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Electronic Supplementary Material for

"Photocatalytic oxidation of thiophene on $BiVO_4$ with dual co-catalysts Pt and RuO_2 under visible light irradiation using molecular oxygen as oxidant"

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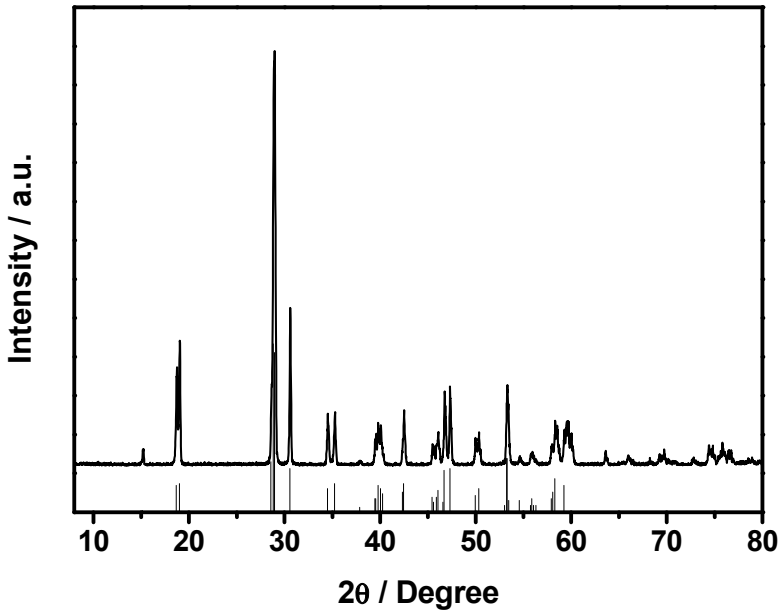

Fig. S1 XRD pattern of $BiVO_4$ prepared by hydrothermal method.

Fig. S1 shows the XRD pattern of $BiVO_4$ prepared by hydrothermal treatment at 200℃ for 24 h. The XRD pattern of $BiVO_4$ was assigned to monoclinic scheelite $BiVO_4$ which is in good agreement with the standard card of No. 14-0688 (space group: I2/a, a = 5.195, b = 11.701, c = 5.092, β = 90.38). This result indicates that the as-prepared $BiVO_4$ contained no other metal oxides (other than $BiVO_4$)。 Characteristic diffraction peaks located at 15.1°, 18.6°, 18.9°, 28.6°, 28.8°, 28.9°, and 30.5°, which were all ascribed to the monoclinic scheelite $BiVO_4$.

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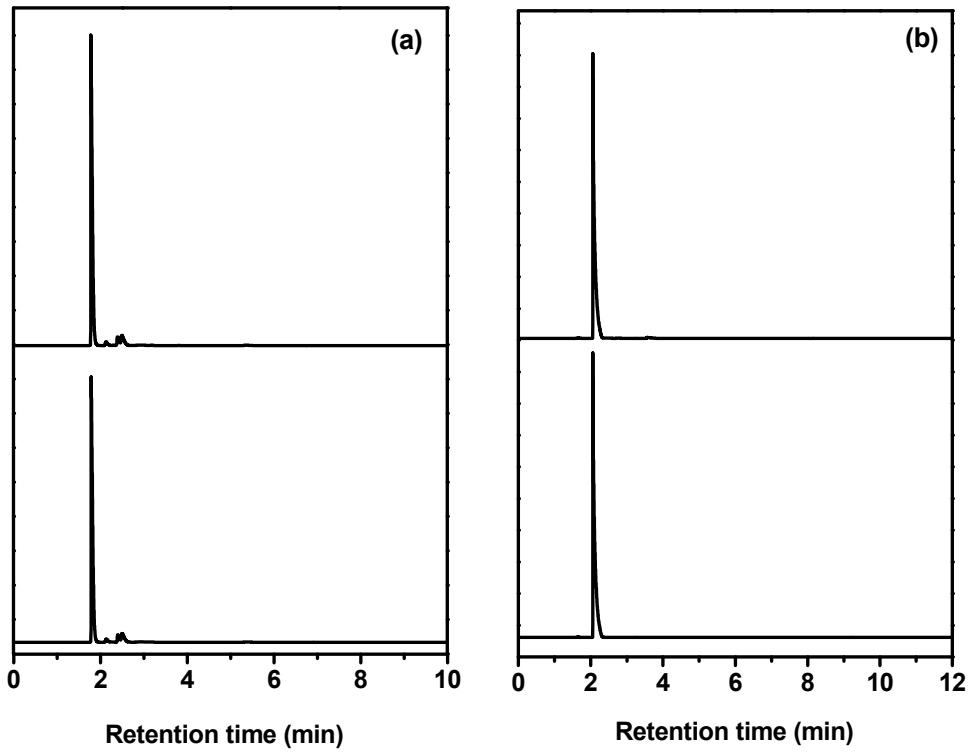

Fig. S2 GC-FID chromatogram for the photocatalytic oxidation of (a) cyclohexene (b) toluene. The upper curve shows the chromatogram after oxidation; The lower curve shows the chromatogram before oxidation; Reaction conditions: catalyst: 0.03 wt. % Pt-0.01 wt. % $RuO_2/BiVO_4$; concentration of photocatalyst: 1 g L^{-1}; O_2 (bubbled into the system); reaction time: 6 h.

