
Supporting Information of the Manuscript

Platinum nanoparticles supported on defective tungsten bronze-type $KSr_2Nb_5O_{15}$ as novel photocatalyst for efficient ethylene oxidation

Wei Zhang,[a,b] Xiaoyang Pan,[a] Peiqing Long,[a] Xitao Liu,[a] Xia Long,[a] YingYu,[b*] and Zhiguo Yi[a,c*]

[a] CAS Key Laboratory of Design and Assembly of Functional Nanostructures & Fujian Provincial Key Laboratory of Nanomaterials, Fujian Institute of Research on the Structure of Matter, Chinese Academy of Sciences, Fuzhou 350002, China.

* Corresponding author E-mail: zhiguo@firsm.ac.cn

[b] Institute of Nanoscience and Nanotechnology, College of Physical Science and Technology, Central China Normal University, Wuhan 430079, China.

[c] University of Chinese Academy of Sciences, Beijing 100049, China

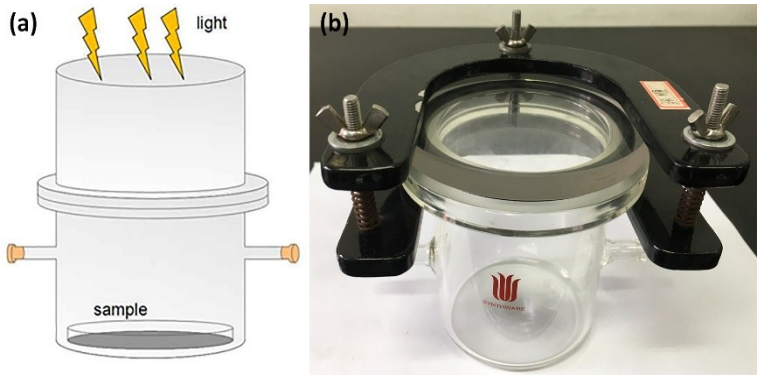

Fig. S1 Reactor used for the photo-oxidation of ethylene in a fixed-bed mode.

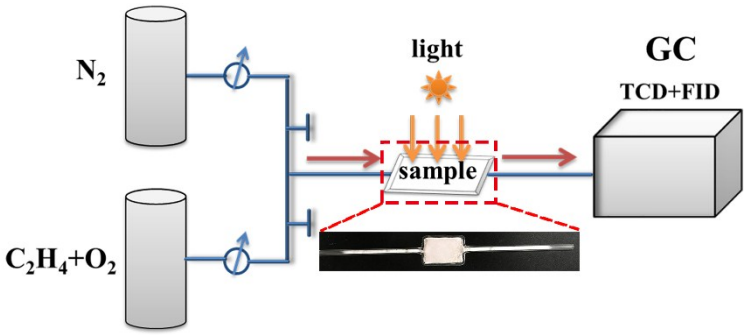

Fig. S2 Reactor used for the photo-oxidation of ethylene in a flow-bed mode.

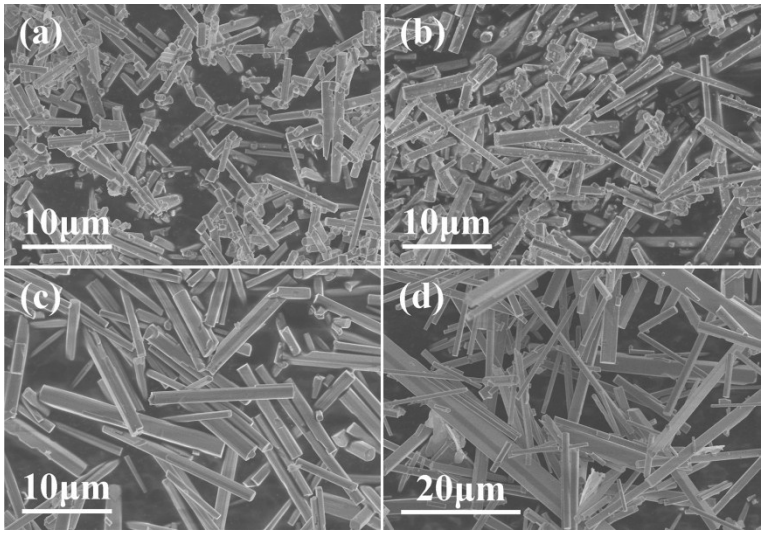

Fig. S3 low-magnification FESEM images of the KSNO samples prepared at 1200 °C with different reaction time: (a) 1 h; (b)3 h; (c) 6 h; (d) 12 h.

