# Supporting Information

## Towards full-spectrum (UV-Vis-NIR) photocatalysis: Achieving a Z-scheme between $Ag_2O$ and $TiO_2$ using reduced graphene oxide as the electron mediator

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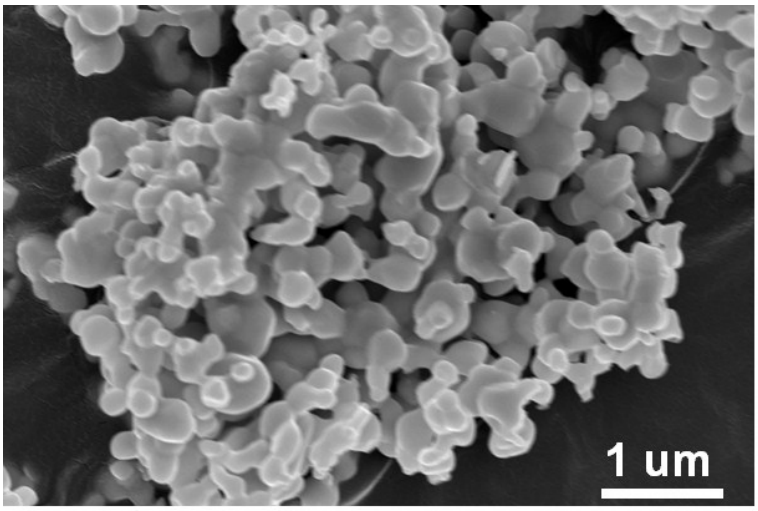



**Fig. S1.** SEM image of pure $Ag_2O$ nanoparticles.

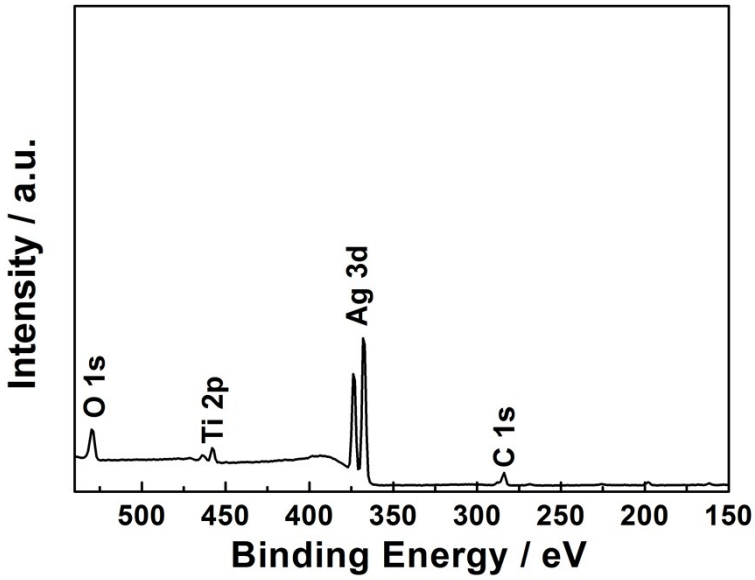



**Fig. S2.** Fully scanned XPS spectra of RGO-$Ag_2O/TiO_2$ composites.

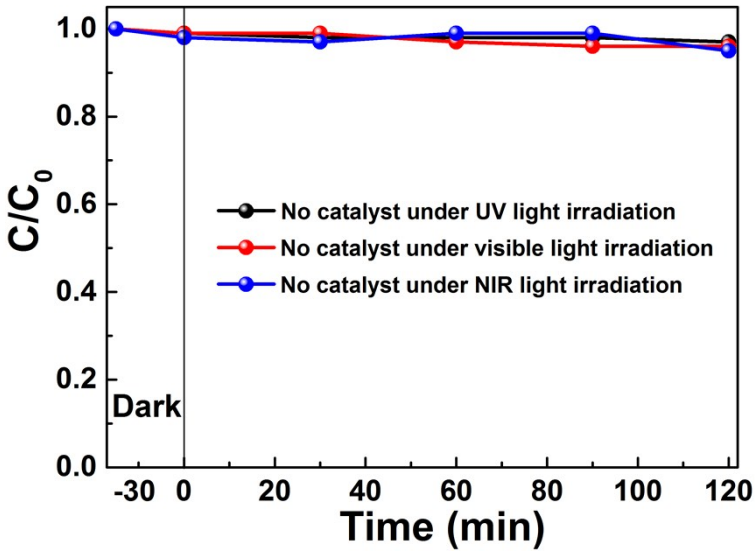



**Fig. S3.** Photocatalytic degradation of TC in the absence of photocatalysts under UV, visible, and NIR light irradiation.

