

Supporting information

Intermittent Microwave Heating-promoted Rapid Fabrication of Sheet-like Ag assemblies and Small-sized Ag Particles and their use as co-catalyst of ZnO for enhanced photocatalysis

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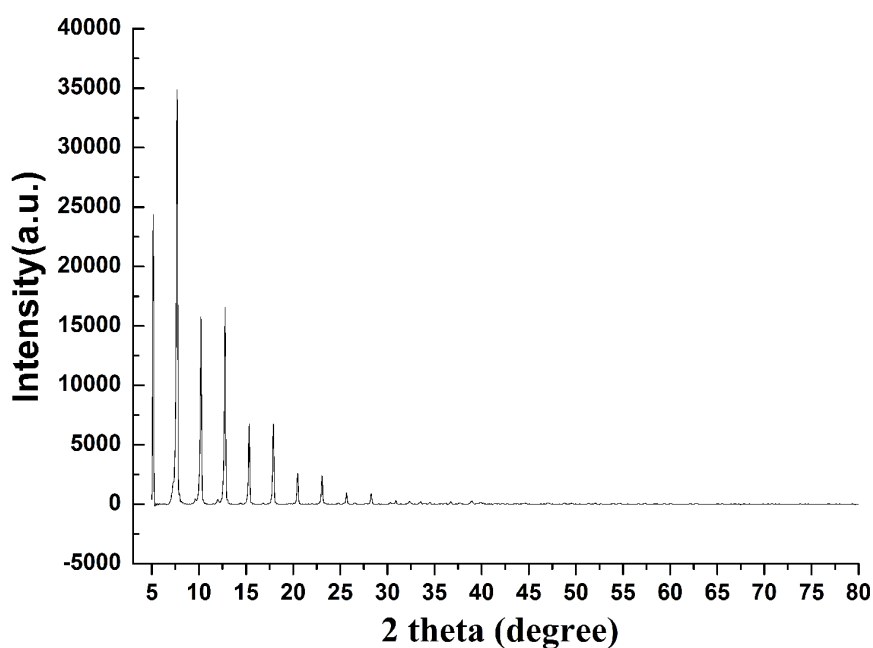


Fig. S1 XRD patterns of Ag-DT complex. The peaks are well similar with that of Ag-DT prepared with other methods in the presence of the acetonitrile and triethylamine [1, 2]. Our synthesis in ethanol is green and easy, so the method can be a promising alternative to previous method in acetonitrile solvent.

[1] Y.-B. Chen, L. Chen, L.-M. Wu, *Inorg. Chem.* 2005, **44**, 9817-9822.

[2] I. G. Dance, K. J. Fisher, R. M. H. Banda, M. L. Scudder, *Inorg. Chem.* 1991, **30**, 183–187.

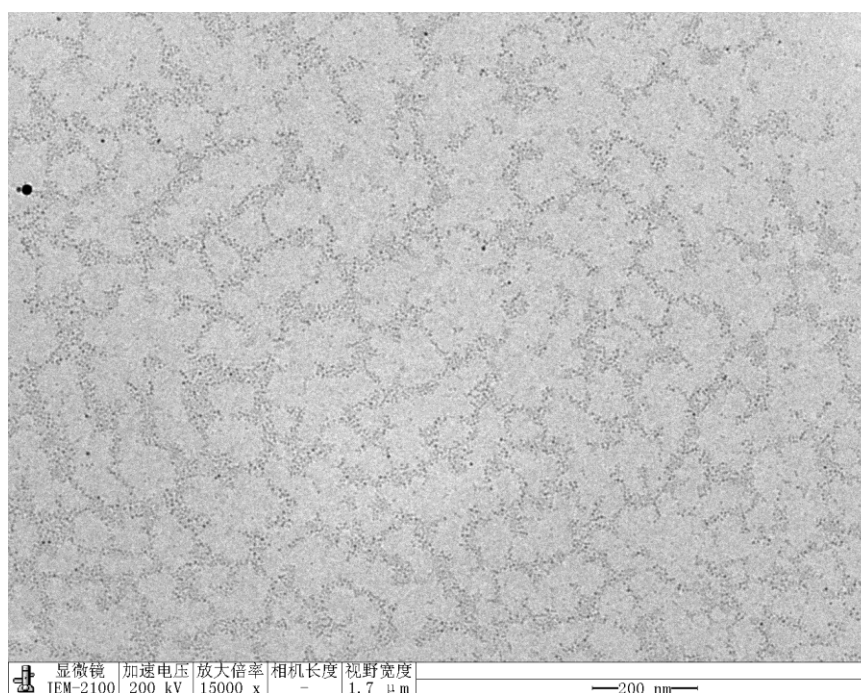


Fig. S2 The TEM image of Ag-5 sample in other area of TEM grid, from which the small-sizes particles with large-scaled uniform can be observed.

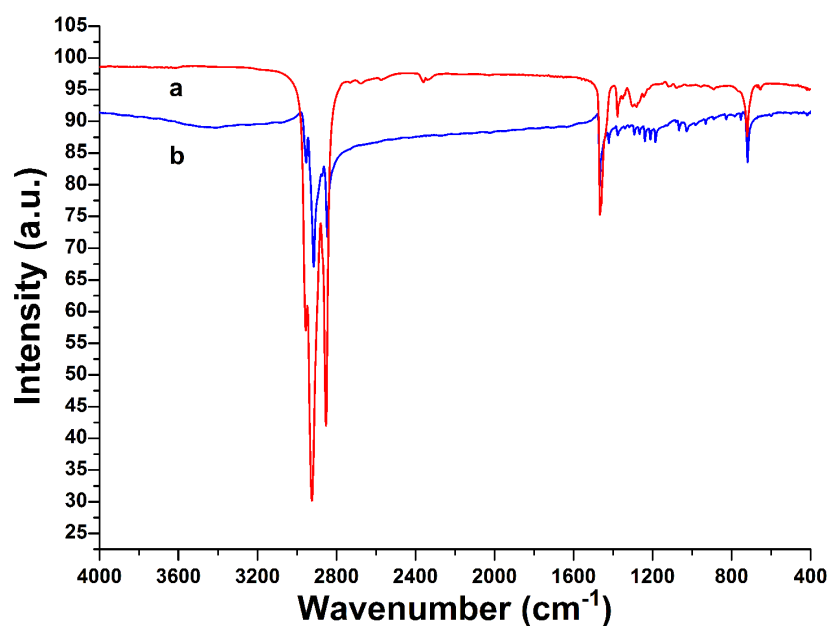


Fig. S3 The IR spectra of DT (a) and Ag-5 sample (b). We can see that the peaks for two curves are similar, indicating the presence of DT component in the Ag-5 sample. In addition, the Ag-5 can be well dispersed in apolar solvent, such hexane, chloroform etc, to form homogeneous and stable colloids, which is also characteristic for thiol-capped metal NCs.

