

Supplementary information

Highly stable heterostructured Ag-AgBr/TiO₂ composite: A bifunctional visible-light active photocatalyst for destruction of ibuprofen and bacteria

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Fig. S1. TEM image of Ag-AgBr/TiO₂, and the corresponding EDX spectra for the designated spots.

Fig. S2. TEM image of S-Ag-AgBr/TiO₂, the corresponding HRTEM images and EDX spectra for the designated spots.

Fig. S3. FESEM images of Ag-AgBr (A), TiO₂ (B) and Ag-TiO₂ (C).

Fig. S4. Time-dependent UV-vis absorption spectra and HPLC profiles of IBP in the course of photocatalytic degradation under white LED irradiation.

Fig. S5. Compare the XRD patterns of fresh and used Ag-AgBr/TiO₂ composites.

Fig. S6. Compare the high resolution XPS spectra of fresh and used Ag-AgBr/TiO₂ composites.

Fig. S7. Proposed photocatalytic mechanisms over the Ag/TiO₂ (A) and Ag-AgBr (B) under white LED irradiation.

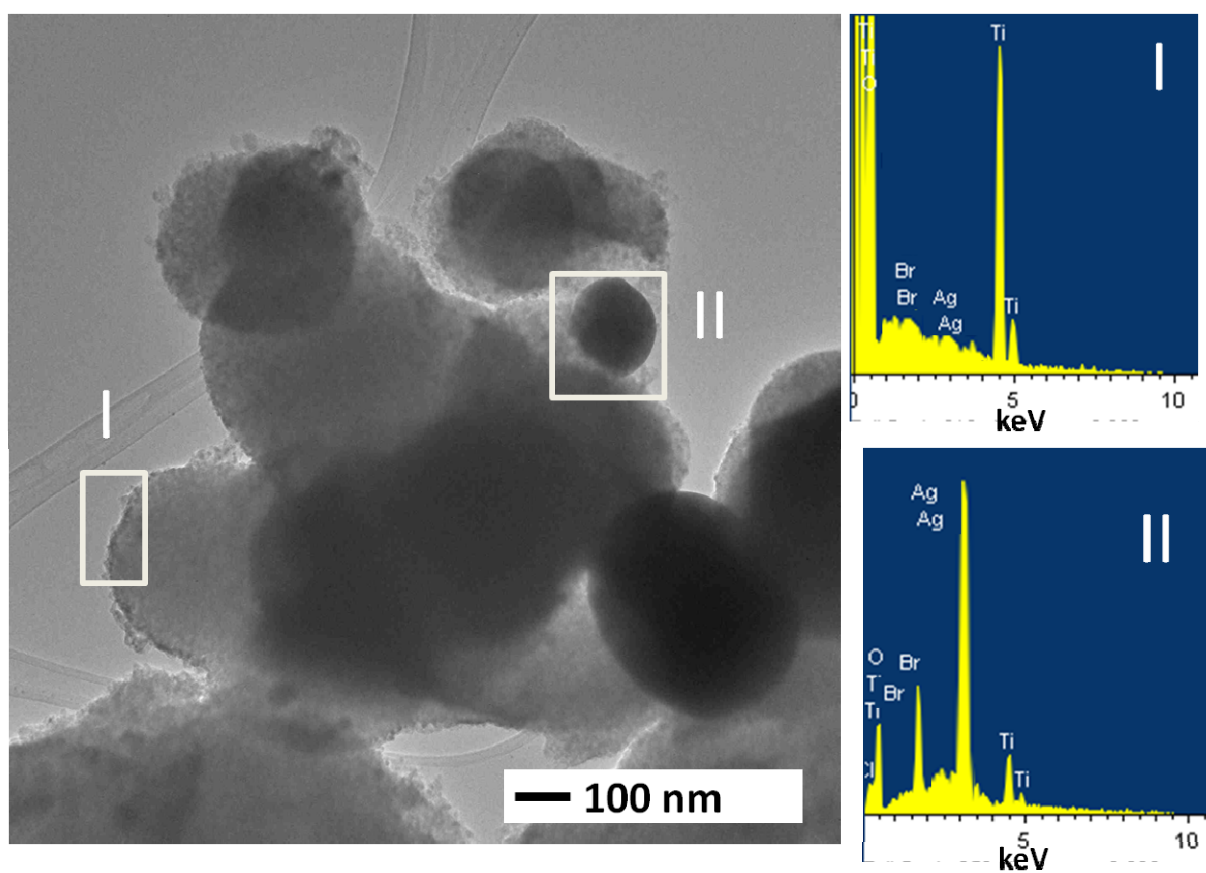


Fig. S1. TEM image of Ag-AgBr/TiO₂, and the corresponding EDX spectra for the designated spots.

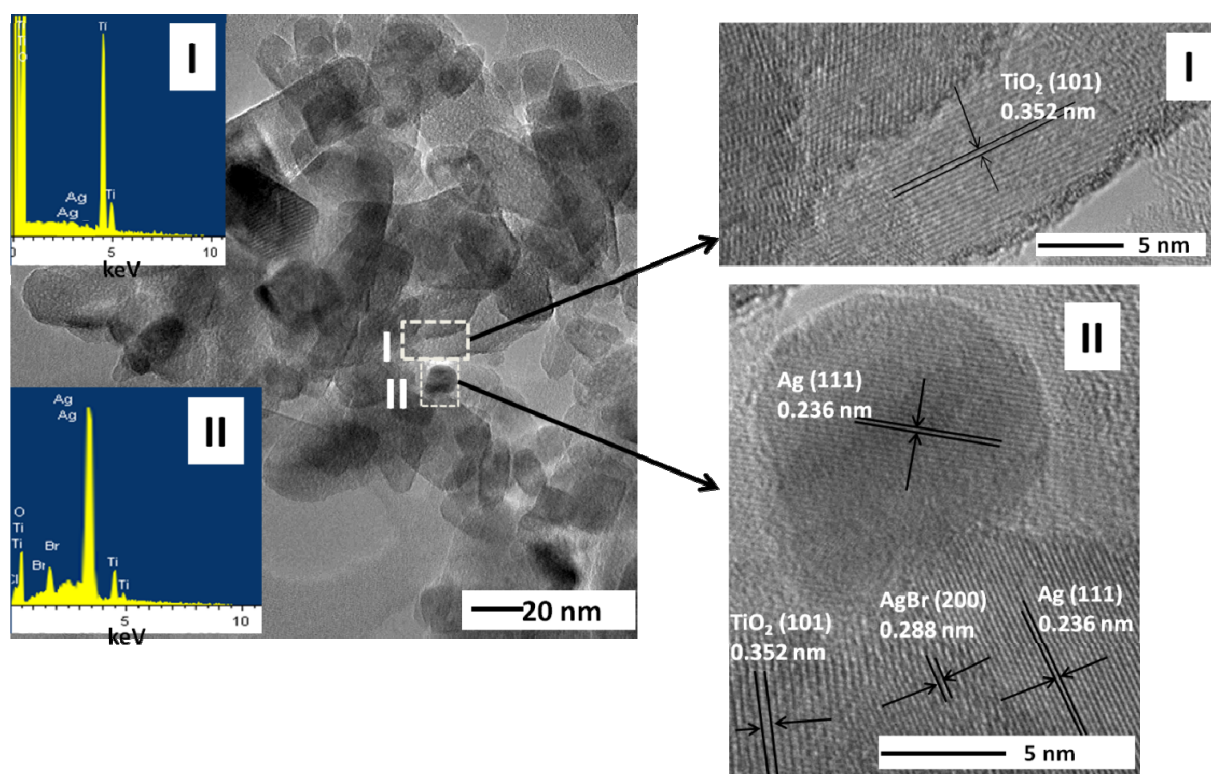


Fig. S2. TEM image of S-Ag-AgBr/TiO₂, the corresponding HRTEM images and EDX spectra for the designated spots.

