Electronic Supplementary Material (ESI) for RSC Advances.

Electronic supplementary information (ESI)

Controlled synthesis of Sn-based oxides via a hydrothermal method and their visible light photocatalytic performances

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Fig. S1 The picture of the reaction system for the photocatalytic degradation of MO under visible light irradiation (λ > 400 nm).

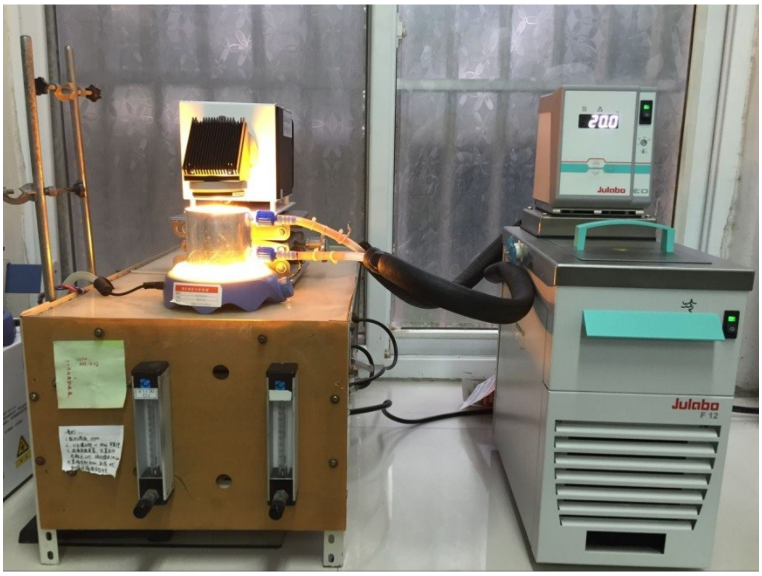


Fig. S2 (a) XPS survey spectrum and (b) high-resolution O 1s of the prepared SnO_2, Sn^{2+}-SnO_2 (prepared at 160 °C), SnO/SnO_2 (prepared in 3 g urea added solution), and SnO.

