Supporting information for

Photo-synergistic promoted in-situ generation of Bi^0-BiSbO$_4$

nanostructure as efficient catalyst for nitrobenzene reduction

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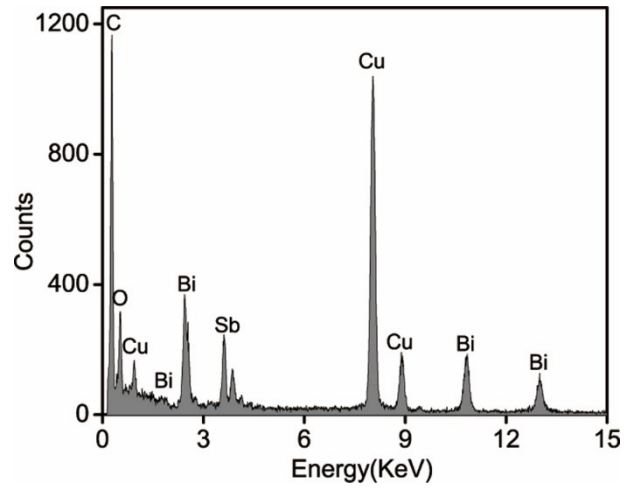Inner Mongolia 010021, P. R. China

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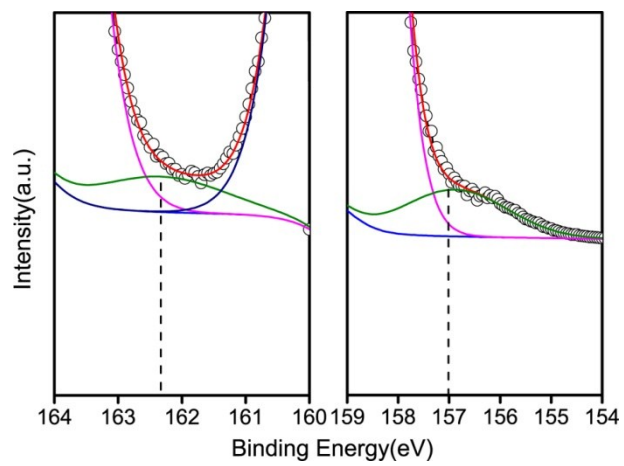
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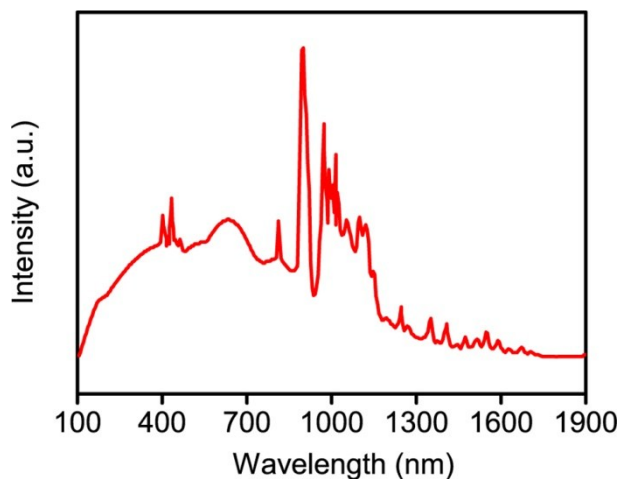
Fig. S1. Spectral range of the Xe lamp (300 W, Perfectlight Technology Co. Ltd.,
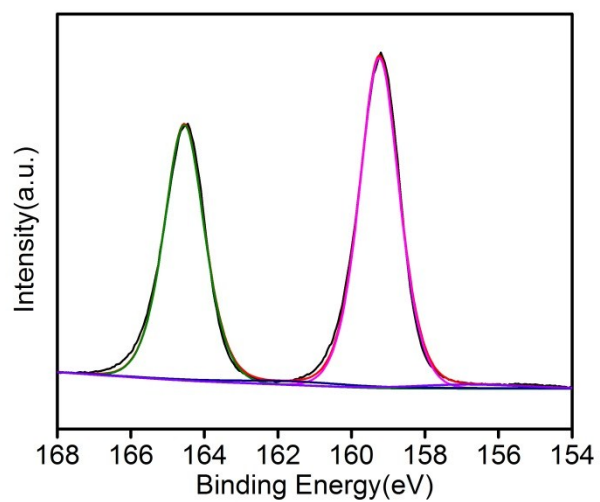