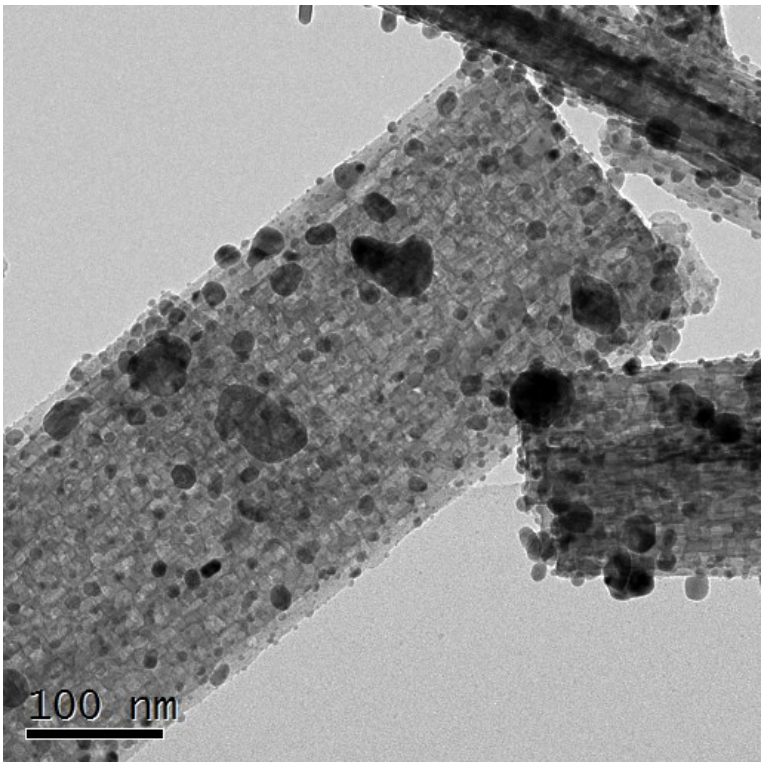



**Fig. S4.** TEM image of $Ag_2O/TiO_2$ composites.

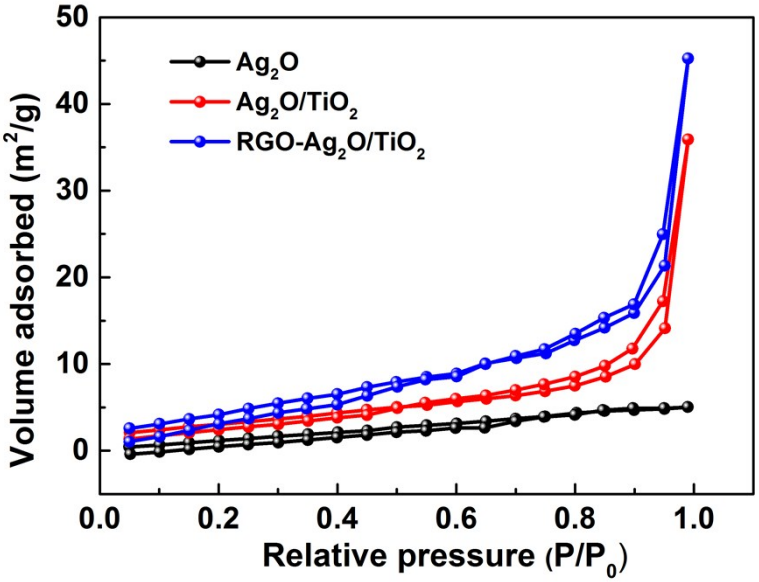



**Fig. S5.** $N_2$ adsorption-desorption isotherms of $Ag_2O$ NPs, $Ag_2O/TiO_2$, and RGO-$Ag_2O/TiO_2$ composites.

**Table S1.** Comparison of BET surface area of the samples.

| Photocatalyst | BET surface area ($m^2g^{-1}$) |
|---|---|
| $Ag_2O$ | 6.847 |

| | |
|---|---|
| $Ag_2O/TiO_2$ | 35.627 |