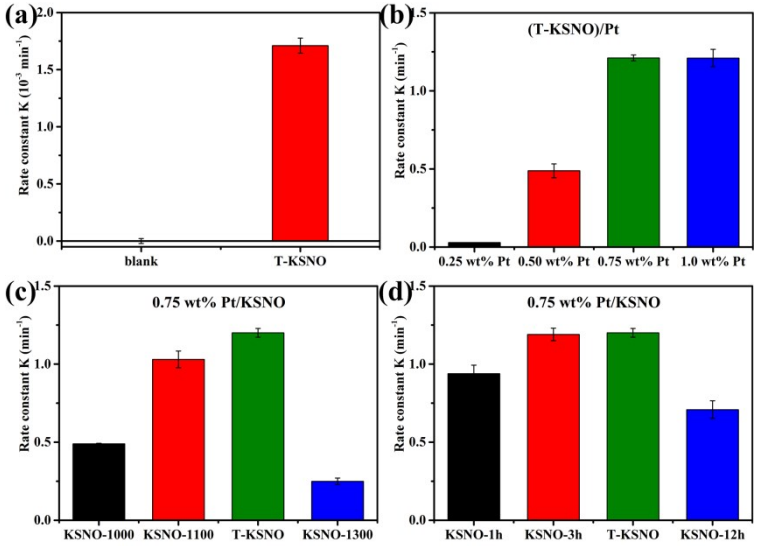

Fig. S4 Photo-oxidation activity of C_2H_4 on Pt/KSNO nanocomposites (a-c) and KSNO (d).

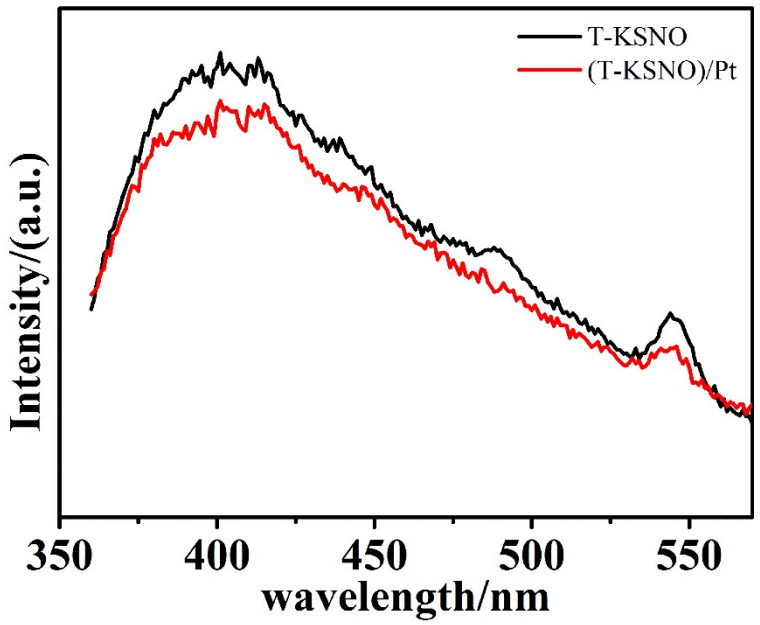

Fig. S5 The room-temperature PL spectra of T-KSNO and (T-KSNO)/Pt (0.75 wt %) samples.

