Electronic Supplementary Material (ESI) for RSC Advances

Supporting Information

Assembly Ultrathin $PbBiO_2Br$ Nanosheets With Enhanced Visible Light Photocatalytic Property

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Experimental section

Synthesis of $PbBiO_2Br$ nanosheets samples. Assembly ultrathin $PbBiO_2Br$ nanosheets samples were synthesized using a solvothermal method. In a typical procedure, 0.5mmol $Bi(NO_3)_3 \cdot 5H_2O$ were added into 20mL of ethanol containing stoichiometric amounts of hexadecyl trimethyl ammonium bromide（CTAB）and $Pb(NO_3)_2$ with continuous stirring, and then 5mL ammonia water were added into this solution. The mixture solution was stirred for at least 30min and then poured into a 50mL Teflon-lined stainless autoclave. The autoclave was heated at 180℃ for 12 h under autogenously pressure and then cooled to room temperature. The resulting precipitates were collected and washed with ethanol and deionized water thoroughly and dried at 70℃ in air. For comparison, further experiments were performed under different synthesis conditions，and the details are shown in the Table 1.

Table1 The synthesis conditions of reference $PbBiO_2Br$ samples.

Precursor	**Sample1(S1)**	**Sample2（S2)**	**Sample3（S3)**	**Sample4（S4)**
$Bi(NO_3) \cdot 5H_2O$	1mmol	0.25 mmol	0.5 mmol	0.5 mmol
$Pb(NO_3)_2$	1mmol	0.25 mmol	0.5 mmol	0.5 mmol
CTAB	1mmol	0.25 mmol	0.5 mmol	
KBr				0.5 mmol
solvent	ethanol	ethanol	distilled water	ethanol
ammonia water	5 mL	5 mL	5 mL	5 mL

Synthesis of bulk $PbBiO_2Br$ samples. BiOBr and PbO (AR, 99.5%) were used as starting materials. BiOBr was prepared by a soft chemical method described elsewhere.[1] These two raw materials were mixed in a molar ratio of 1:1. Handing grinding using a mortar and pestle was performed for at least 40 minutes to guarantee a homogeneous mixing and then the mixture was calcined in air at 973 K for 20 h. For comparison, $TiO_{2-x}N_x$, C_3N_4 and BiOBr are used as the reference photocatalyst, which were obtained according to previously reports.[2]

1. H. Cheng, B. Huang, P. Wang, Z. Wang, Z. Lou, J. Wang, X. Qin, X. Zhang and Y. Dai, *Chemical Communications*, 2011, **47**, 7054-7056.
2. Z. Zhao, J. Fan, J. Wang and R. Li, *Catalysis Communications*, 2012, **21**, 32-37.

Photocatalytic Activity Test. The photocatalytic activity experiments of the products for the degradation of methyl orange (MO) were performed at ambient temperature using a 350 W Xe arc lamp with a 420 nm cutoff filter as the light source. The distance between the liquid surface of the suspension and the light source was about 10 cm. Typically, 0.05 g photocatalysts were added into 50 mL of 10 mg L^{-1} MO aqueous solution in a container. Prior to irradiation, the suspensions were stirred in the dark for 1 h to ensure the adsorption/desorption equilibrium. At the given time intervals, about 5 mL suspension were taken for the following analysis after centrifugation. The MO photodegradation was then analyzed on a UV–vis spectrophotometer (UV-2012PC).

Materials characterizations. The crystal structure was determined using X-ray diffraction (XRD, Bruker D8 Advanced Diffractometer with Cu Kα radiation). The morphology and structure of the samples were characterized by high-resolution transmission electron microscopy and selected area electron diffraction (HRTEM/SAED, JEOL JEM-2100), and field emission scanning electron microscopy (FESEM, HITACHI S4800). The optical absorbance spectra were recorded in a UV/vis spectrophotometer (CARY 500). The photoluminescence (PL) spectra were acquired at room temperature with a UV-VIS-NIR fluorescene spectrophotometer (Fluorolog-3-P) under the ultraviolet excitation of 491 nm.