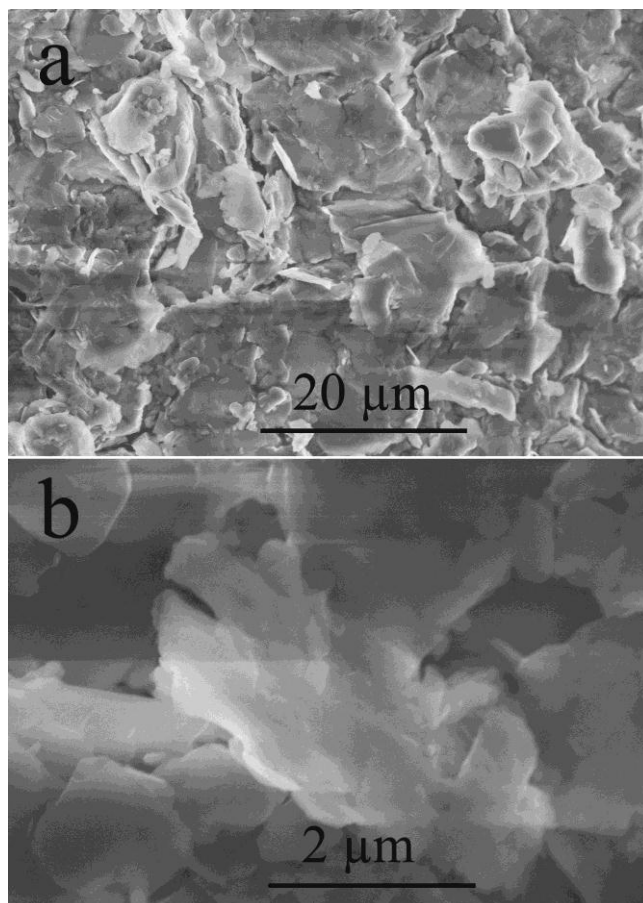


Fig. S4 the SEM images of Ag-1 samples with low-magnification (a) and high magnification (b). It can be seen that the size of most Ag-1 (above 5 μm) is more larger than that of Ag-DT complex. (about 500 nm).

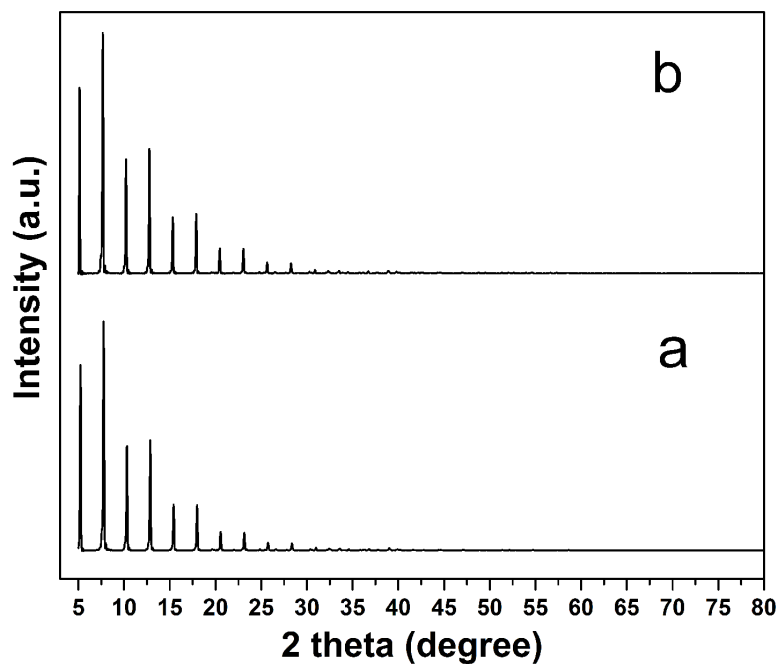


Fig. S5 XRD patterns of Ag-1 sample (a) and Ag-3 sample (b). Although the Ag NCs can be observed in TEM test, the XRD patterns show no peaks of Ag NCs for Ag-1 and Ag-3 samples besides the intensive peaks belonging to the Ag-DT. These should be due to the high content of Ag-DT and their intensive diffraction, resulting the undetectable intensity of Ag phase in the product.

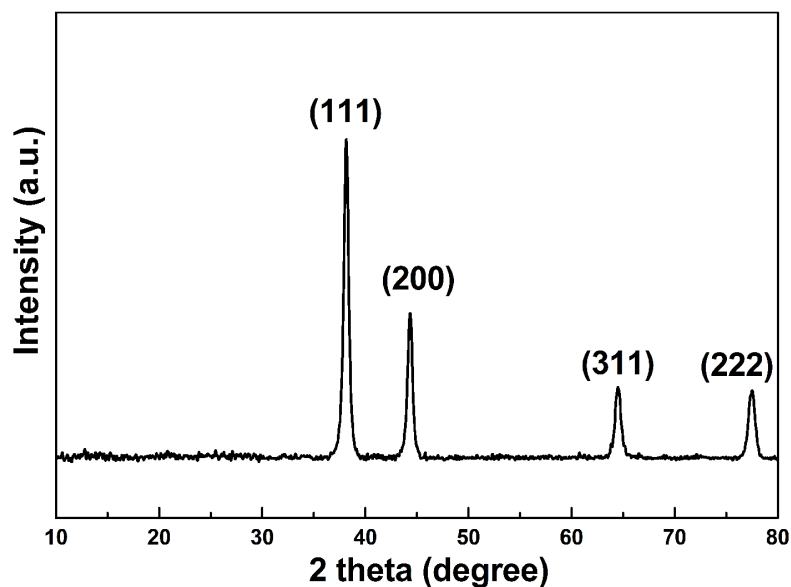


Fig. S6 The XRD pattern of Ag-6 samples. In this case, the intensive peaks located at $2\theta=38.2^\circ$, 44.4° , 64.4° and 77.8° can be observed, indexing to the (111), (200), and (311) and (222) diffraction of fcc-structured metal Ag. No other peaks, such as those for Ag-DT, can be observed.