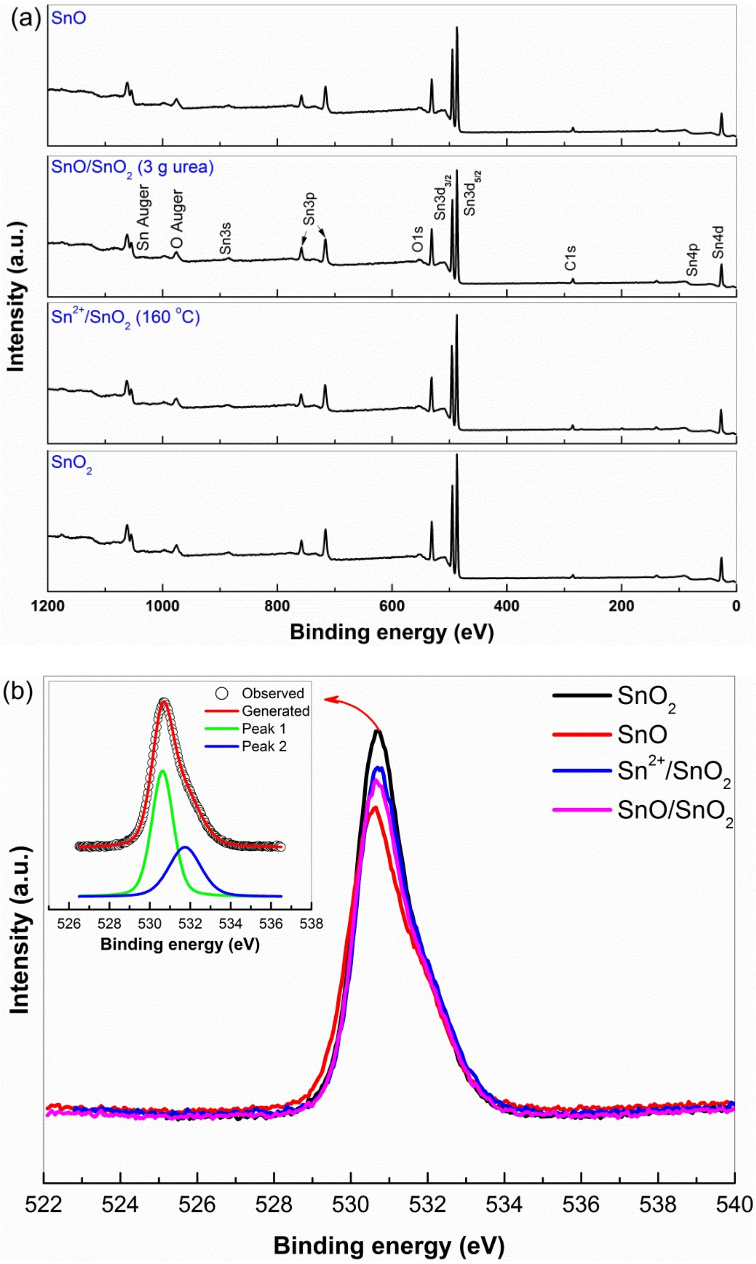


Fig. S3 The time dependent UV-vis absorption spectrum of MO solution during the degradation performed over Sn^{2+}-SnO_2 prepared at (a) 120, (b) 140, (c) 160, (d) 180, and (e) 200 °C and (f) the prepared SnO_2. (g) and (h) shows the comparison test without using any photocatalyst or light.

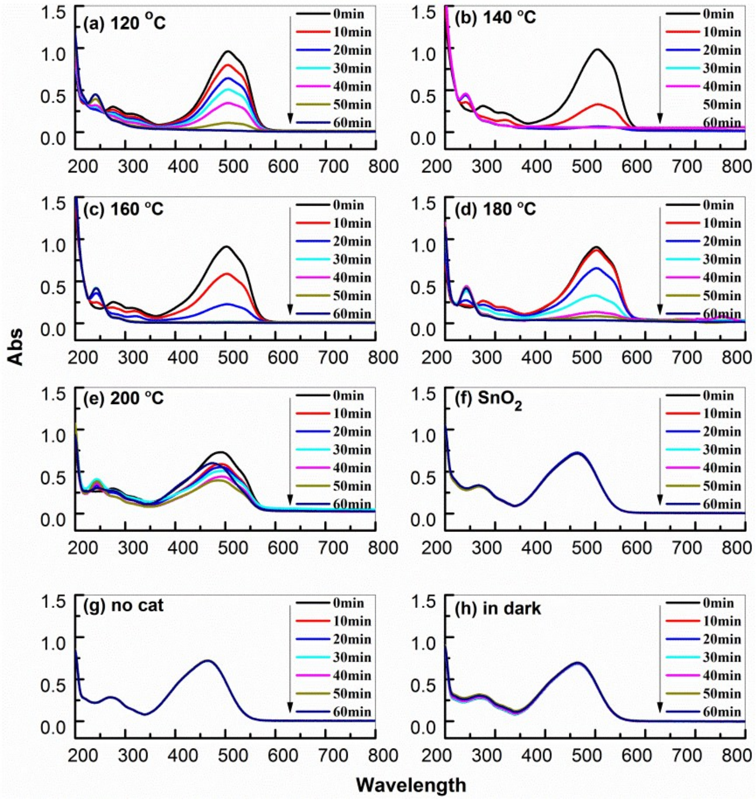


Fig. S4 The time dependent UV-vis absorption spectrum of MO solution during the degradation performed over SnO/SnO_2 prepared in different urea-containing solutions (a) 0.5, (b) 1.0, (c) 2.0, (d) 3.0 g, and (e) the prepared SnO.

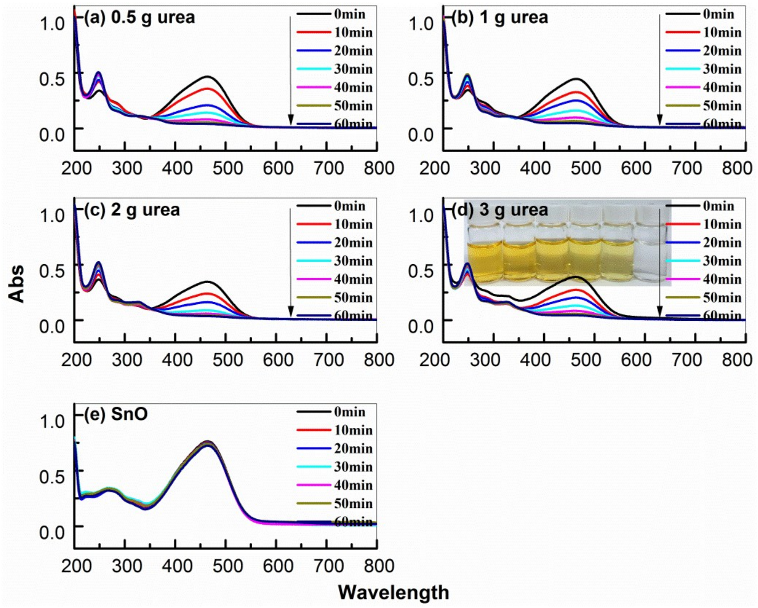


Fig. S5 Chemical structure of MO and its UV-vis absorption spectrum.