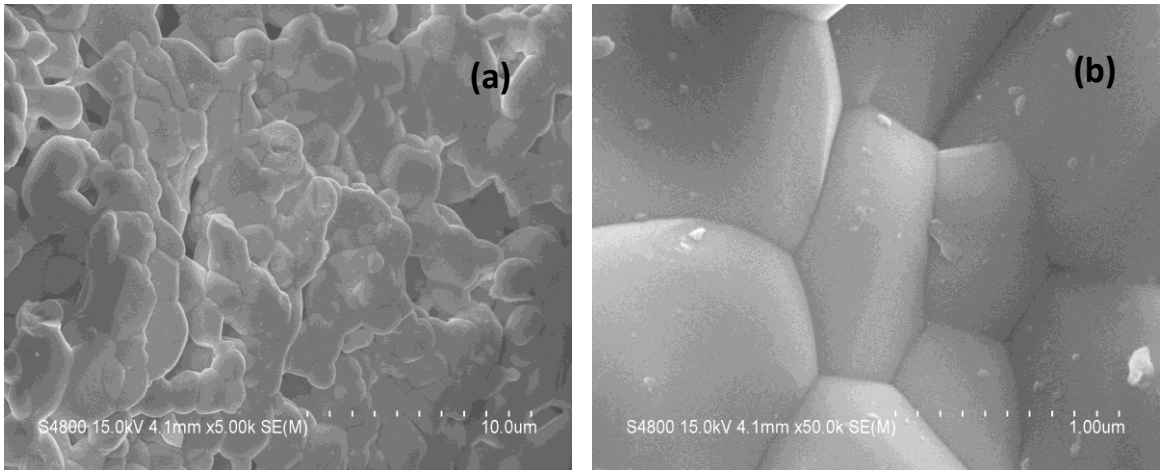

Fig. S1 SEM images of bulk $PbBiO_2Br$ samples.