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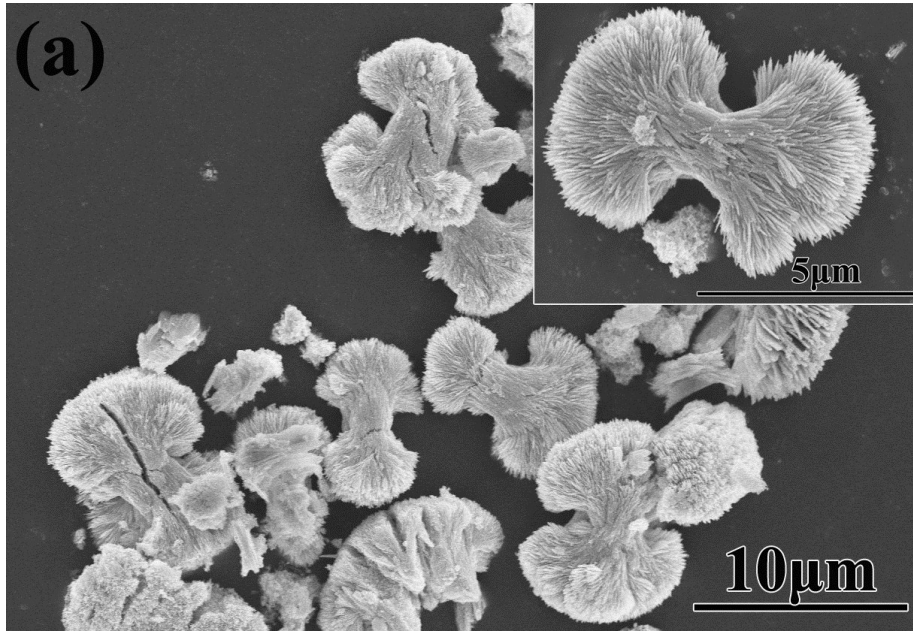
Fig. S2. SEM image of Bi^0-$BiSbO_4$ (Bi^0/Bi^{3+} = 2.72 mol%).
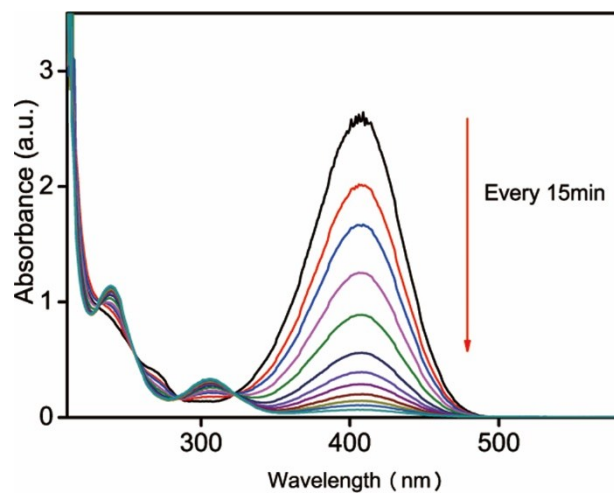
Fig. S3. EDS data of Bi^0-$BiSbO_4$ (Bi^0/Bi^{3+} = 2.72 mol%) sample.
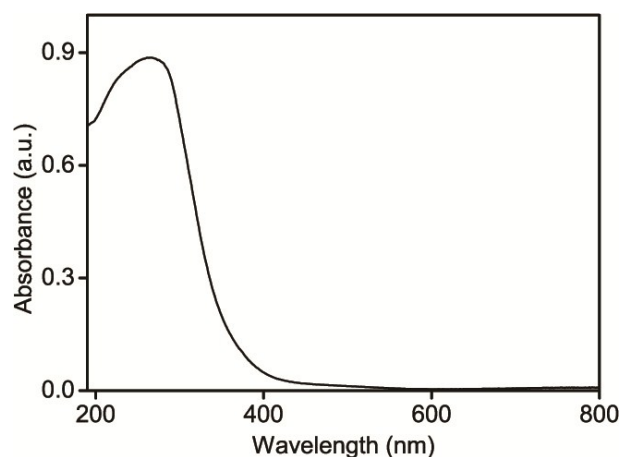
Fig. S4. Enlarged XPS spectra of Bi 4f signal.

Fig. S5. Bi 4f XPS spectrum of Bi^0-$BiSbO_4$ (Bi^0/Bi^{3+} = 2.05 mol%) without light irradiation during the reduction of 4-nitrophenol.

Fig. S6. UV-vis absorption spectrum recorded during the catalytic reduction of 4-nitrophenol over $BiSbO_4$ at 25 °C in dark.