| RGO-$Ag_2O/TiO_2$ | 44.831 |

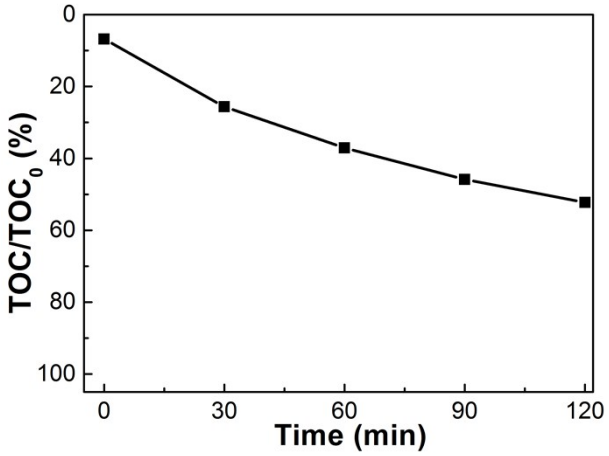



**Fig. S6.** The removal of TOC during the degradation process in RGO-$Ag_2O/TiO_2$ composites.

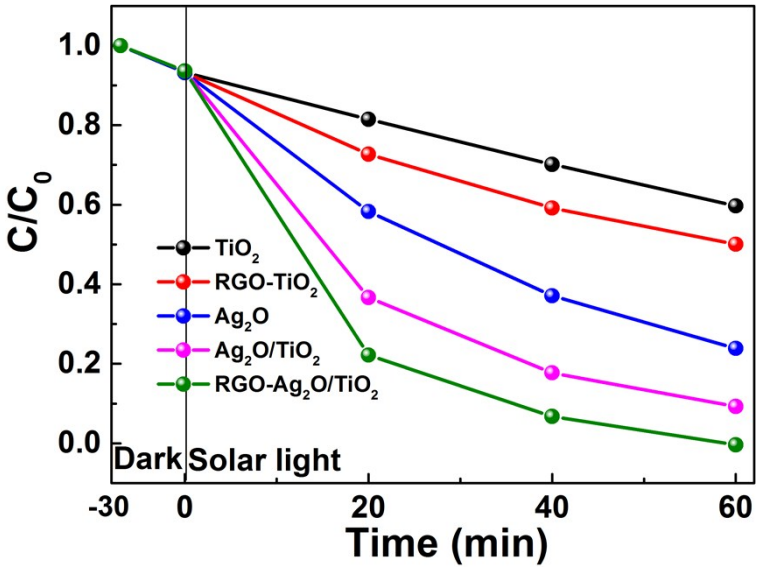
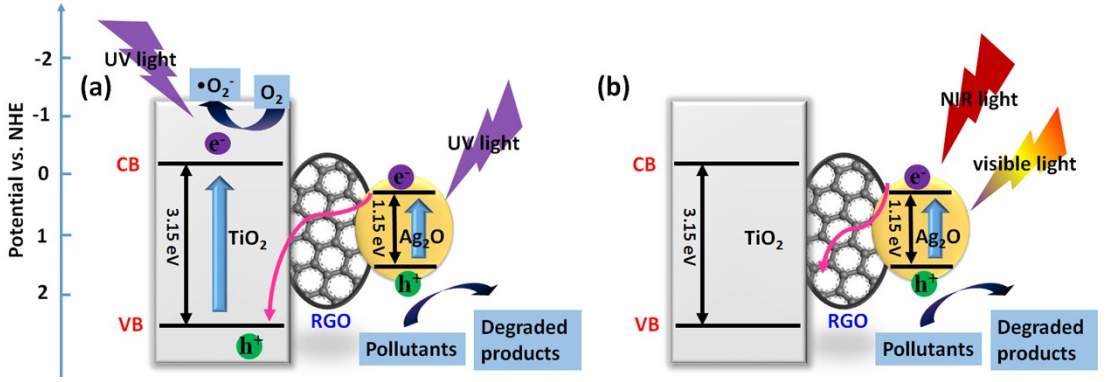



**Fig. S7.** Photocatalytic decomposing of TC in the presence of $TiO_2$ NBs, RGO-$TiO_2$, $Ag_2O$ NPs, $Ag_2O/TiO_2$, and RGO-$Ag_2O/TiO_2$ composites under simulated solar light.