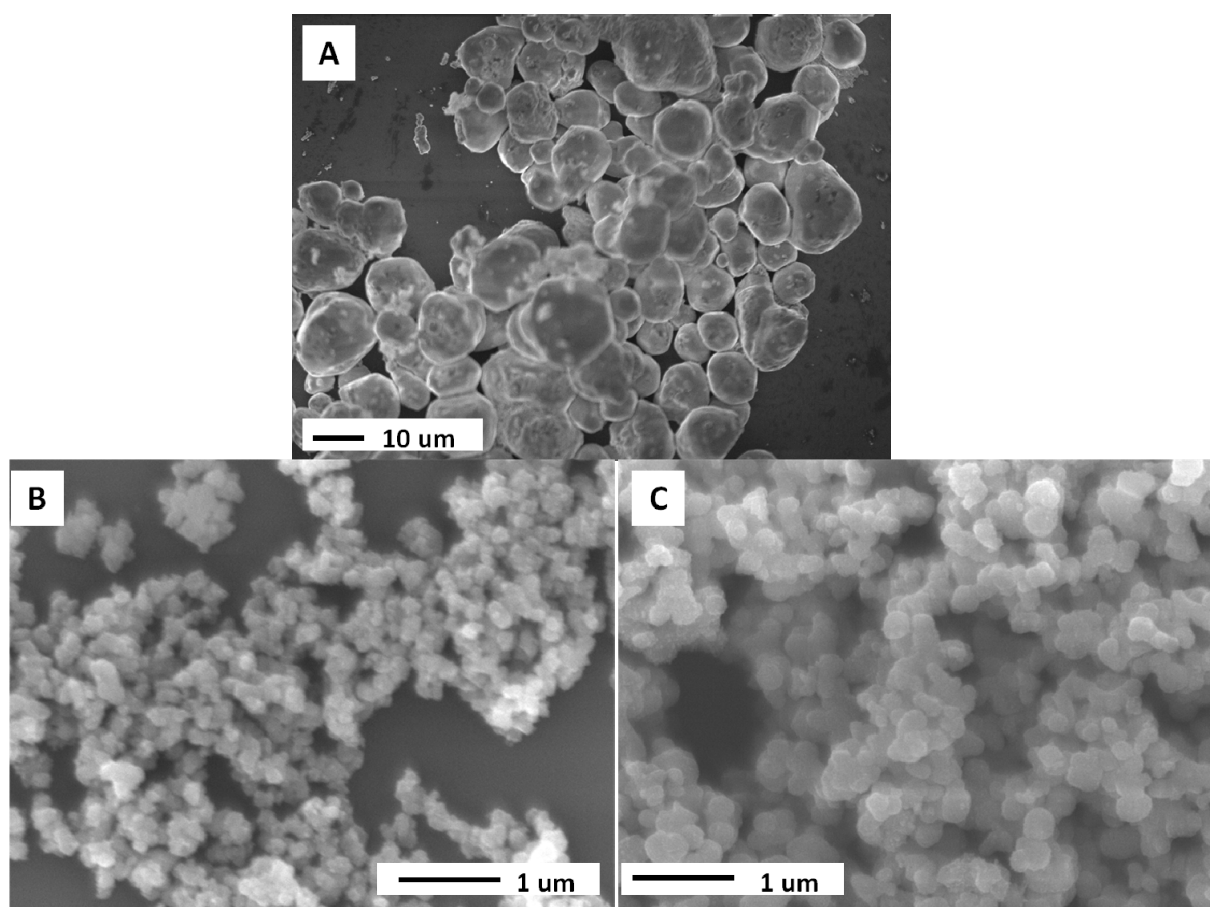


Fig. S3. FESEM images of Ag-AgBr (A), TiO₂ (B) and Ag-TiO₂ (C).