Fig. S7. UV-vis diffuse reflectance spectrum of $BiSbO_4$.

The conduction band edge energy of a semiconductor at the point of zero charge can be expressed by

$$E_{CB} = X - 0.5E_g$$

Where E_{CB} is the conduction band edge potential and X is the Mulliken electronegativity of the semiconductor, which is the geometric mean of the electronegativities of the constituent atoms. E_g is the band gap energy of $BiSbO_4$ nanoparticles, which is determined to be 3.40 eV from Fig. S7. The Mulliken electronegativity of an atom is the arithmetic mean of the atomic electron affinity and the first ionization energy. According to this expression, the rough conduction band potential was determined to be 4.64 eV with respect to absolute vacuum energy. On the basis of the relationship between the absolute vacuum energy and the normal electrode potential, the conduction band potential was estimated to be 0.14 V versus NHE.
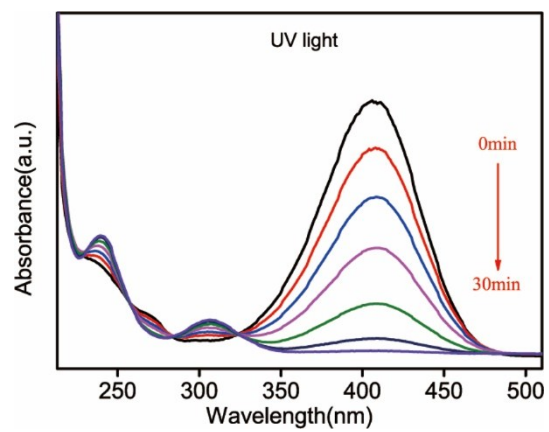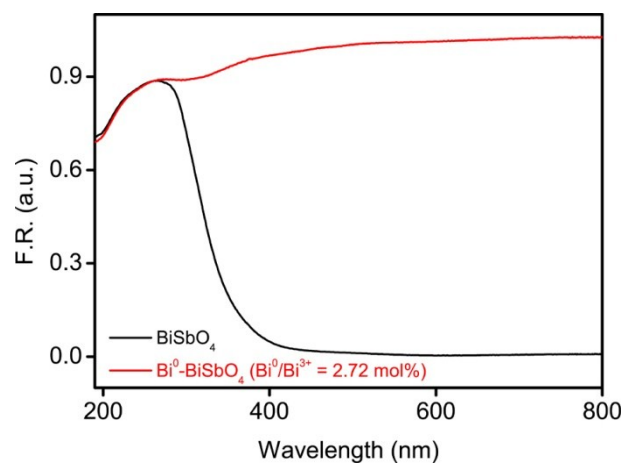
Fig. S8. UV-vis absorption spectrum recorded during the catalytic reduction of 4-nitrophenol over $BiSbO_4$ at 25 °C under UV light irradiation.
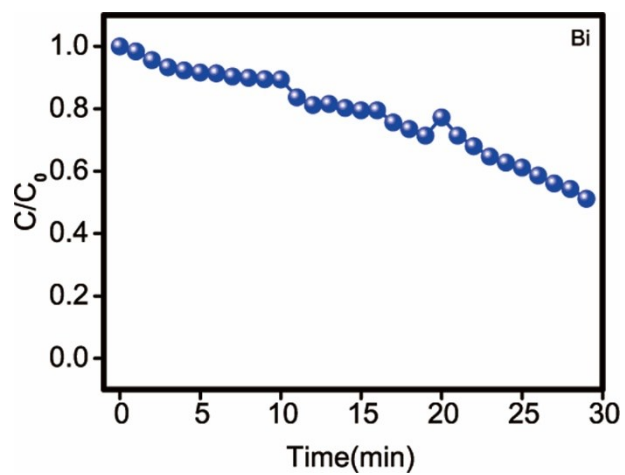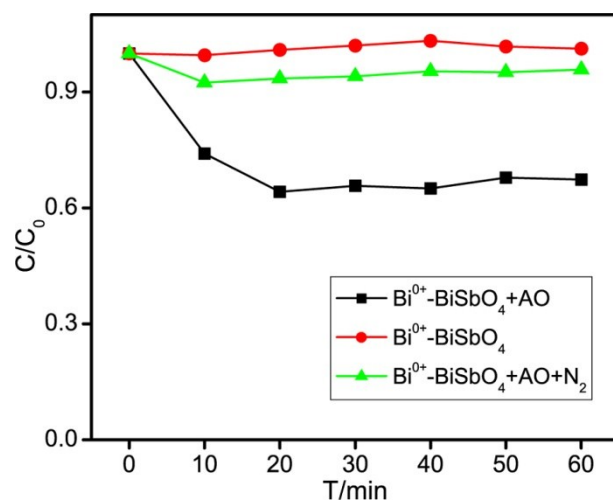
Fig. S9. Residual fraction of 4-nitrophenol as a function of reaction time and the relationship between C/C_0 and reaction time at the presence of bare Bi nanoparticles.