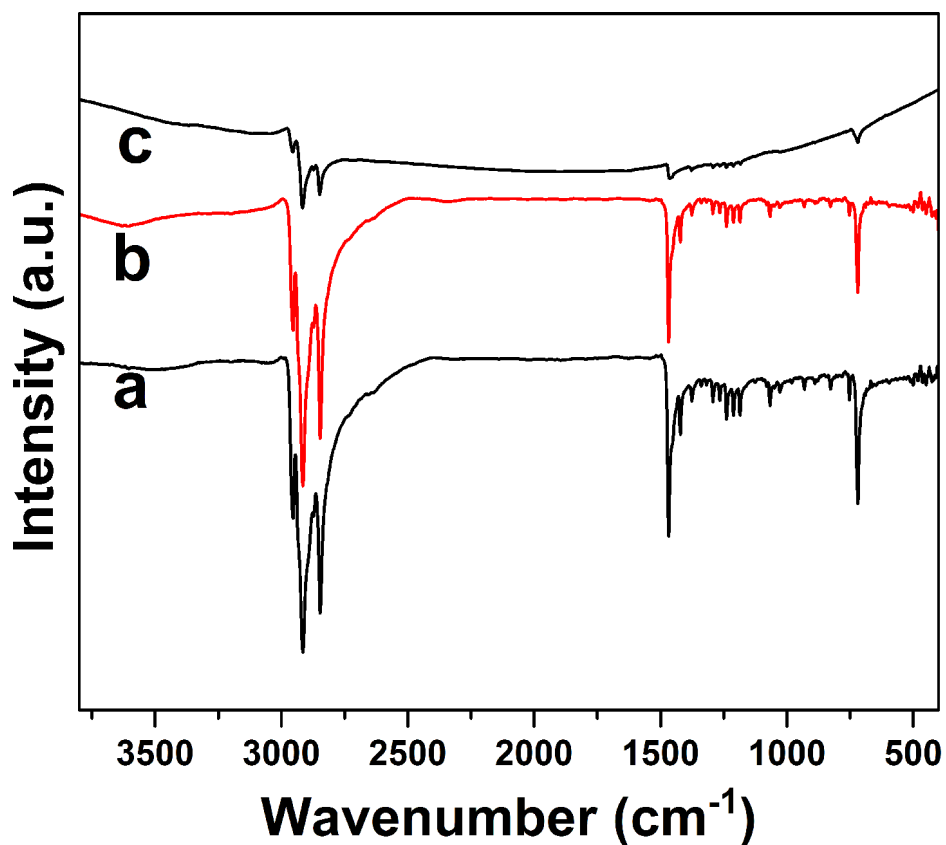


Fig. S7 IR spectra Ag-1, Ag-3 and Ag-6 samples. IR spectra of all three samples show obvious peaks like pure DT, indicating the presence of DT in the products. However, the peak intensity is relative low for Ag-6 sample, implying little amount of DT in the sample. The low amount of DT components will weaken their protected role on Ag NCs. This would be important reason for final aggregation of Ag NCs.

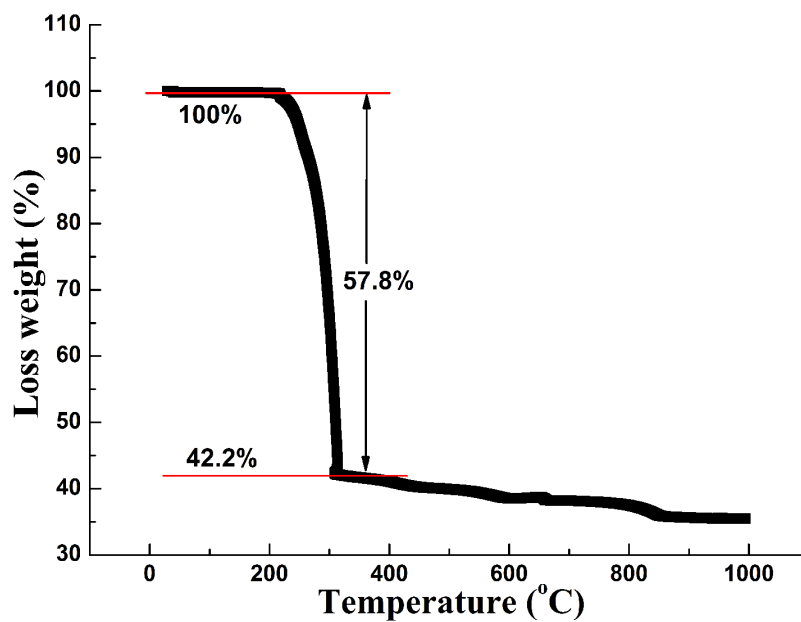


Fig. S8 TG curve of Ag-1 skample under O₂ atomsphere. From the TG analyses, we can observe the loss weight of Ag-1 is about 57.8% at about 300°C. The loss weight is close to pure Ag-DT (58.5%).