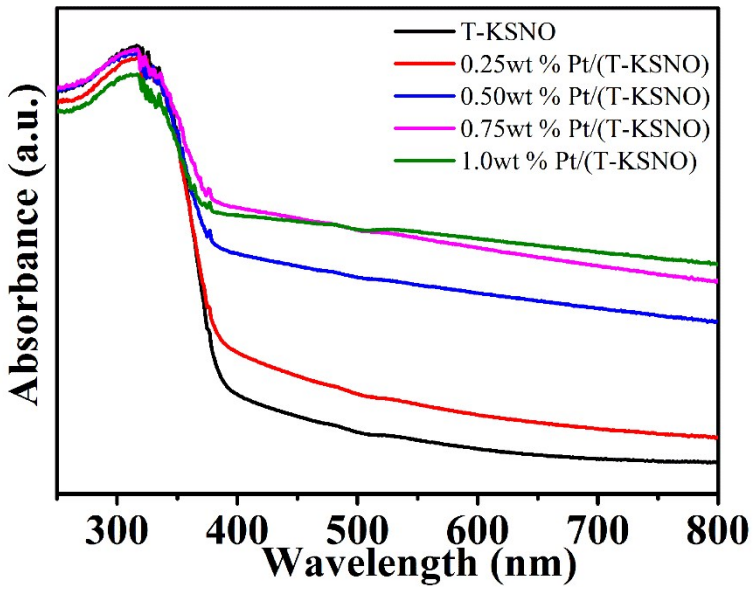

Fig. S6 UV−vis diffuse reflectance spectra of the samples.

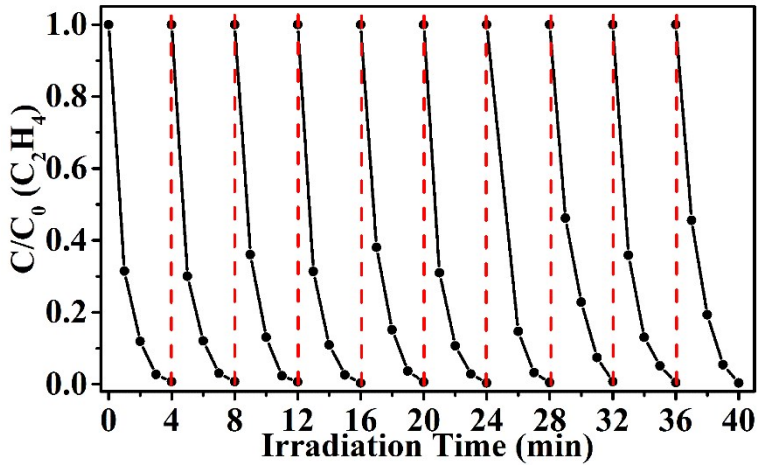

Fig. S7 recycled testing of C_2H_4 photo-oxidation upon the (T-KSNO)/Pt (0.75 wt %) samples under the simulated solar light irradiation.

Note: Turnover number (TON) calculations

Reaction formula: $C_2H_4 + 3O_2 \rightarrow 2CO_2 + 2H_2O$

The number of electrons gain and loss in the reaction: $12 \cdot e^{-1}$

The amount of substance of 0.9 mL C_2H_4: $n_1 = 4.018 \times 10^{-5}$ mol

The total amount of substance of electrons gain and loss in the photo-oxidation of 0.9 mL C_2H_4:

$n_2 = 12 \times n_1 = 4.821 \times 10^{-4}$ mol

For the 0.2 g (T-KSNO)/Pt (0.75 wt%):

