Supporting information for

Synthesis and Facet-Dependent Photoreactivity of BiOBr Single-Crystalline Nanosheets

Wenwen Lin,[a] Xian Wang,[a] Wang Yonghao,[a] Zhang Jiye,[a] Zhang Lin,[b] Bintian Zhang [b] and Feng Huang [*a]

[a] Key Laboratory of Optoelectronic Materials Chemistry and Physics, Fujian Institute of Research on the Structure of Matter, Chinese Academy of Sciences, Fuzhou, Fujian, 350002, PR China

[b] State Key Lab of Structural Chemistry, Fujian Institute of Research on the Structure of Matter, Chinese Academy of Sciences, Fuzhou, Fujian, 350002, PR China

*Corresponding author *E-mail address*: fhuang@fjirsm.ac.cn.

Experimental section

Synthesis of photocatalysts. In a typical procedure, 1 m mol of $Bi(NO_3)_3 \cdot 5H_2O$ and 3 m mol of KBr was added into 15 mL distilled water at the room temperature with continuous stirring, and then 2 M NaOH solution was added to this solution till the pH value of solution reaches to 6.0. The mixture solution was magnetically stirred for 15 min and then poured into a 20 mL Teflon-lined stainless autoclave. The autoclave was heated at 160 ^{O}C for 2 h under autogenous pressure, and then cooled to room temperature. The resulting precipitates were collected and washed with deionized water and ethanol thoroughly and dried at 60 ^{O}C in air. The product obtained was denoted as BOB-010. Moreover, the product obtained without the adjustment of pH was denoted as BOB-001.

Characterization. The powder X-ray diffraction (XRD) measurement was carried out on Philip X'pert Pro diffractometer with monochromatized Cu *Ka* radiation (λ=0.15418nm).Scanning electronic microscopy (SEM, JEOL, JSM-6700F) analyses were used to determine the particle size and morphology. Further morphological and s tructural characterization was based on transmission electron microscopy (TEM) and high-resolution transmission microscopy (HRTEM) observation. TEM/HRTEM analyses were conducted on a JEM-2010 electron microscope at an acceleration voltage of 200 kV. Before TEM observation, the samples were dried in air, and then suspended in ethanol, and then a drop of this suspension was deposited onto a holey carbon film supported by a Cu grid. UV-visible diffused reflectance spectra of the samples were obtained for the dry-pressed film samples using a UV-visible spectrophotometer (UV-2500, Shimazu, Japan). The reflectance standard in the UV-visible diffused reflectance experiment is $BaSO_4$. The absorption-desorption isotherms were recorded on a nitrogen-absorption system (Micrometritics ASAP 2010) at the liquid-nitrogen temperature of 77 K.

Adsorption capacity measurements. 2,4-DCP solutions with concentration of 1×10^{-3} mol/L were prepared before hand. Then BOB SCNs adsorbent (50 mg) was added to the dye solution (50 ml) that was immersed in a water bath at 35 ^{o}C. The concentration of the dye solution were determined by a UV-vis spectroscopy (UV-2500, Shimazu, Japan) every 20 min till unchanged.

Photoreactivity evaluation. The photoreactivity evaluation of the samples for the degradation of 2,4-dichlorophenol (DCP) were carried out at room temperature under the photoexcitation of 300 W Xe lamp with a 420 nm cutoff. In a typical procedure, a 10 mg amount of photocatalyst was added into 50 mL of 10^{-3} mol/L 2,4-DCP solution in a container. In order to ensure the adsorption/desorption equilibrium, the solution was stirred for 30 min in the dark before illumination. During the degradation, the solution with photocatalyst was continuously stirred with a magnetic stirrer and the concentration of 2,4-DCP was determined by colorimetry with a UV-visible spectrophotometer (UV-2500, Shimazu, Japan).

Photoluminescence (PL) spectra. Photoluminescence measurements were carried out at room temperature in a Cary Eclipse Fluorescence Spectrophotometer. The samples were excited at 300 nm, and an emission filter (360–1100 nm) was used in order to minimize the background signal at the excitation wavelength.

Photoelectrochemical Measurements. The photoelectrodes were prepared according to previously reported work.[1,2] The indium doped tin oxide (ITO, China Southern Glass

Co., Ltd., Shenzhen, China) substrates were cleaned by ultrasonication in distilled water and absolute alcohol for 10 min sequentially. Both edges of the conducting glass substrates were covered with adhesive tapes. Typically, the aqueous slurries of the BOB SCNSs were spread on an ITO glass substrate with a glass rod, using adhesive tapes as spaces. The suspension was prepared by grinding 20 mg of the BOB SCNSs, 40 μL of PEDOT-PSS (Sigma-Aldrich, 1.3-1.7%) aqueous solution and 100 μL of water, and the film was dried in air and annealed at 150 °C for 30 min in flowing N_2 atmosphere. The photocurrents were measured by an electrochemical analyzer (CHI660D Instruments) in a standard three-electrode system with the BOB SCNSs as the working electrodes, a Pt foil as the counter electrode, and a saturated Ag/AgCl electrode as a reference electrode. A 300 W Xe lamp was utilized as a light source. A 0.5 mol/L Na_2SO_4 aqueous solution was used as the electrolyte.