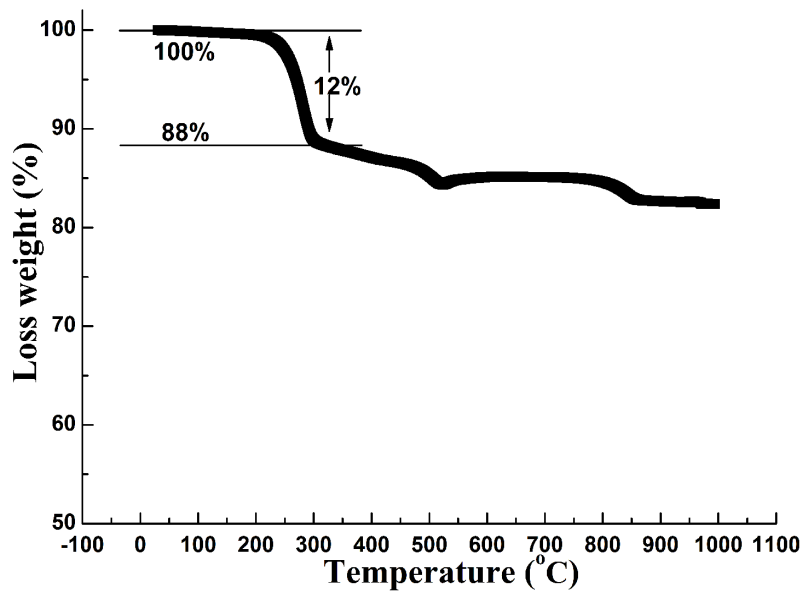


Fig. S9 TG curve of Ag-6 sample under O₂ atmosphere. From the TG analyses, we can observe the loss weight of Ag-6 sample is about 12% at about 300°C.

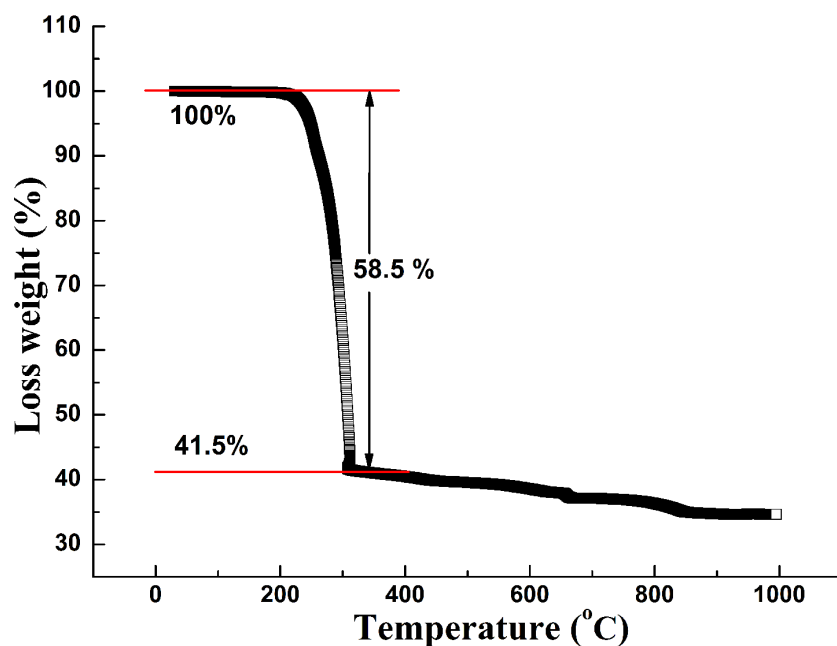


Fig. S10 TG curve of Ag-DT sample under O₂ atmosphere.

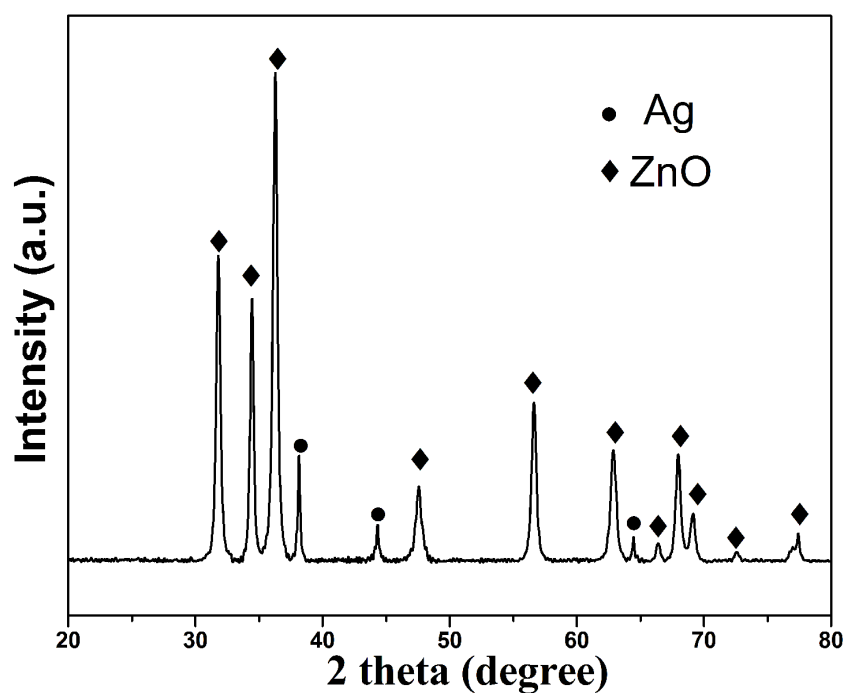


Fig. S11 XRD pattern of Ag-ZnO composite. As shown, the diffraction peaks at $2\theta = 31.7^\circ$, 34.4° , and 36.2° are indexed to (100), (002) and (101) diffractions of hexagonal structured ZnO (wurtzite), respectively (JCPDS no. 36-1451). The peaks located at $2\theta = 38.2^\circ$ and 44.4° are characteristic to (111) and (200) diffractions of face centered-cubic structured Ag (JCPDS no. 04-0783). XRD test shows the combination of ZnO and Ag in the samples.