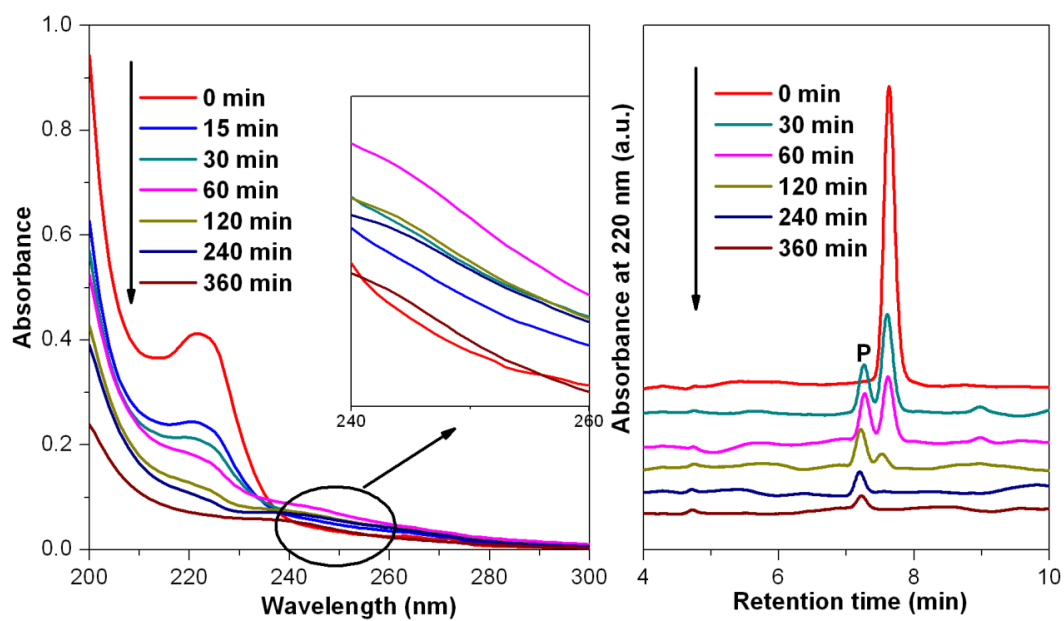


Fig. S4. Time-dependent UV-vis absorption spectra and HPLC profiles of IBP in the course of photocatalytic degradation under white LED irradiation.