The amount of substance (T-KSNO)/Pt: $n_3 = 2.176 \times 10^{-4}$ mol

For (T-KSNO)/Pt, the Turnover number (TON): $n = {}^{n_2}/_{n_3} = 2.216$

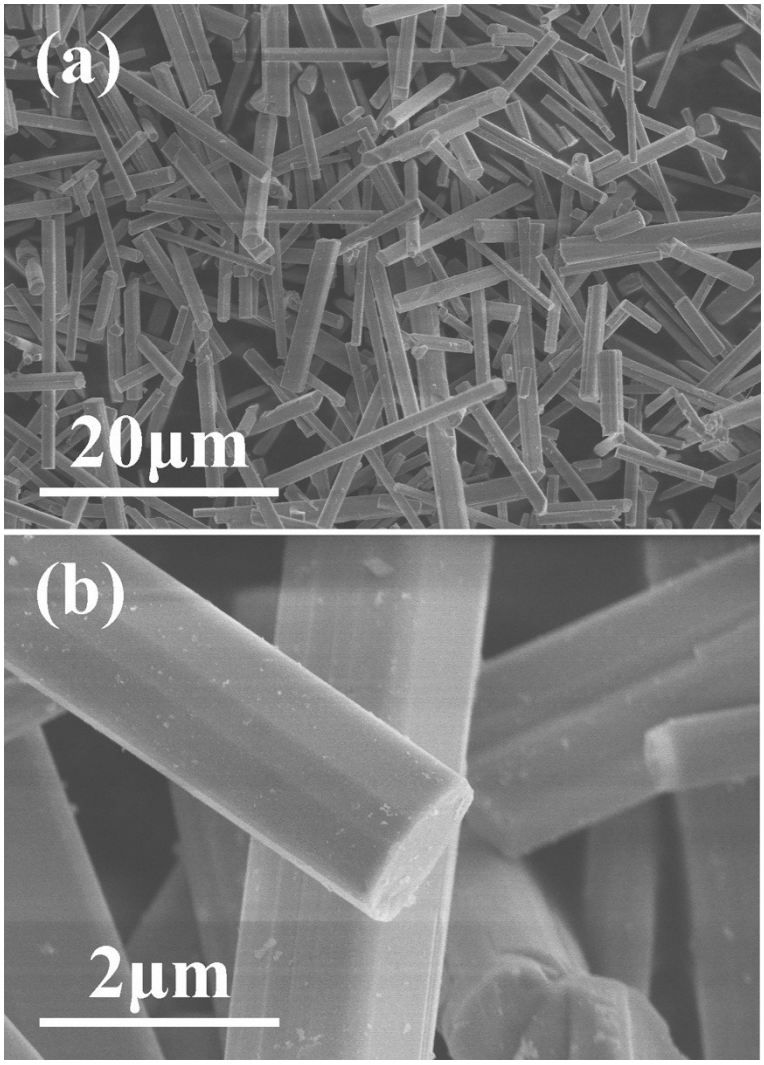

Fig. S8 FESEM images of (T-KSNO)/Pt (0.75 wt %).

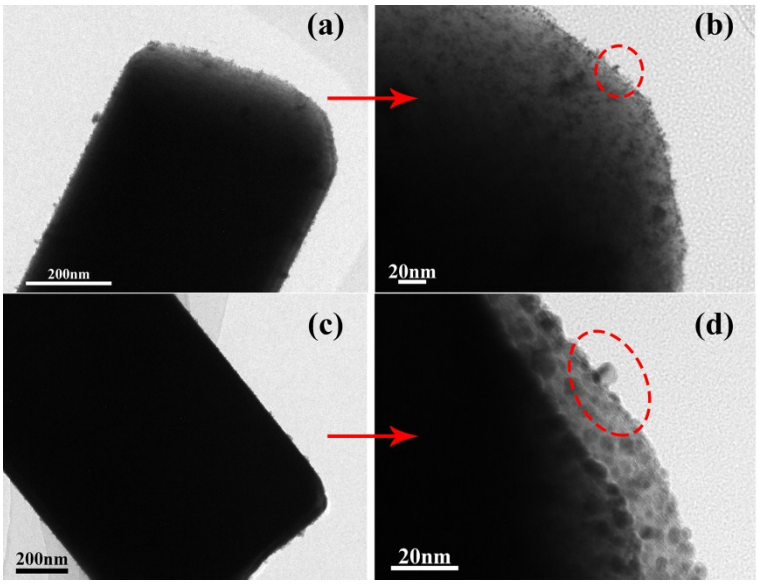

Fig. S9 TEM images of (T-KSNO)/Pt (0.75 wt %): (a) and (c) are low-magnification TEM images; (b) and (d) are partial enlarged images from (a) and (c), respectively.

