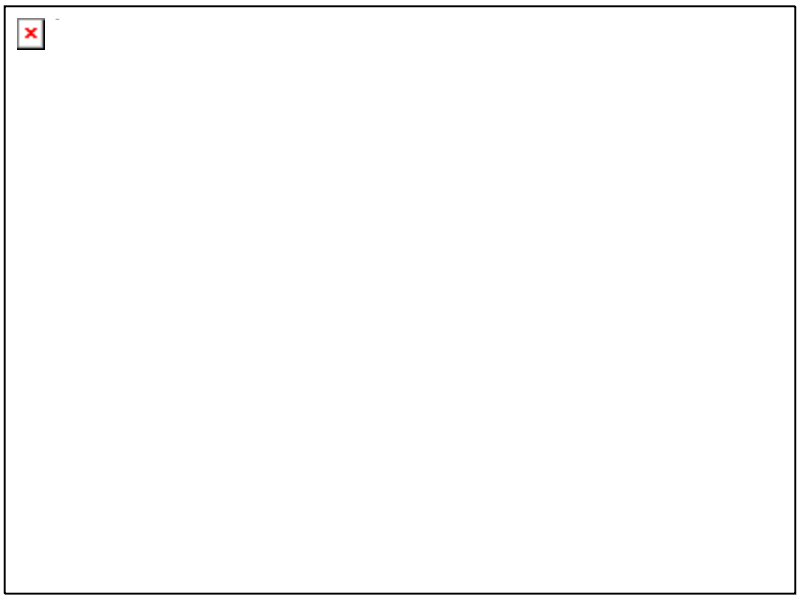

Figure S2: CTL response profiles of the SnO_2/graphene composite to propanal with different concentrations. The flow rate of carrier gas: 300 mL min^{-1}; Temperature: 493 K.

Ⅳ TEM image and corresponding SAED pattern of pure SnO_2

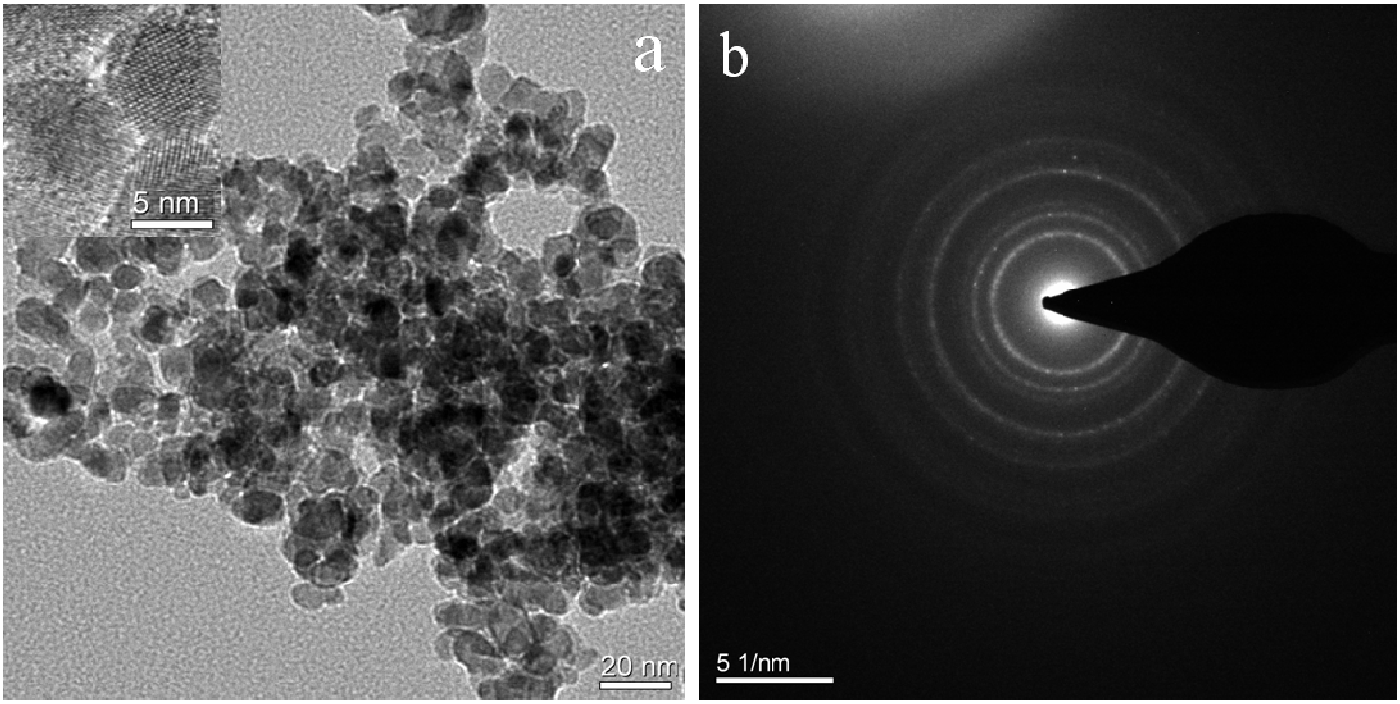

Figure S3: (a) TEM image and high magnification TEM image (inset) of pure SnO_2; (b) The corresponding SAED pattern of pure SnO_2.