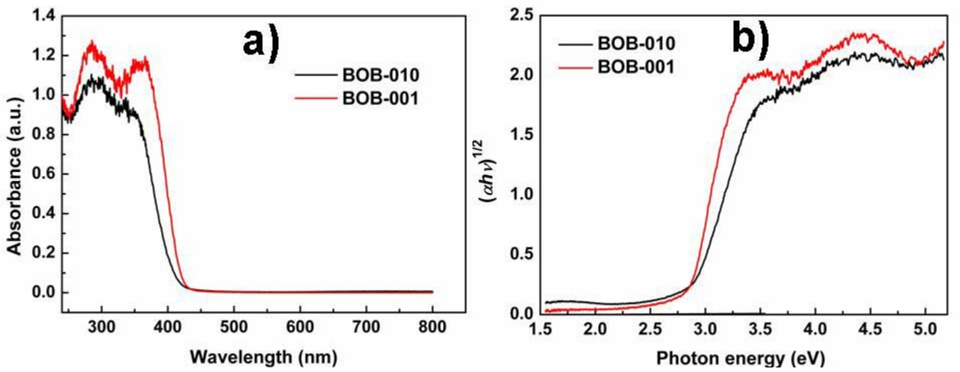

Fig. S1 UV-vis diffuse reflectance spectra of the BOB SCNs (a) $(\alpha h\nu)^{1/2}$ versus photon energy ($h\nu$) for BOB SCNs (b).

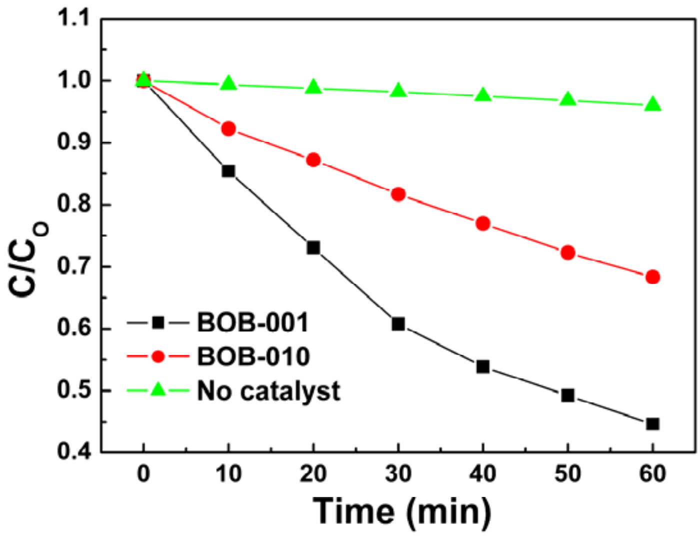

Fig. S2 Time profiles of photocatalytic degradation of 2,4-DCP over the BOB SCNs under UV light irradiation.

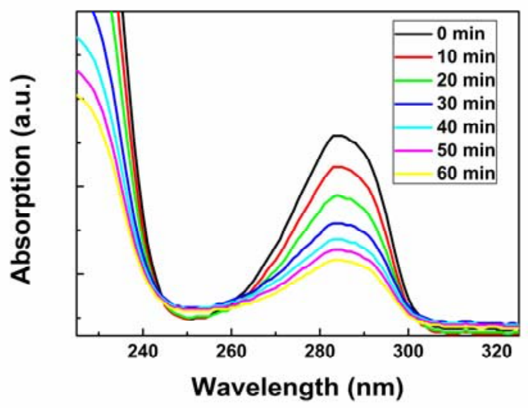

Fig. S3 Photocatalytic irradiation time-dependent absorption spectra of 2,4-DCP over the BOB-001 SCNs under UV light irradiation.

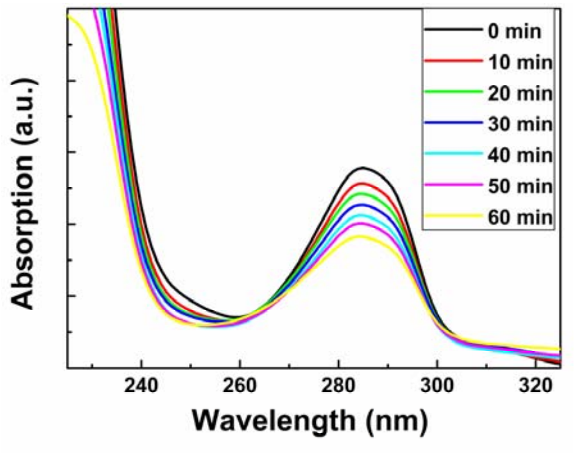

Fig. S4 Photocatalytic irradiation time-dependent absorption spectra of 2,4-DCP over the BOB-010 SCNs under UV light irradiation.

