Supporting Materials

1. The growth mechanism of different reaction conditions

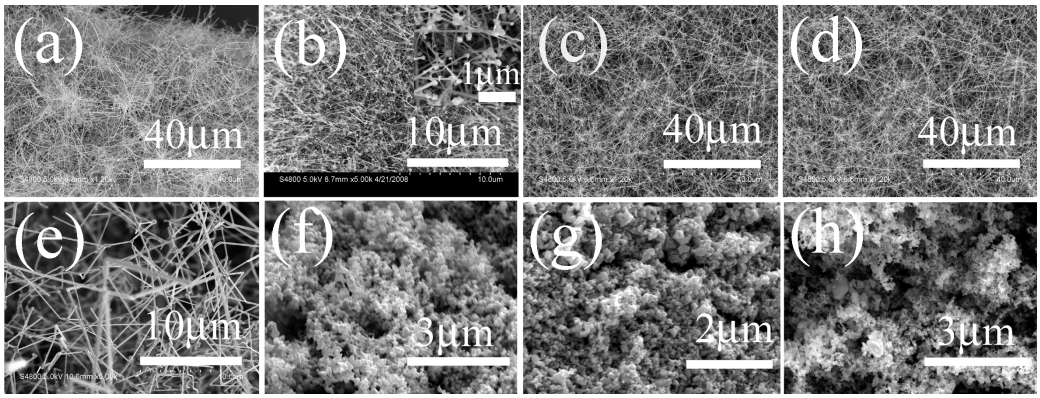

Figure S1: The morphology of SnO_2 products under 150 sccm argon carrier gas and (a) 5 sccm oxygen and at 900 ^oC, (b) 5 sccm oxygen and at 1100 ^oC, (c) 10 sccm oxygen and at 800 ^oC, (d) 10 sccm oxygen and at 900 ^oC, (e) 10 sccm oxygen and at 1100 ^oC, (f) 20 sccm oxygen and at 800 ^oC, (g) 20 sccm oxygen and at 900 ^oC, and (h) 20 sccm oxygen and at 1100 ^oC.

Figure S1 shows the morphology of SnO_2 products under different reaction conditions: products with morphology of particle instead of nanowire (Figs. S1f-S1h) were obtained with high oxygen flow (20 sccm); SnO_2 nanowries were only appeared in appropriate reaction condition (Figs. S1a-S1e).

SnO_2 nanowires with tips on the head were obtained under 5 sccm oxygen carrier gas and 1100 ^oC (Fig. S1b, and inset in Fig. S1b), and nanojunctions with the first and the second branch growth were appeared under 10 sccm oxygen carries gas and 1100 ^oC (Fig. S1e), both of them suggesting a self-catalytic VLS mechanism.

Nanowires without tips or junctions (Figs. S1a, S1c and S1d) occur under low oxygen flows (5 or 10 sccm) and low reaction temperature (800 or 900 ^{o}C), which suggests a VL growth mechanism. Yet, if reaction takes place under 5 sccm oxygen flow and 800 ^{o}C, the amount of products was too small to be collected.

2. PL of products under different reaction conditions

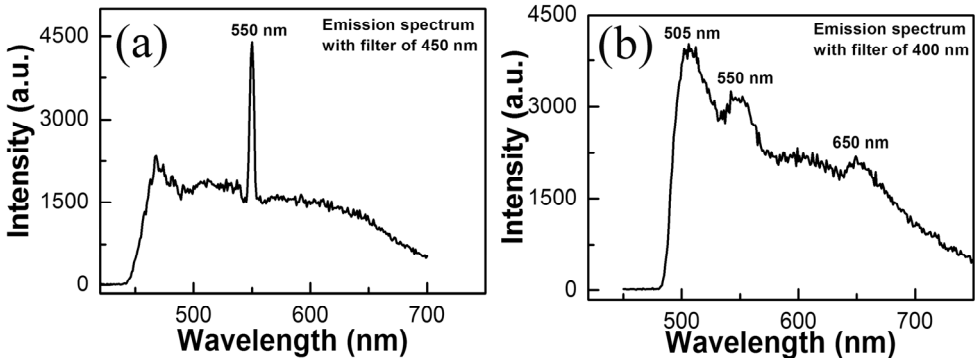

Figure S2: PL spectra of products obtained: (a) 10 sccm oxygen flow and 800 ^{o}C, and (b) 20 sccm oxygen flow and 1100 ^{o}C.