Ⅴ Optimal CTL Sensing Conditions

The sensing conditions of the composite-based CTL senor to propanal were optimized by choosing proper temperature and carrier gas flow rate. Figure S4 and Figure S5 show the dynamic signals and the Signal/Noise ratios of the propanal sensor in the temperature range of 473-573 K, with an air flow rate in the range of 100-400 mL min^{-1}. In terms of higher Signal/Noise ratio, 513 K and 300 mL min^{-1} air flow rate were selected for the following use.

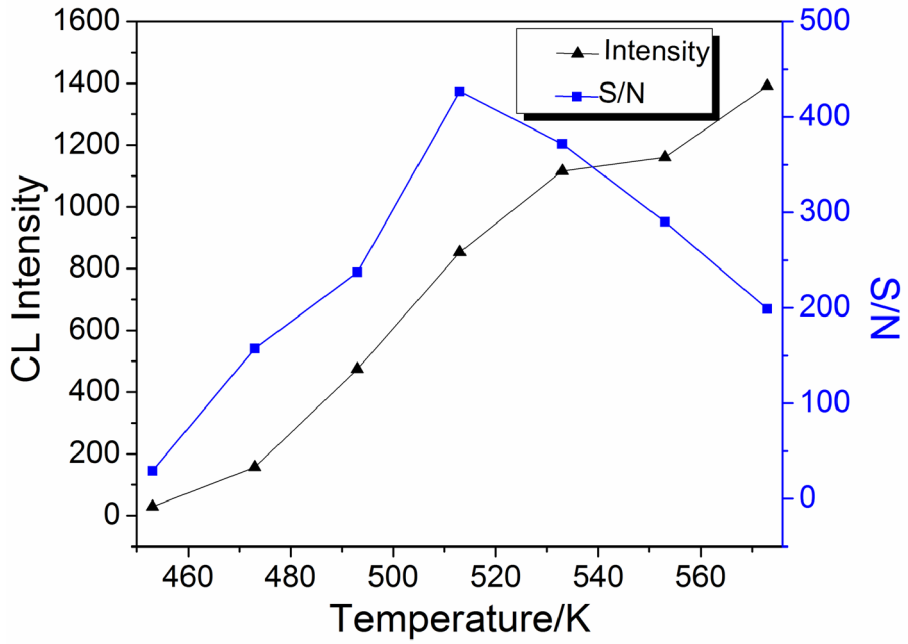

Figure S4: The temperature dependence of CTL intensity and S/N of the CTL sensor. The concentration of propanal: 26.67 μg mL^{-1}; The flow rate of carrier gas: 300 mL min^{-1}.

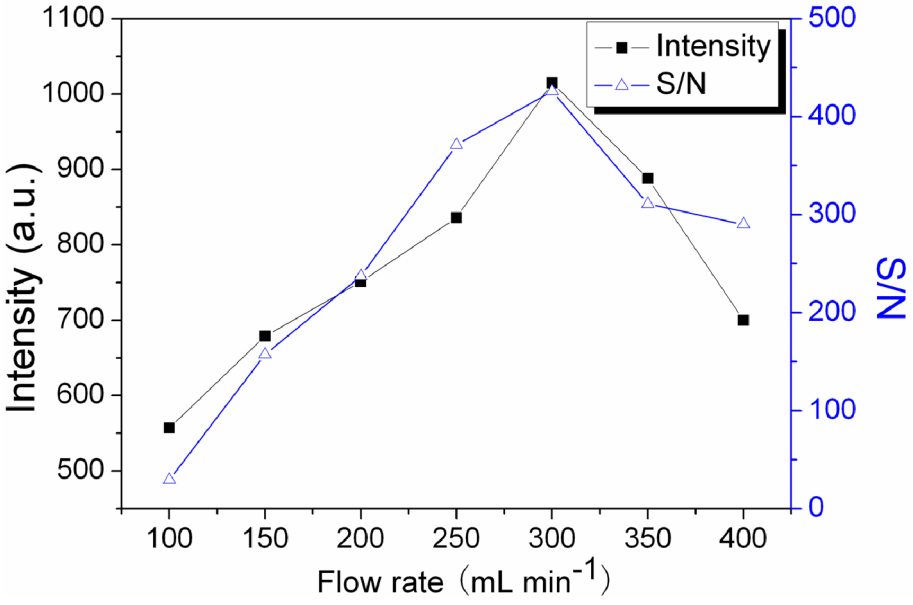

Figure S5: Effect of carrier gas flow rate on the CTL intensity and S/N. The concentration of propanal: 26.67 μg mL^{-1}; Temperature: 513 K.

References

1. J. Hu, K. L. Xu, Y. Z. Jia, Y. Lv, Y. B. Li and X. D. Hou, *Analytical Chemistry*, 2008, **80**, 7964-7969.

2. S. Gilje, S. Han, M. Wang, K. L. Wang and R. B. Kaner, *Nano Letters*, 2007, **7**, 3394-3398.