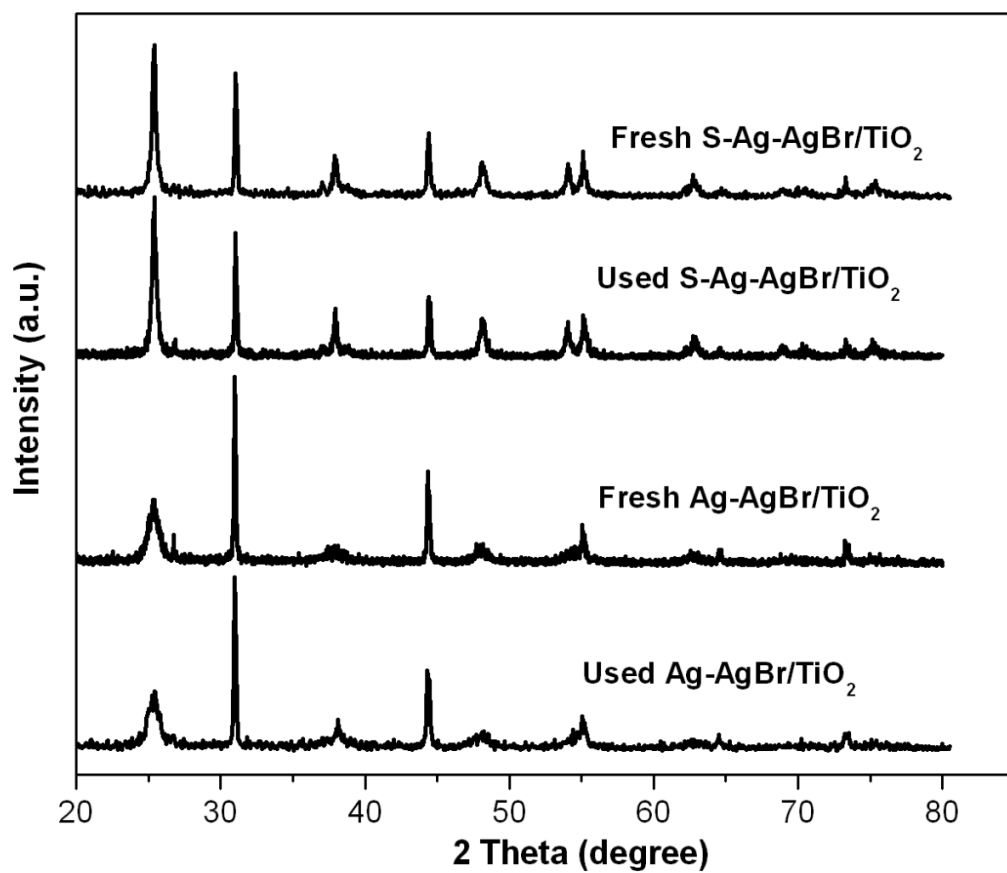


Fig. S5. Compare the XRD patterns of fresh and used Ag-AgBr/TiO₂ composites.

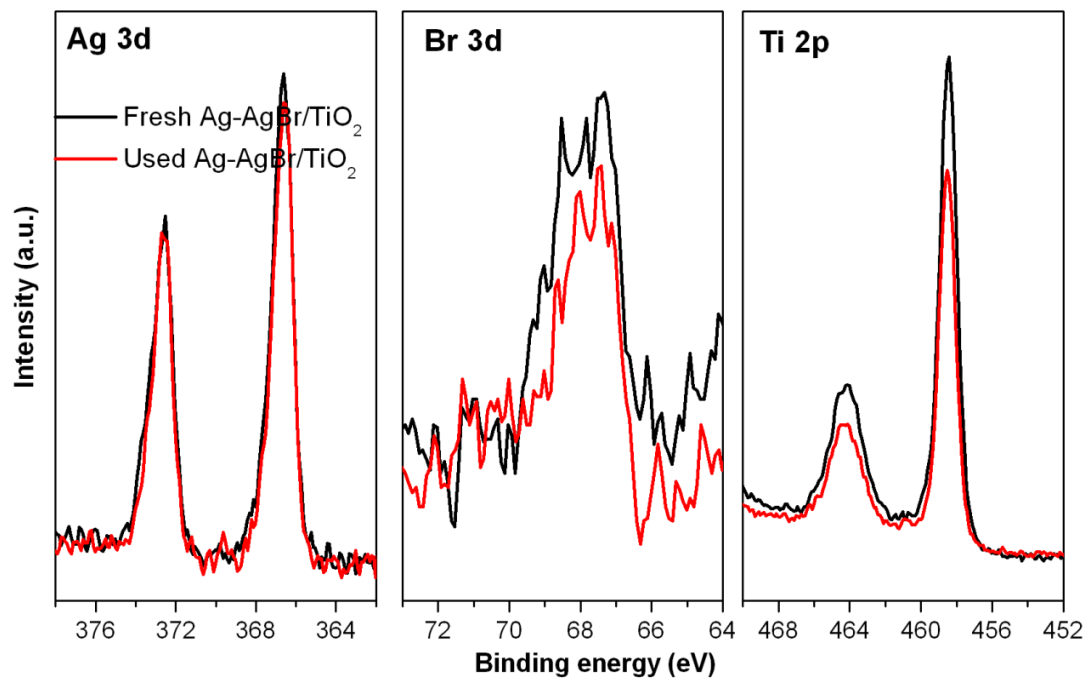


Fig. S6. Compare the high resolution XPS spectra of fresh and used Ag-AgBr/TiO₂ composites.