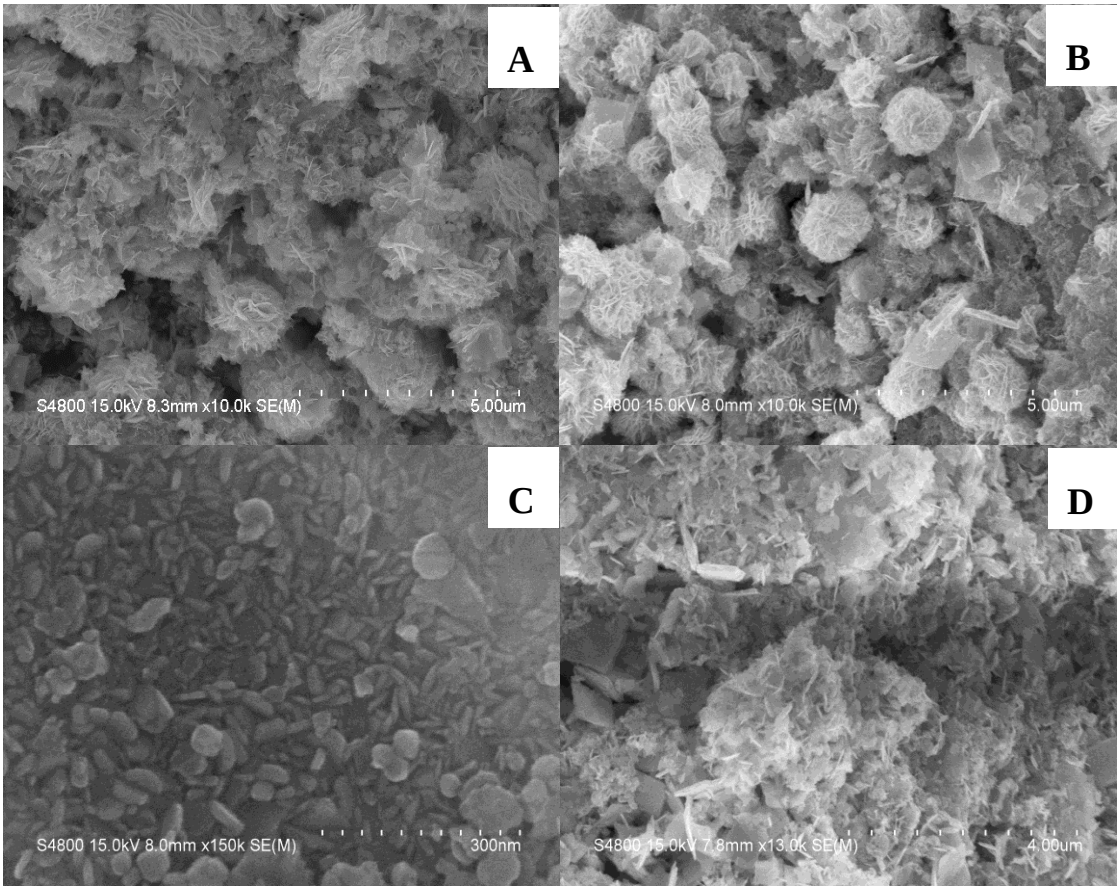

Fig. S2 SEM images of reference $PbBiO_2Br$ samples. A) S1, B) S2, C) S3, D) S4.

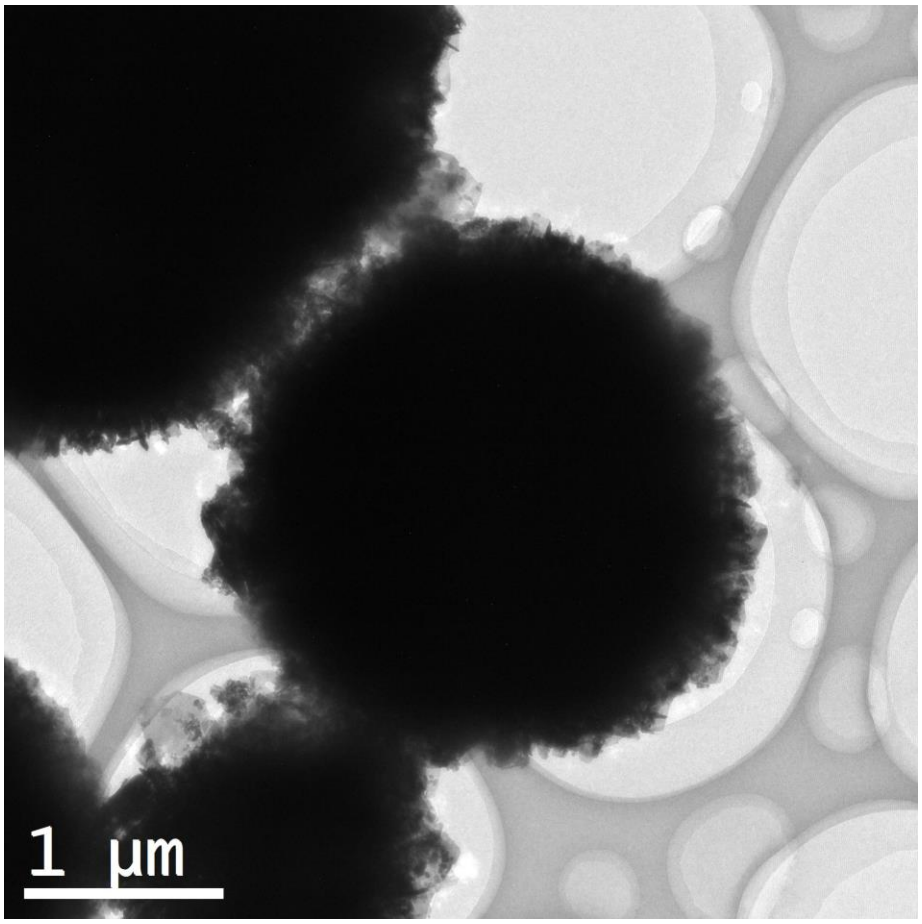

Fig. S3 TEM image of $PbBiO_2Br$ hierarchical microspheres.