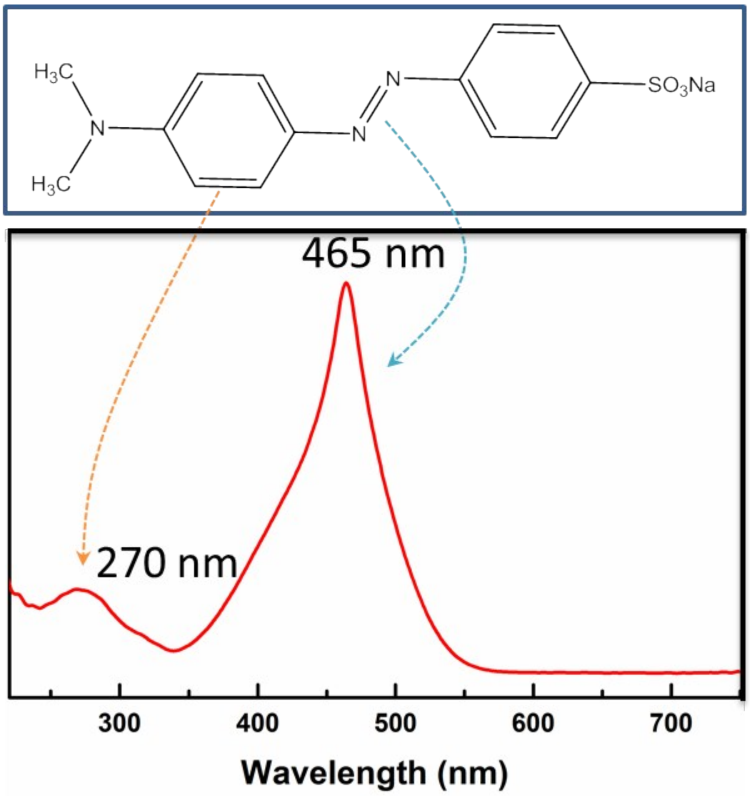
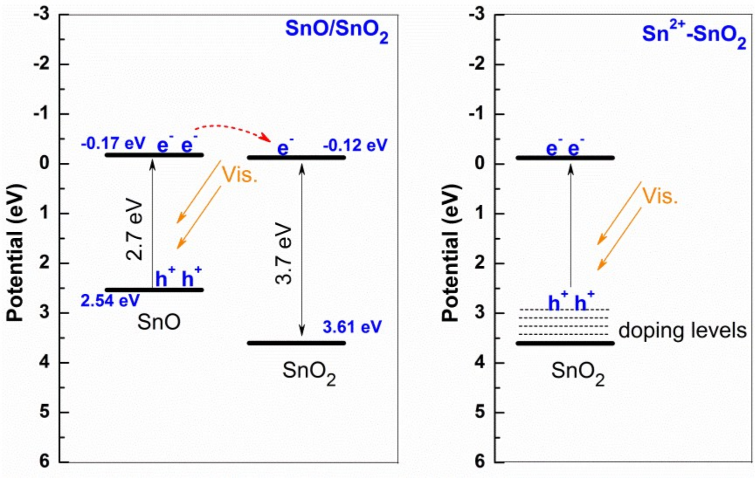


Fig. S6 schematic band structures of the prepared SnO/SnO_2 and Sn^{2+}-SnO_2.



The valence band potentials (E_{vb}) of the prepared SnO and SnO_2 were calculated by a commonly used empirical equation:

$$E_{vb} = X - 4.5 + 0.5E_g$$

Where X is the electronegativity of SnO and SnO_2 and the corresponding value is 5.68 and 6.24 eV[1], E_g is the band gap energy of SnO and SnO_2. Consequently, the conduction band potentials (E_{cb}) of the samples can be determined from:

$$E_{cb} = E_{vb} - E_g$$

As for Sn^{2+}-doped SnO_2, Fan's work indicated that the doping energy levels were located above the top of E_{vb}.[2] The specific location of the energy levels cannot be certain at present and they should be determined by the doping content of Sn^{2+}.

(1) Xia, W.; Wang, H.; Zeng, X.; Han, J.; Zhu, J.; Zhou, M.; Wu, S. *CrystEngComm* **2014**, *16*, 6841-6847.
(2) Fan, C. M.; Peng, Y.; Zhu, Q.; Lin, L.; Wang, R. X.; Xu, A. W. *J. Phys. Chem. C* **2013**, *117*, 24157-24166.

Fig. S7 The time dependent fluorescence spectra of the formed TAOH under visible light irradiation: over the (a-e) Sn^{2+}-SnO$_2$ prepared at different temperatures, (f-k) SnO/SnO$_2$ prepared in different urea-containing solutions, (i) SnO, (m) SnO$_2$, and the comparison test without (n) photocatalyst or (o) light.