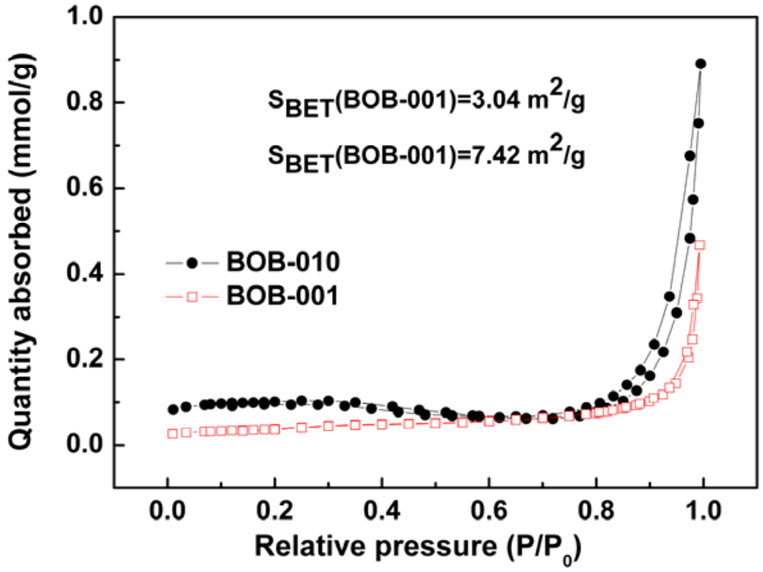

Fig. S5 Nitrogen adsorption-desorption isotherm of the BOB SCNs.

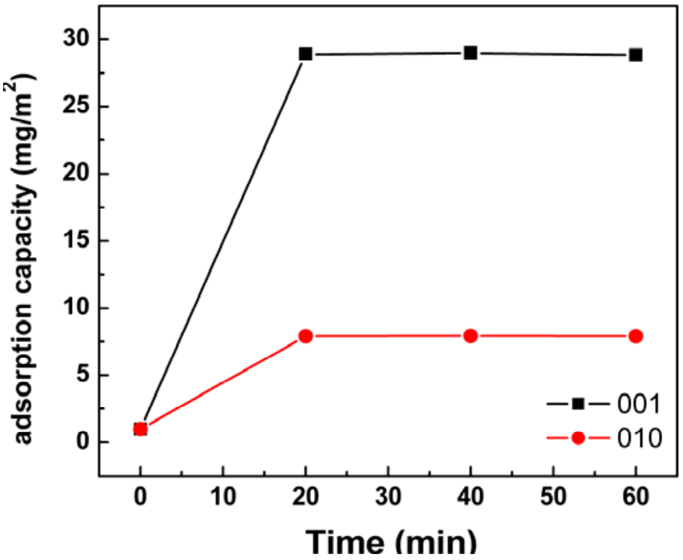

Fig. S6 Time profiles of adsorption of 2,4-DCP over the BOB SCNs in the dark.

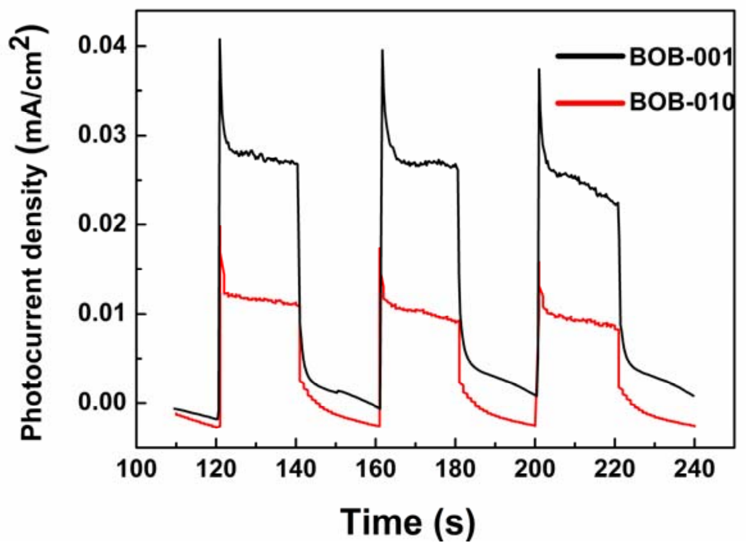

Fig. S7 Photocurrent responses of the BOB SCNSs in 0.5 M Na_2SO_4 aqueous solutions under UV irradiation

Photoelectrochemical measurement is a conventional method for surveying the efficiency of charge transfer and separation. As shown in Figure S7, the transient photocurrent responses of the two BOB SCNS films. Both electrodes were prompt in generating photocurrent with a reproducible response to on/off cycles, but the BOB-001 film electrode exhibited a higher photocurrent than the BOB-010 film electrode, indicating the more efficient photoinduced charge separation and transfer in BOB-001.

References:

(1) Zhang, Y. J.; Mori, T.; Ye, J. H.; Antonietti, M. *J. Am. Chem. Soc.* **2010**, *132*, 6294.

(2) Dong, G. H.; Zhang, L. Z. *J. Mater. Chem.* **2012**, *22*, 1160.