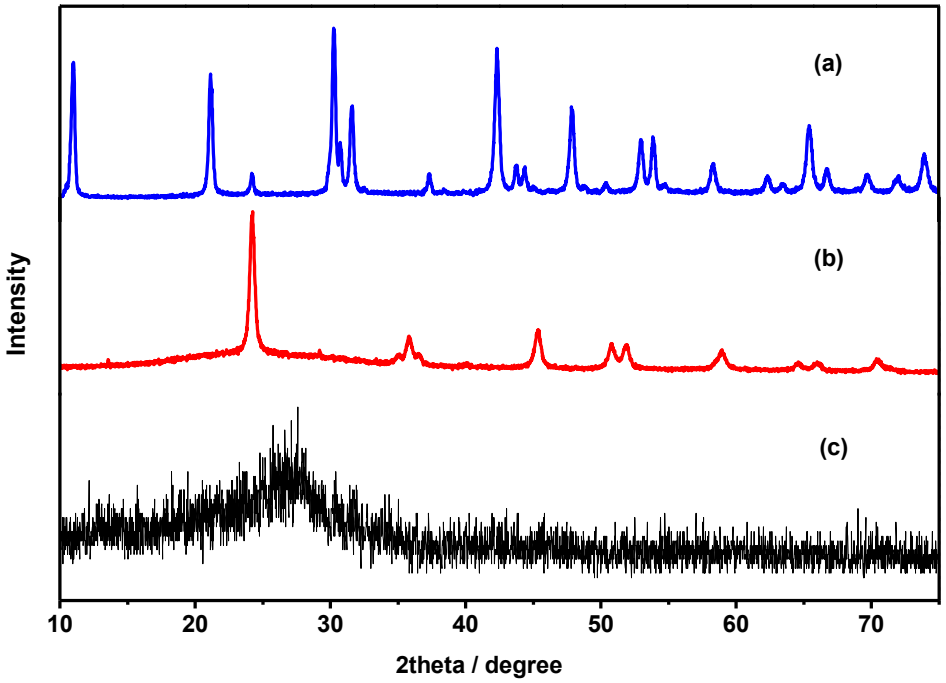

Fig. S4 XRD patterns of (a) BiOBr, (b) $TiO_{2-x}N_x$, and (c) C_3N_4.

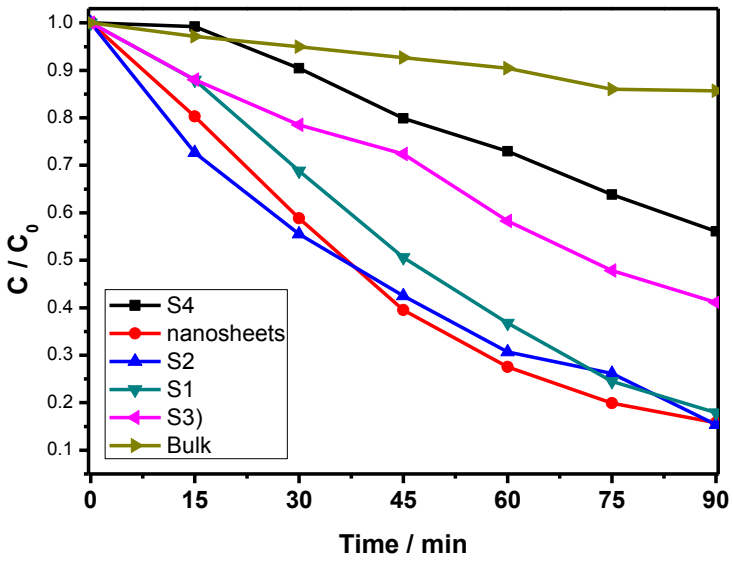

Fig. S5 The MO normalization concentration in the solution with different $PbBiO_2Br$ versus the exposure time under visible light (λ>420 nm).