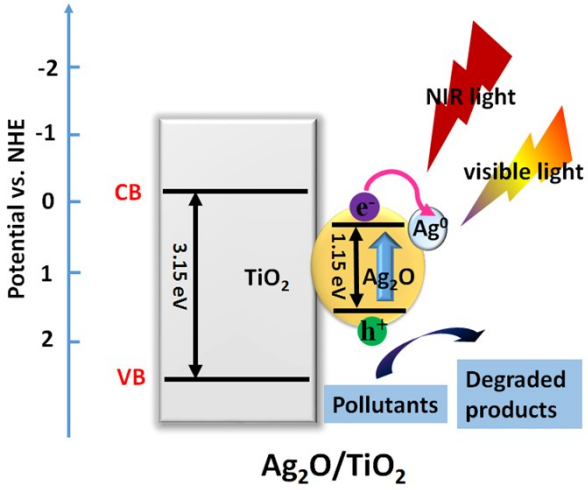
**Table S2.** Comparison of the rate constants of samples under UV, visible and NIR light.

| Photocatalyst | Rate constant (k) ($min^{-1}$) (UV light) | Rate constant (k) ($min^{-1}$) (Vis light) | Rate constant (k) ($min^{-1}$) (NIR light) |
|---|---|---|---|
| $TiO_2$ | $32.3*10^{-3}$ | $3.4*10^{-3}$ | $1.0*10^{-3}$ |
| RGO-$TiO_2$ | $39.0*10^{-3}$ | $5.0*10^{-3}$ | $1.7*10^{-3}$ |
| $Ag_2O$ | $22.2*10^{-3}$ | $18.2*10^{-3}$ | $7.6*10^{-3}$ |
| $Ag_2O/TiO_2$ | $60.8*10^{-3}$ | $32.5*10^{-3}$ | $12.5*10^{-3}$ |

| | | | |
|---|---|---|---|
| RGO-$Ag_2O/TiO_2$ | $88.7*10^{-3}$ | $59.4*10^{-3}$ | $18.7*10^{-3}$ |




**Scheme S1.** Diagram of electron transfer mechanism of RGO-$Ag_2O/TiO_2$ composites under (a) UV, (b) visible and NIR light irradiation.




**Scheme S2.** Diagram of electron transfer mechanism of $Ag_2O/TiO_2$ composites under visible and NIR light irradiation.

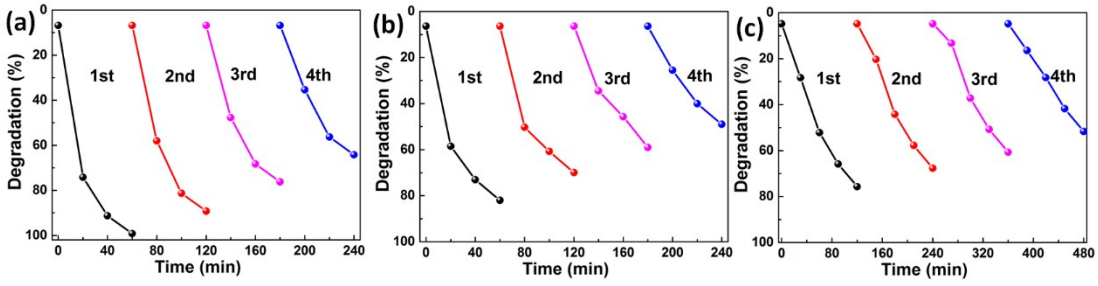



**Fig. S8.** Photocatalytic degradation of TC for $Ag_2O/TiO_2$ composites under (a) UV (b) visible and (c) NIR light irradiation after four cycles.