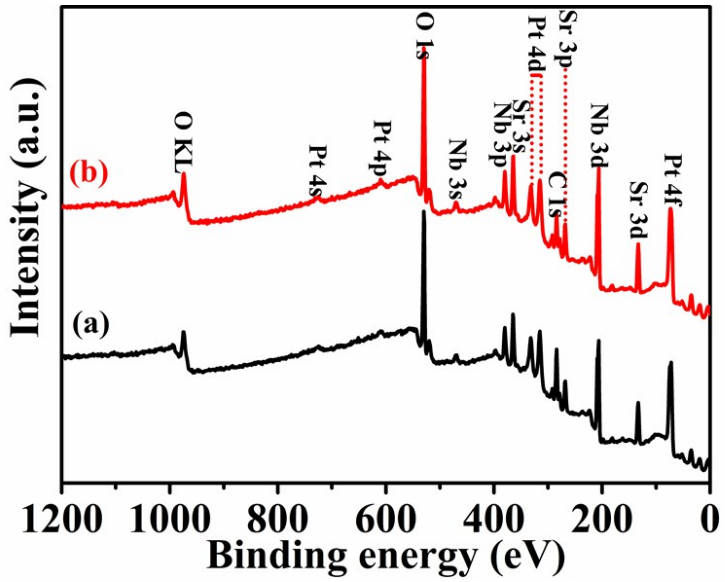

Fig. S10 XPS survey spectra of (T-KSNO)/Pt (0.75 wt %): before catalytic test (a) and after catalytic test (b).

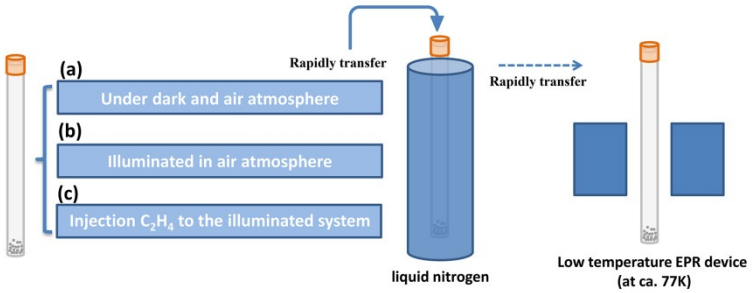

Fig. S11 Schematic illustration for EPR test process.

The method of EPR test:

The schematic illustration of EPR test is shown in Fig. S10. Typically, the as-synthesized (T-KSNO)/Pt sample was put into quartz EPR sample tube. Subsequently, EPR spectra were collected upon the same sample at 77 K under the following three conditions in proper order: (1) in dark and air atmosphere; (2) in air atmosphere after illumination; (3) inject C_2H_4 to the illuminated system. Furthermore, the sample was immediately put into a liquid nitrogen container after step 1, as shown in Fig. S10.

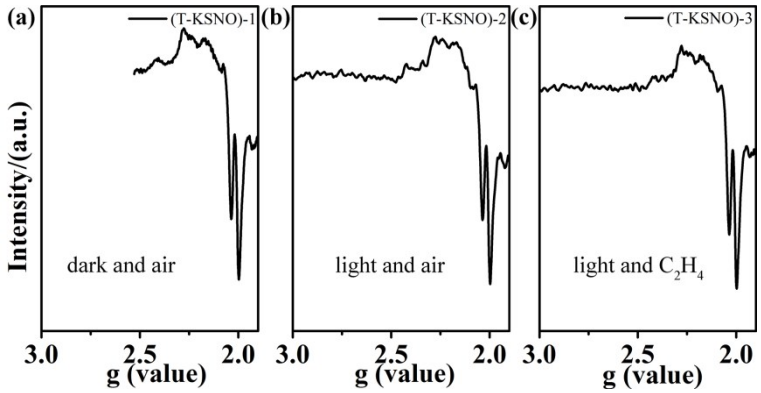

Fig. S12 EPR spectra collected upon the T-KSNO sample at 77 K under various conditions: (a) dark and air, (b) under irradiation and air, and (c) under irradiation and inject C_2H_4.