Supplementary Information for *New Journal of Chemistry*

A facile solvothermal approach of novel W-doped TiO_2 nanoparticles/reduced graphene oxide composites with enhanced photodegradation performance under visible light irradiation

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Content

1. PL spectra

Photoluminescence (PL) spectroscopy is a useful technique to investigate the efficiency of charge carrier trapping, immigration and transfer at the surface of semiconductors.[1] As shown in Fig. S1, PL emission results from the recombination of photoinduced charge carriers. The stronger the PL signal, the higher the recombination rate of the photoinduced charge carriers.[2] Fig. S1 shows that all samples display similar shapes of emission curve attributed to the indirect transition of charge carriers within the band gap of TiO_2, indicating that the presence of W and RGO does not lead to a new PL phenomenon. In addition, W-TiO_2/RGO composites exhibit the lowest PL signal intensity among all the samples, indicating the recombination rate of photoinduced charge carriers of W-TiO_2/RGO is the lowest.

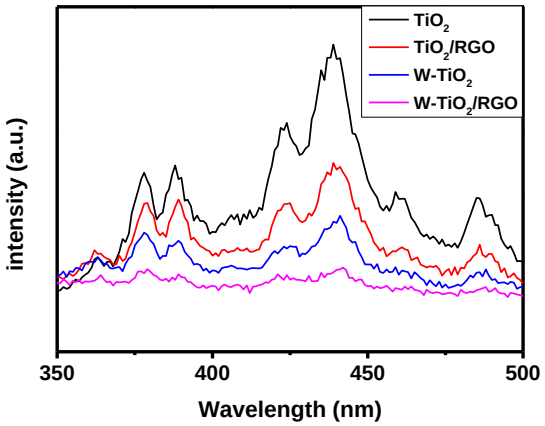
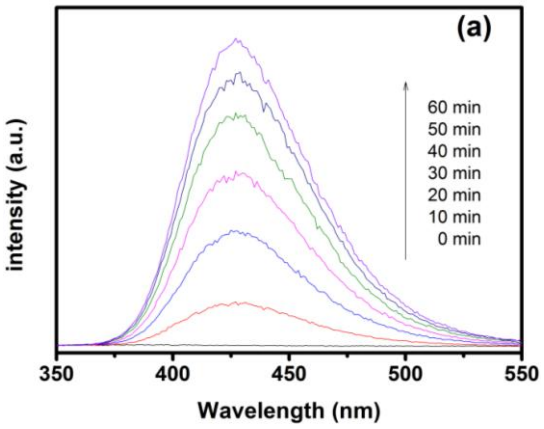


Fig. S1 PL spectra of TiO_2, W-TiO_2, TiO_2/RGO and W-TiO_2/RGO samples

In order to further explain the enhanced visible response of W-TiO_2/RGO, the hydroxyl radicals (•OH) were tested to quantify this in terms of photonic efficiencies.[3] The •OH radicals were measured by recording the fluorescence derived from 2-hydroxyterephthalic acid (with a high fluorescent characteristic peak) which was generated during the reactions between terephthalic acid and •OH radicals. Fig. S2(a) shows a high fluorescent peak, indicating that •OH radicals were produced during the degradation of MB. In addition, the greater the response of the sample to visible light, the more •OH radicals produced through the degradation process, resulting in a stronger fluorescence.[4,5] Fig. S2(b) shows a gradual increase in PL intensity in the case of TiO_2, W-TiO_2, TiO_2/RGO and W-TiO_2/RGO samples. These results indicate that the W^{6+} doping and graphene incorporation can enhance the photocatalytic activity of TiO_2.



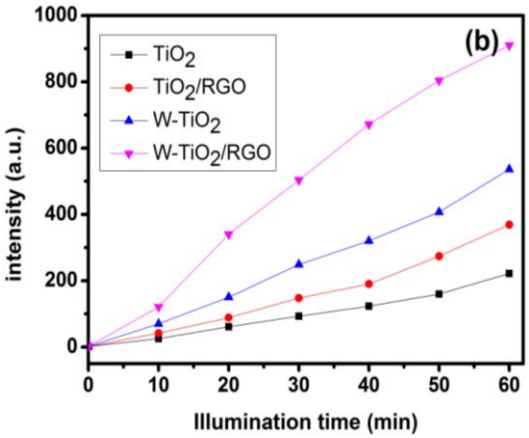


Fig. S2 (a) PL spectral changes observed during illumination for the W-TiO_2/RGO composites; (b) Comparison of PL intensity at 425 nm against irradiation time for TiO_2, W-TiO_2, TiO_2/RGO and W-TiO_2/RGO samples

2. XPS spectra of TiO_2/RGO

The XPS spectra of TiO_2/RGO composites are showed in Fig. S3. Fig. S3 (a) indicates the existence of elements Ti, O and C in the composites. Fig. S3 (b) exhibits Ti $2p_{3/2}$ and Ti $2p_{1/2}$ peaks of TiO_2/RGO composites at 457.2 and 462.9 eV , which can be compared with Ti $2p_{3/2}$ and Ti $2p_{1/2}$ peaks (458.9 eV and 464.6 eV, respectively) of W-TiO_2/RGO composites (Fig. 6(c)), indicating the presence of W into the titania lattice.[6,7]

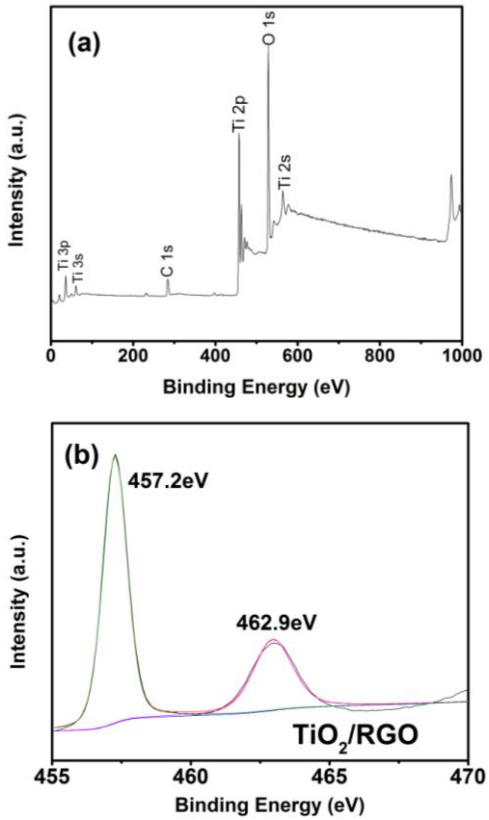


Fig. S3 (a) XPS survey spectrum of TiO_2/RGO, (b) Ti 2p XPS spectrum of TiO_2/RGO.

3. References

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