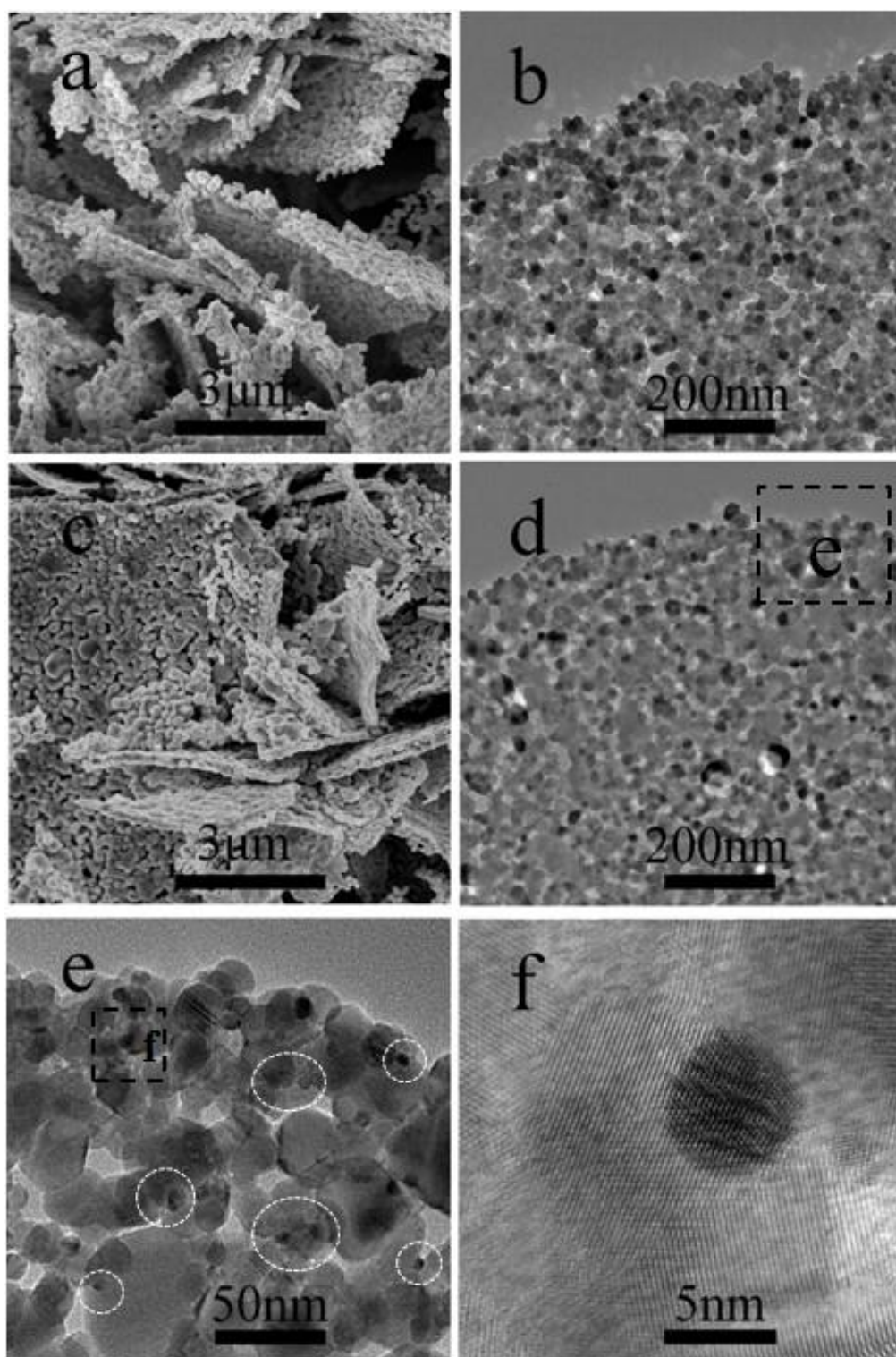


Fig. S12 (a) SEM and (b) TEM images of ZnO sheets, (c) SEM and (d-f) TEM images of Ag-ZnO composite.

We can see that both the ZnO and Ag-ZnO show the sheet-like structure. The Ag NPs are well dispersed on the ZnO. HRTEM image shown in f indicates the intimate

contact of Ag with ZnO.

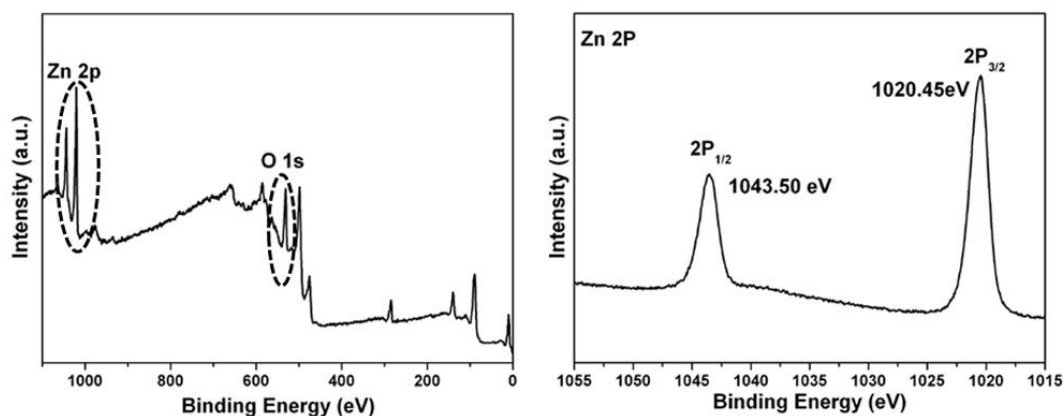


Fig.S13 XPS spectra of ZnO.