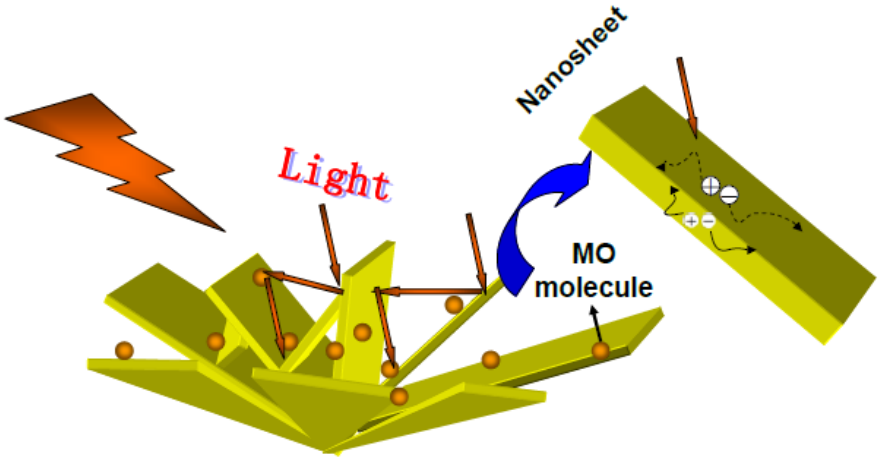

Fig. S6 Schematic illustration of photocatalytic degradation MO on hierarchical $PbBiO_2Br$.

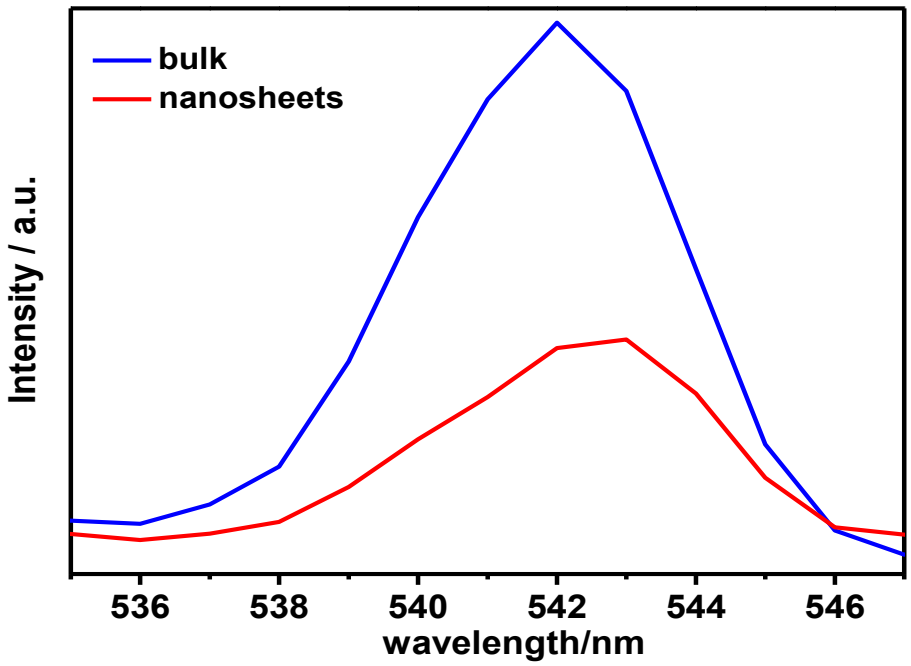

Fig. S7 PL emission spectra of the bulk $PbBiO_2Br$ and $PbBiO_2Br$ nanosheets.