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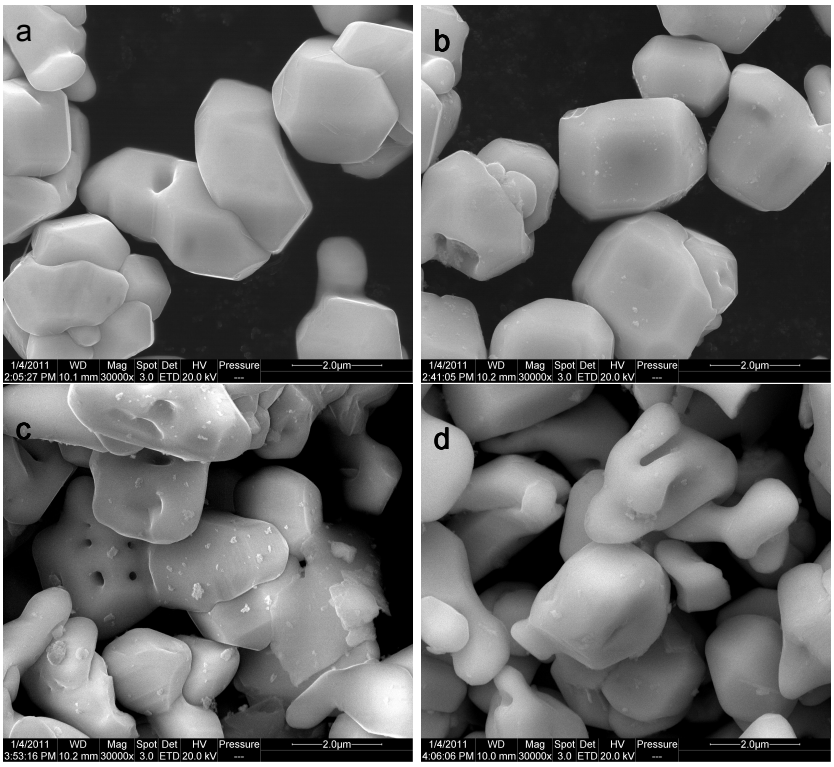

Fig. S3 SEM images of (a) $BiVO_4$, (b) 0.01 wt. % Pt-0.01 wt. % $RuO_2/BiVO_4$, 0.03 wt. % Pt- 0.01 wt. % $RuO_2/BiVO_4$ (c) before and (d) after the photocatalytic reaction.

Fig. S3 shows the morphologies of the $BiVO_4$, 0.01 wt. % Pt-0.01 wt. % $RuO_2/BiVO_4$, 0.03 wt. % Pt-0.01 wt. % $RuO_2/BiVO_4$ before and after the photocatalytic reaction. $BiVO_4$ synthesized by hydrothermal method possess large compact particles (about 2 μm in size) (Fig S3a). After loading co-catalyst, the nanoparticles are highly dispersed on the surface of $BiVO_4$ for Pt-$RuO_2/BiVO_4$ (Fig. S3b and c). After the photocatalytic reaction, there is no significant difference of the morphology was observed for the catalyst (Fig. S3d).

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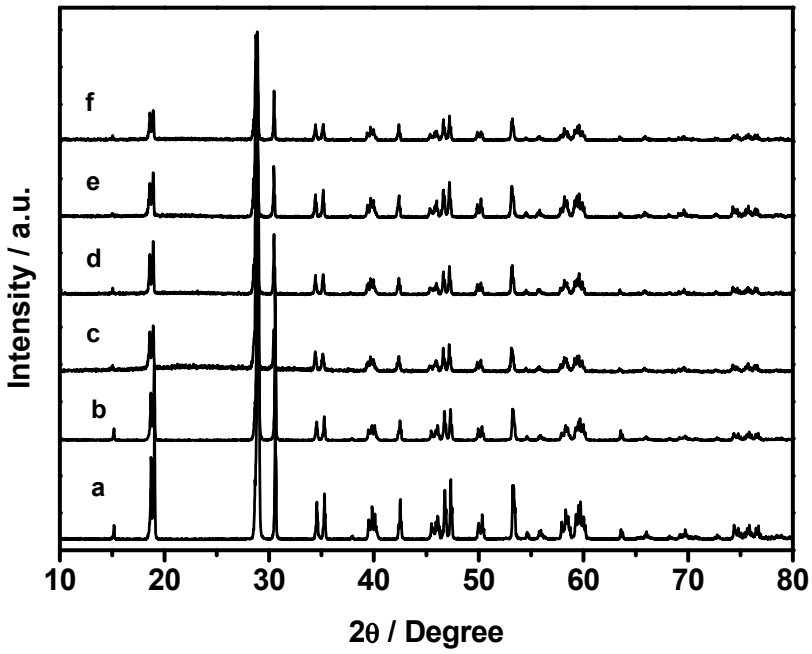

Fig. S4 XRD patterns of $BiVO_4$ (a) before and (b) after the photocatalytic reaction, XRD patterns of 0.02 wt. % Pt-0.01 wt. % $RuO_2/BiVO_4$ (c) before and (d) after the photocatalytic reaction, XRD patterns of 0.03 wt. % Pt-0.01 wt. % $RuO_2/BiVO_4$ (e) before and (f) after the photocatalytic reaction.

Fig. S4 shows the XRD patterns of $BiVO_4$ samples before and after the photocatalytic reaction. From Fig. S4, we can see that all the XRD patterns of $BiVO_4$ samples are well preserved for the monoclinic phase. The catalysts are quite stable in the reaction process.