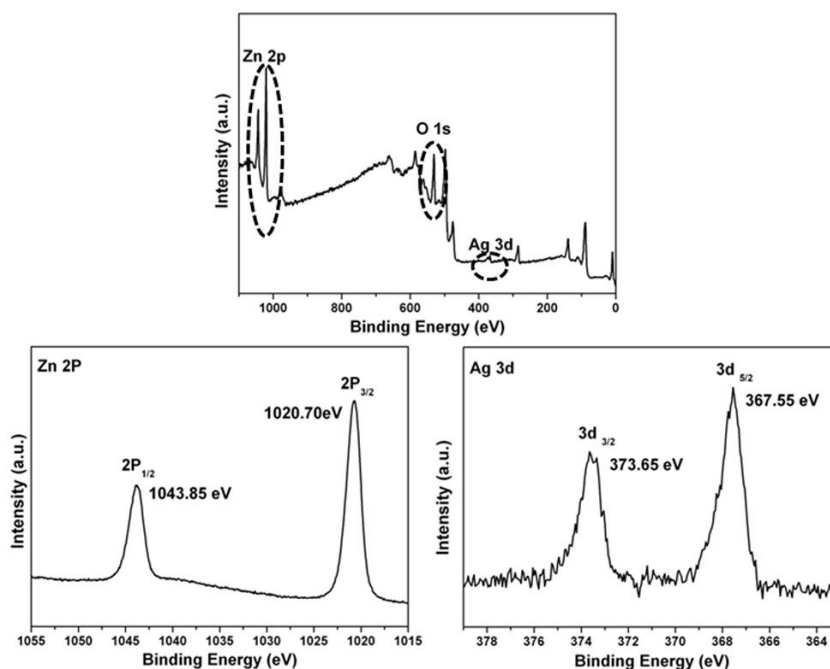


Fig. S14 XPS spectra of Ag-ZnO

In the XPS spectra of ZnO, we can observe the peaks of Zn and O elements, and no peaks of Ag can be detected. For Ag-ZnO complex, the peaks belonging to the Ag element can be found, in addition to that of Zn and O. The XPS results indicate the formation of Ag-ZnO. In addition, by comparison with Zn 2p peak in ZnO, we can observe the positive shift (0.35 eV) of Zn2p peak in Ag-ZnO. The positive shift implies the electron transfer from Zn to Ag and intensive interaction between them. This intensive interaction is favorable for enhancing the photocatalytic performance of ZnO.

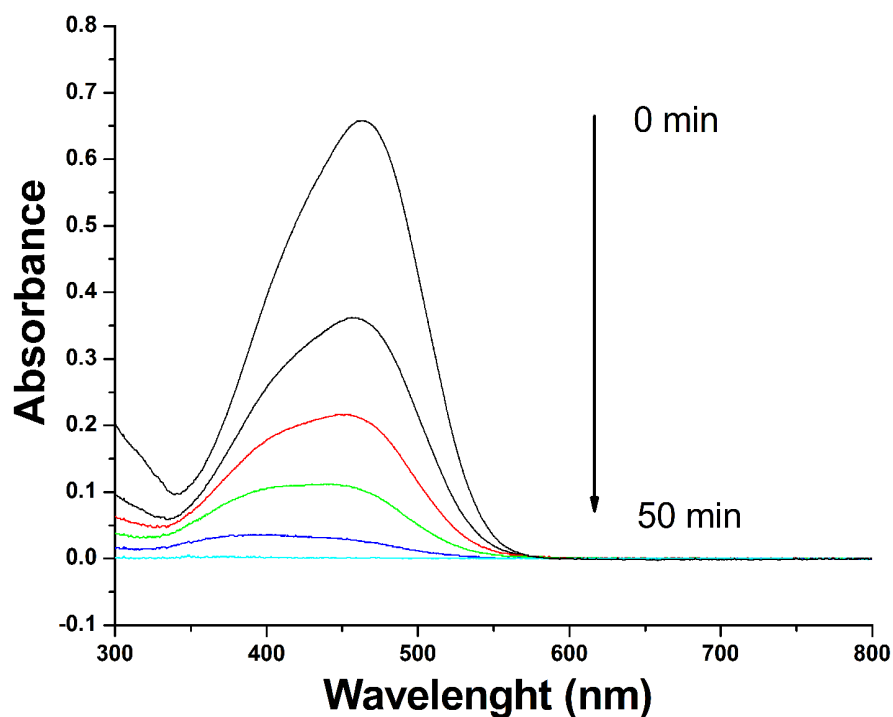


Fig. S15 Absorption spectra of the MO solution under UV light irradiation in the presence of Ag-ZnO composites. (Time interval: 10 min)

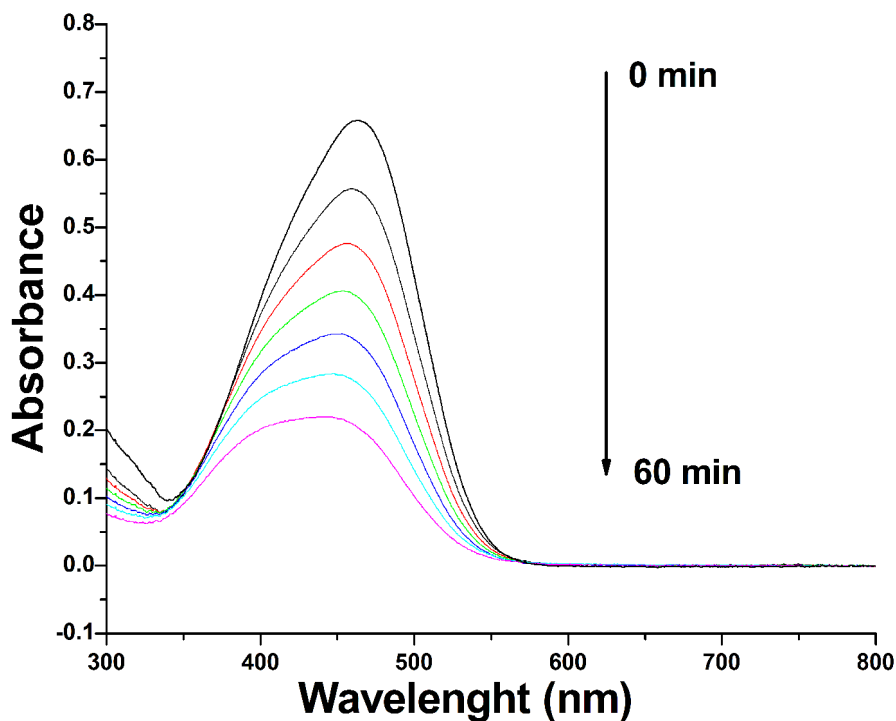


Fig. S16 Absorption spectra of the MO solution under UV light irradiation in the presence of ZnO sheets. (Time interval: 10 min).