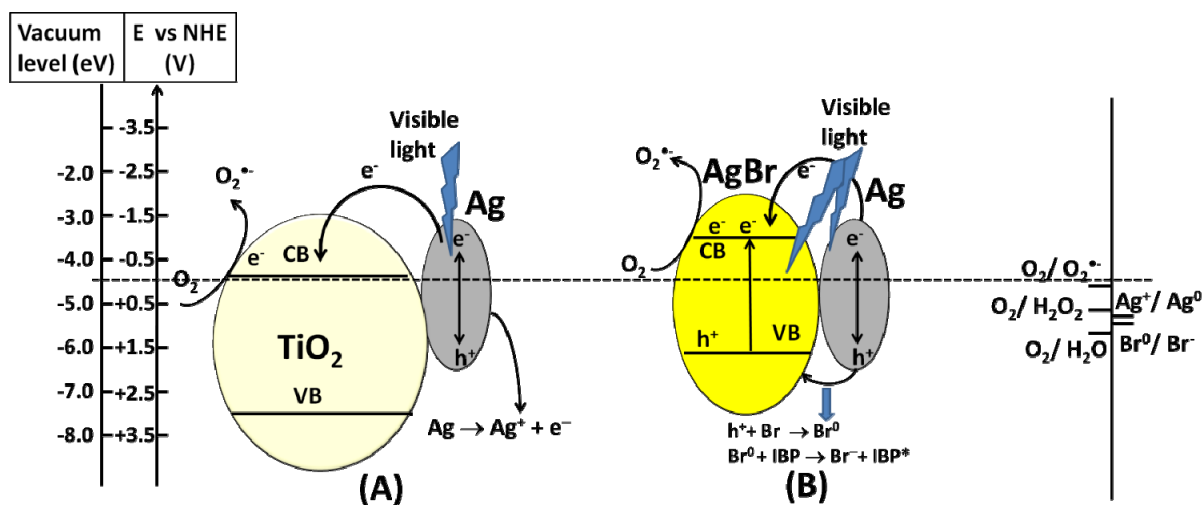


Fig. S7. Proposed photocatalytic mechanisms over the Ag/TiO₂ (A) and Ag-AgBr (B) under white LED irradiation.

For the visible-light irradiated Ag/TiO₂ and Ag-AgBr, the plasmon-induced electrons on the surface of Ag nanoparticles could migrate to the conduction band (CB) of TiO₂ and AgBr respectively. The migration of plasmon-induced electrons from Ag nanoparticles in the Ag/TiO₂ could result in the oxidation of metallic Ag and formation of soluble Ag⁺. Then electrons in the CB of TiO₂ could be trapped by O₂ to generate O₂^{•-} and other oxidative species, which subsequently could be consumed for oxidation of IBP. Hence, the process of IBP degradation might facilitate the continual electron transfer from Ag nanoparticles to TiO₂ to some extent. It has been reported that the plasmon-induced hole on Ag nanoparticles as a reactive species were able to oxidize organic pollutants such as RhB and 2-chlorophenol, etc., consequently Ag nanoparticles were promptly regenerated by accepting the electrons from these organic pollutants. As mentioned above, certain amount of Ag⁺ ions was released from the Ag/TiO₂ and Ag-AgBr in the IBP solutions. It infers that Ag⁺ might not be capable of oxidizing IBP (and regenerate Ag⁰) due to its relatively low oxidizing potential of E⁰(Ag⁺/Ag⁰) (+0.799 V vs NHE), or Ag⁺ might not be completely reduced by the IBP. As a result, the corrosion of Ag nanoparticles occurred. For Ag-AgBr, the plasmon-induced holes would migrate away from the Ag and be trapped within the surface of AgBr particles, leading to the efficient charge separation in the Ag nanoparticles. Similarly, the electrons in the CB of AgBr could be subsequently transferred to the surface-absorbed O₂ to form various oxidative species. Therefore, the Ag-AgBr was stable under the experimental conditions.