According to the previous reports, there exist two kinds of surface oxygen vacancies (100º nad 130º coordinated). PL at 2.48 eV (~500 nm) is connected with the surface oxygen vacancies of 130º coordinated, while PL at 2.20 eV (~560 nm) and 1.98 eV (630 nm) to 100º coordinated vacancies. 100º coordinated oxygen vacancies are present at low temperature whereas 130º coordinated one at high temperature. [S1] As shown in supporting materials, our results reveal that only one PL peak at about 550 nm appeared at reaction temperature at 800 ^{o}C. And PL of 500 nm appeared in the products obtained from high temperature of 1100 ^{o}C.

3. Raman spectra of products

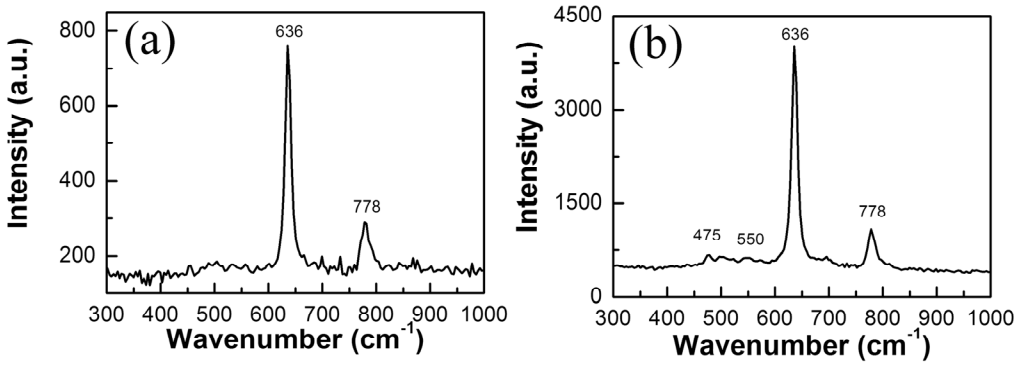

Figure S3: Raman spectra of products obtained: (a) 10 sccm oxygen flow and 800 ^{o}C, and (b) 20 sccm oxygen flow and 1100 ^{o}C.

Raman peaks at 475, 636 abd 778 cm-1 are three fundamental vibrations, which separately correspond to the Eg, A1g and B2g modes. The 475 peak in Figure S3a is too weak to be observed. And the 550 peak appears in Fig. S3b, which is suggested that the consequence of the disorder activation of SnO_2 nanostructure. [S2]

4. The time-resolved PL decay curve of the SnO_2 nanwires

The time-resolved PL decay curves of 550 nm (Fig. S4) at room temperture was found that the lifetime 1.06 ns, which was investigated by the a fluorescence spectrophotometer (Edinburgh FLS920) with a 450W xenon lamp as the light source. The lifetime is rather short and predicts that number of the defects is not large.

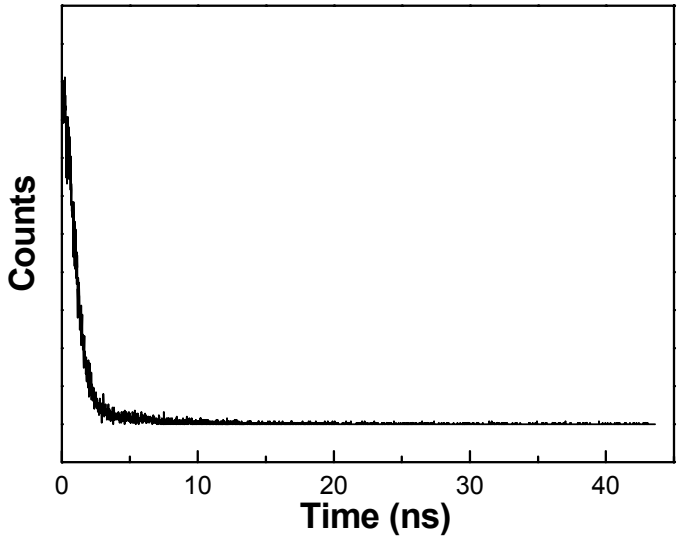

Figure S4 Time-resolved PL decay curves of the samples

Reference

[S1] J. D. Prades, J. Arbiol, A. Cirera, J. R. Morante, M. Avella, L. Zanotti, E. Comini, G. Faglia, G. Sberveglieri, Sensors Actua. B, 2007, 126, 6-12.

[S2] B. Wang, Y. H. Yang, C. X. Wang, N. S. Xu, G. W. Yang, J. Appl. Phys. 2005, 98, 124303.