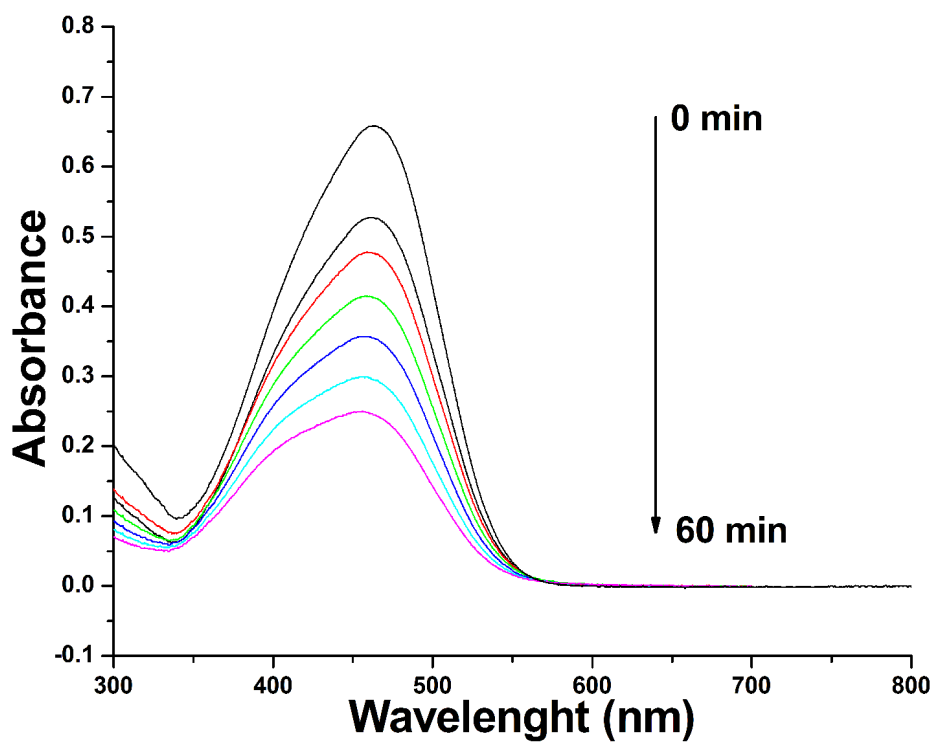


Fig. S17 Absorption spectra of the MO solution under UV light irradiation in the presence of P25 TiO₂. (Time interval: 10 min)

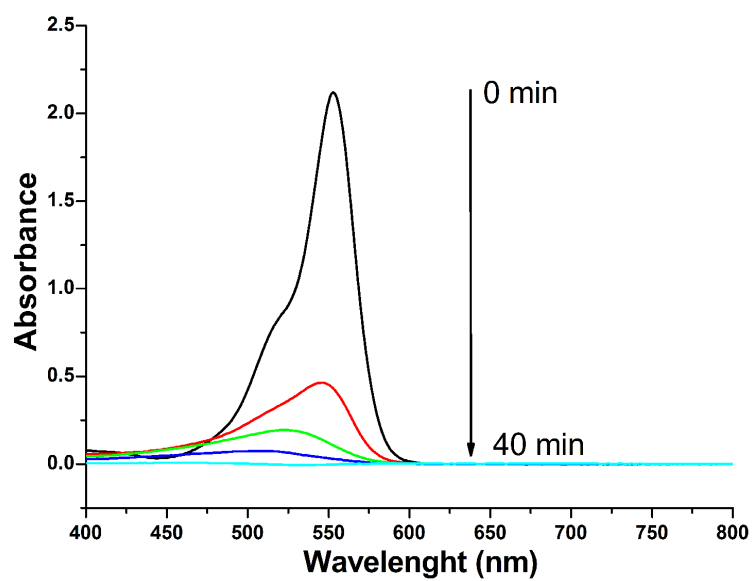


Fig. S18 Absorption spectra of the RhB solution under UV light irradiation in the presence of Ag-ZnO composites. (Time interval: 10 min)

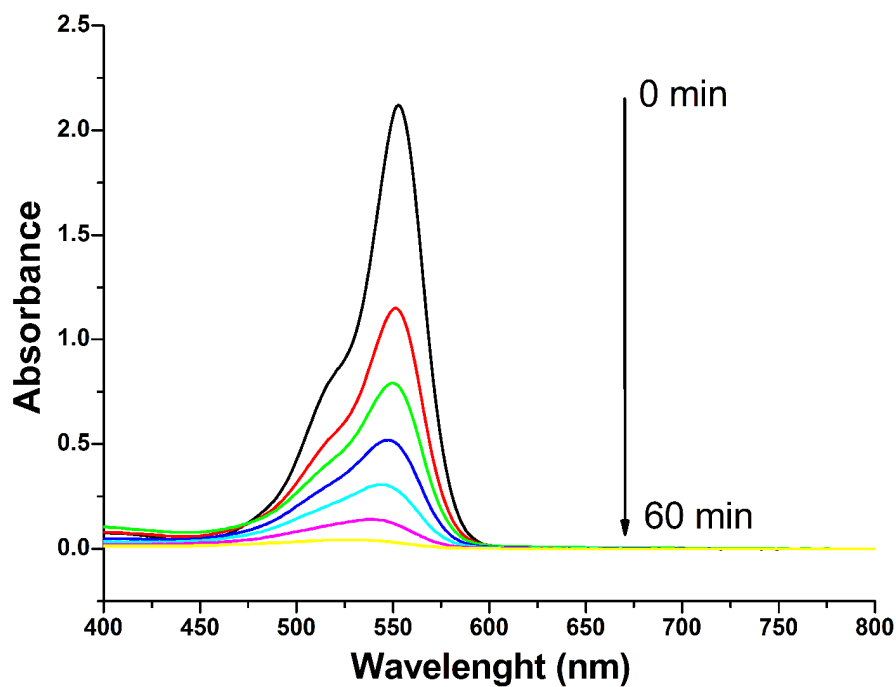


Fig. S19 Absorption spectra of the RhB solution under UV light irradiation in the presence of P25 TiO₂. (Time interval: 10 min)