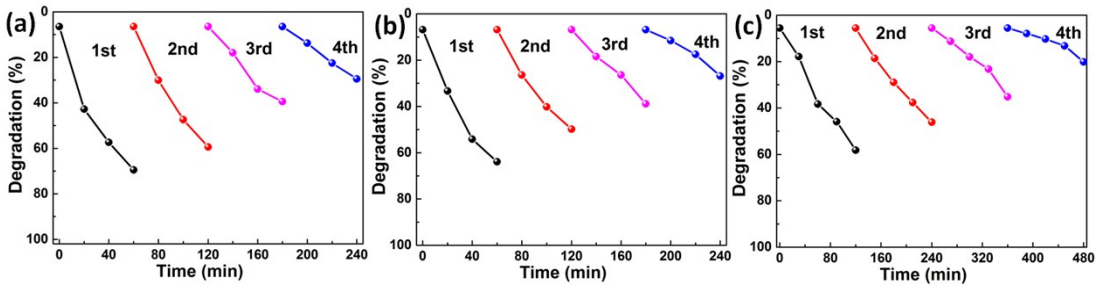



**Fig. S9.** Photocatalytic degradation of TC for $Ag_2O$ NPs under (a) UV (b) visible and (c) NIR light irradiation after four cycles.

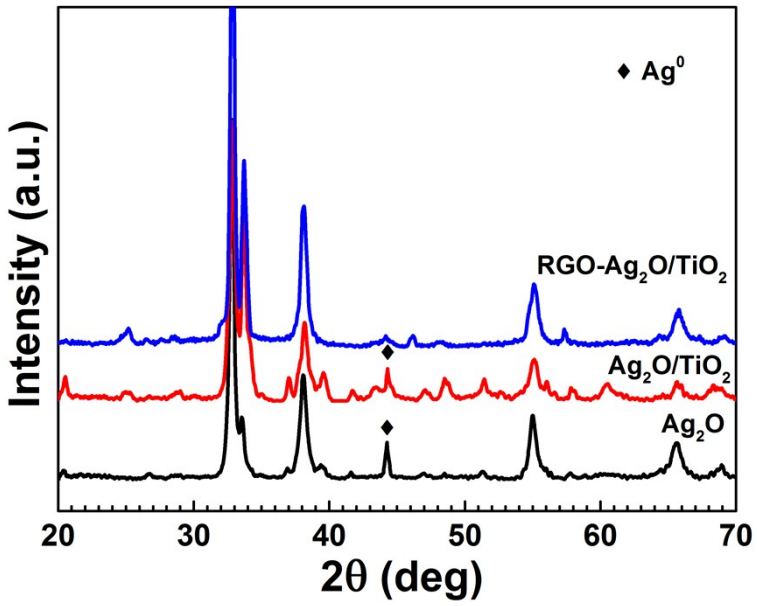



**Fig. S10.** XRD patterns of $Ag_2O$ NPs, $Ag_2O/TiO_2$ and RGO-$Ag_2O/TiO_2$ after photocatalysis.

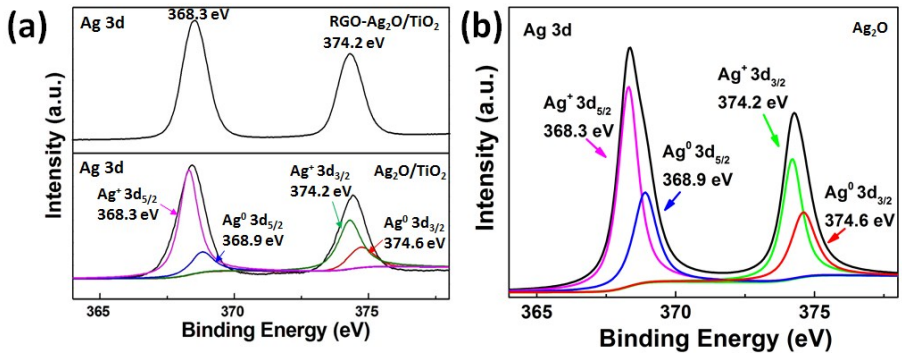



**Fig. S11.** High resolution XPS spectrum of elemental Ag 3d in (a) $Ag_2O/TiO_2$, RGO-$Ag_2O/TiO_2$, and (b) $Ag_2O$ NPs after photocatalytic reaction.