Fig. S10. UV-vis diffuse reflectance spectrum of $BiSbO_4$ and Bi^0-$BiSbO_4$.

Fig. S11. Photocatalytic reduction of 4-nitrophenol under different conditions, where ammonium oxalate (AO) is the hole scavenger and N_2 is used to minimized the influence of O_2.
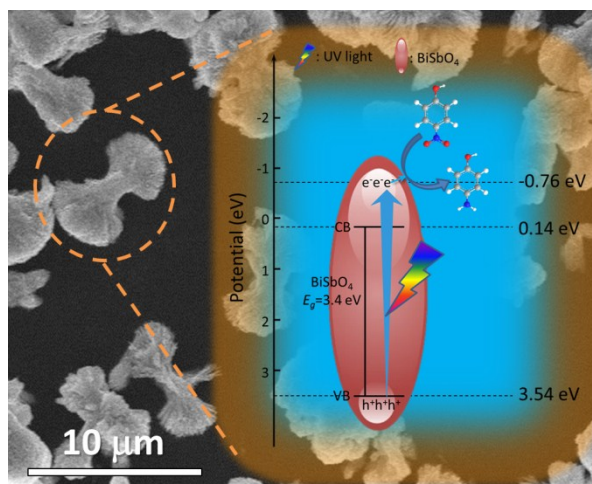
Fig. S12. Schematic illustration of the photo-synergistic catalytic reaction of BiSbO$_4$ for the reduction of 4-nitrophenol to 4-aminophenol under a Xe lamp light irradiation.
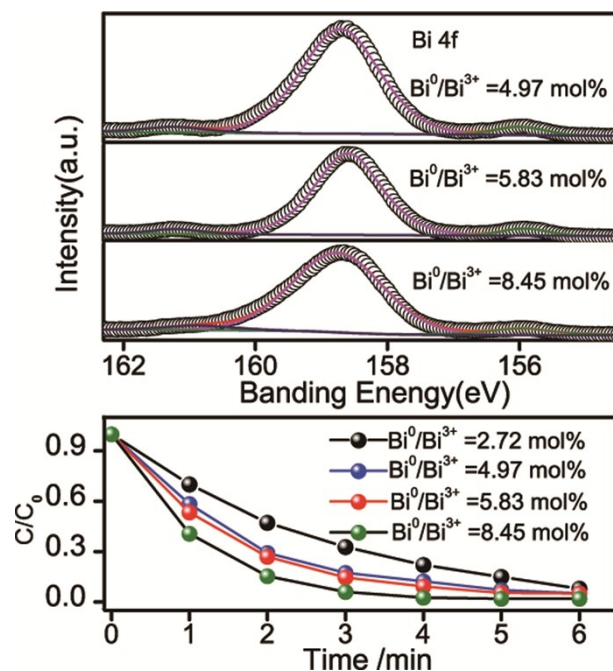
Fig. S13. XPS signal of Bi 4f for Bi^0-$BiSbO_4$ with different Bi^0 content. Residual fraction of 4-nitrophenol as a function of reaction time over Bi^0-$BiSbO_4$ catalyst with different Bi^0 content.

Bi^0-$BiSbO_4$ nanostructure with higher Bi^0 content was prepared similar to that of Bi^0-$BiSbO_4$ nanostructure (Bi^0/Bi^{3+} = 2.05 mol%). Since the Bi^0-$BiSbO_4$ nanostructure (Bi^0/Bi^{3+} = 2.05 mol%) was prepared at 25 ^oC by a Xe lamp light irradiation. The Bi^0-$BiSbO_4$ nanostructure with higher Bi^0 content was prepared at 35, 45 and 55 ^oC by a Xe lamp light irradiation. The corresponding XPS spectra of Bi 4f for all samples were shown in Fig. S13. From Fig. S13, it is clearly to see that a XPS signal appeared at 157.02 eV being related to metallic Bi^0 nanoparticles. The surface Bi^0/Bi^{3+} molar ratios were also determined by XPS spectra, which is shown in Fig. S13.