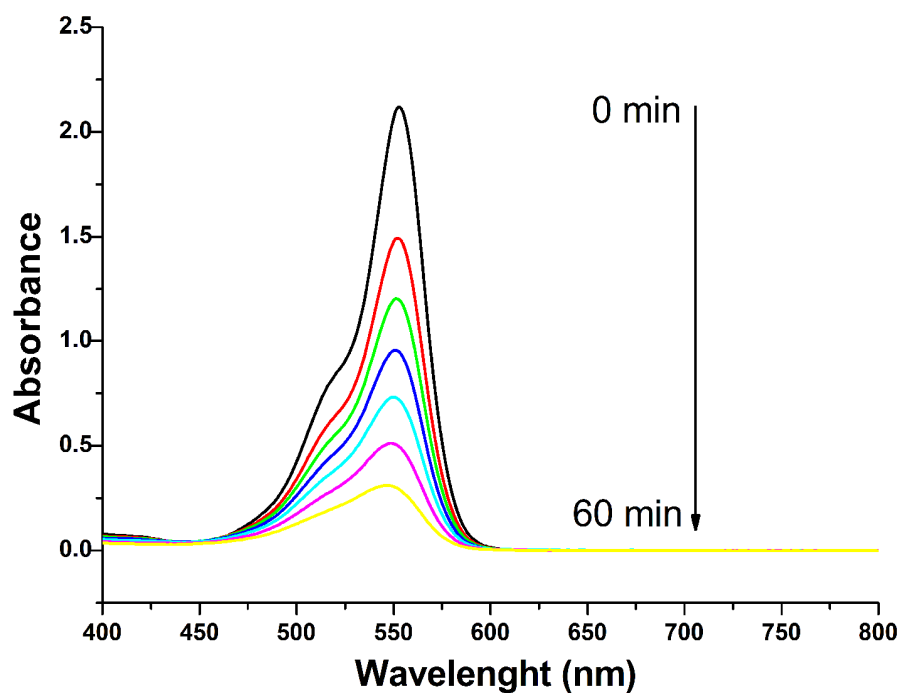


Fig. S20 Absorption spectra of the RhB solution under UV light irradiation in the presence of ZnO. (Time interval: 10 min)

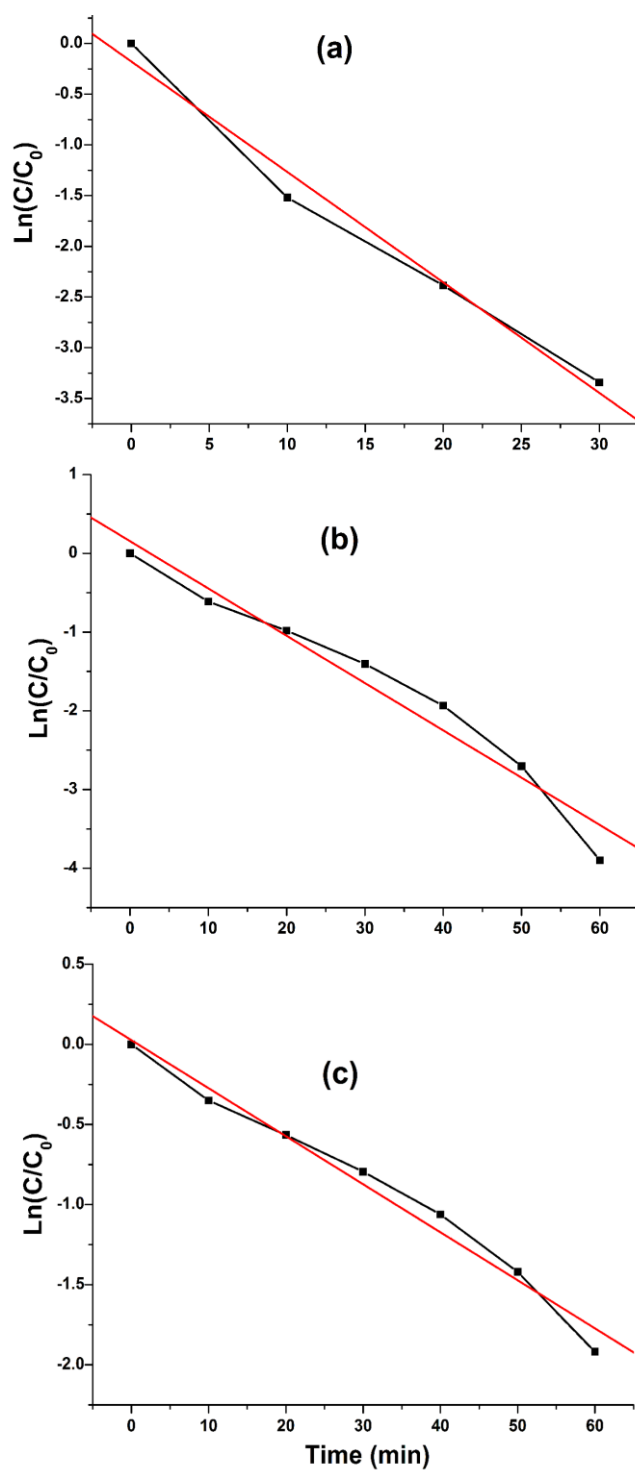


Fig. S21 The $\ln(C/C_0)$ vs. time curves of photodegradation of RhB. The apparent rate constant for RhB photocatalytic degradation is about 0.1089 min^{-1} for Ag-ZnO, 0.06009 min^{-1} for Degussa P25 TiO_2 and 0.02997 min^{-1} for ZnO sheets. The rate constant for Ag-ZnO is about 1.8 times for P25 TiO_2 and 3.6 times for ZnO sheet