Supporting Information

Fabricating Oxygen Vacancy-Rich Bi_2WO_6/Bi_2S_3 Z-Scheme Nano-Heterojunction on Carbon Fiber with Polydopamine for Enhanced Photocatalytic Activity

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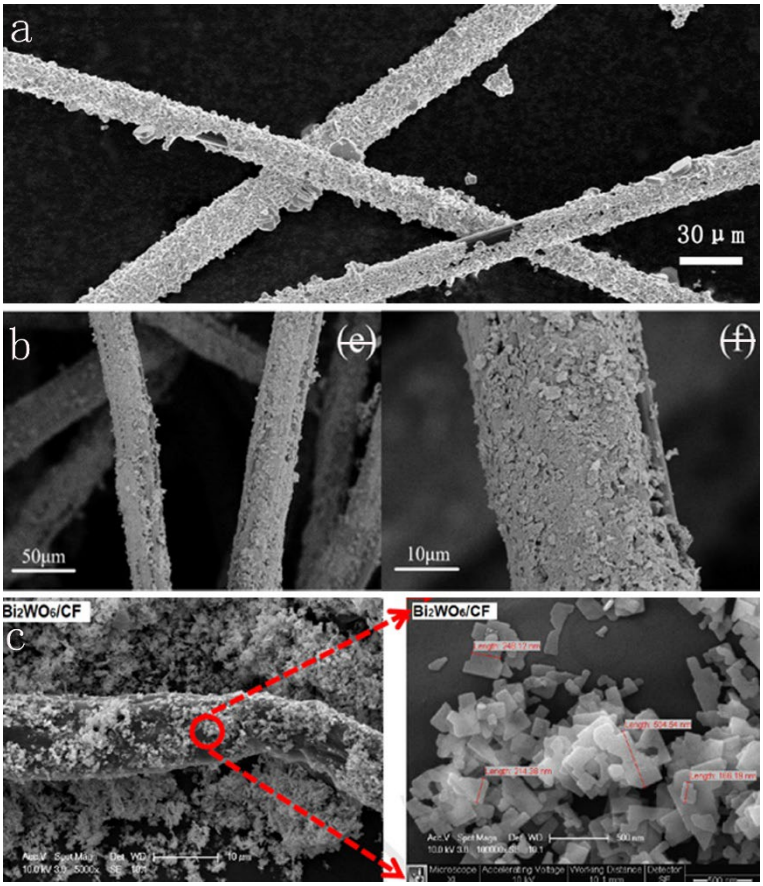


Fig. S1. Carbon fibre surface loaded photocatalytic materials: (a) $BiVO_4$/carbon fiber [1],
(b) BiOI/Bi_2WO_6/ACF[2], (c) Bi_2WO_6/carbon fibre [3].

Text S1. Characterizations Methods

The morphological structure, elemental content and distribution of the catalysts were characterized and analyzed by scanning electron microscopy (FESEM, Hitachi S-4800), and the microstructure was tested by transmission electron microscopy (TEM, JEM-2100). The physical structure (crystal structure and physical composition) of the samples was characterized by X-ray diffractometry (XRD, Bruker D8 Disvover), and the physical structure of the prepared samples was determined using Cu Kα (λ = 1.5406) radiation at 40 kV and 40 mA. The surface elemental composition and chemical valence states of the samples were analyzed by X-ray photoelectron spectroscopy (XPS) characterisation and tested using a Thermo ESCALAB 250XI instrument. Oxygen vacancies and free radical active species determination were analyzed by EPR test, which was performed on a Bruker A-300 instrument. UV-vis DRS was performed by UV-visible spectrophotometer (Hitachi-U3900). Photoluminescence spectra were tested using a fluorescence photometer (Hitachi F-7000). FT-IR spectra were tested using a FT-IR spectrometer (Thermo, Nicolet 5700). The photoelectrochemical properties were tested using an electrochemical workstation (CHI660E) with a standard three-electrode test method. Specific surface area was measured at 77 K by an F-sorb 3400 microporous analysis system (3H-2000PS1). The content of carbon fibres in the catalyst was determined by using a thermogravimetric analyser (PerkinElmer PYRIS 1).

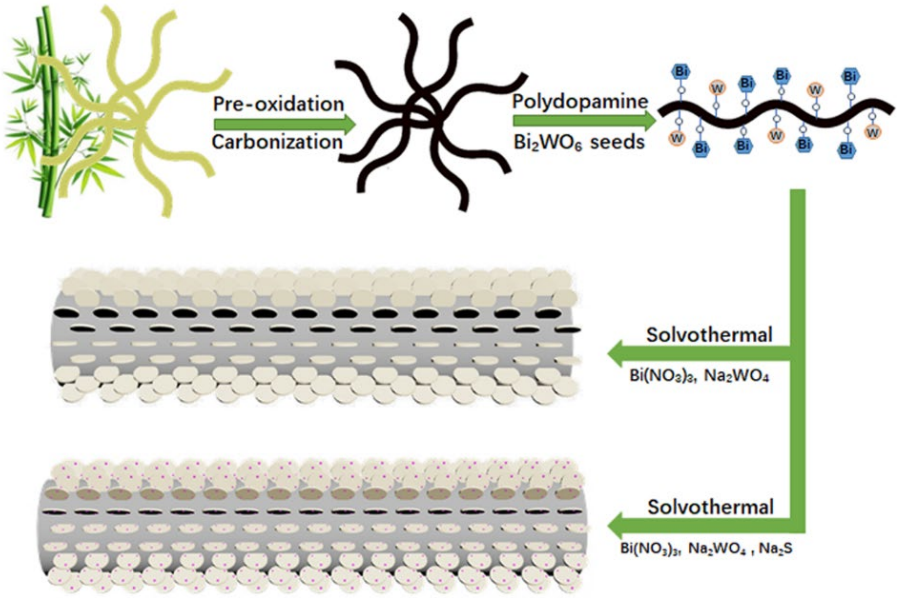


Fig. S2. Preparation of Bi_2WO_6/CFb and Bi_2WO_6/Bi_2S_3/CFb composite photocatalytic fibres

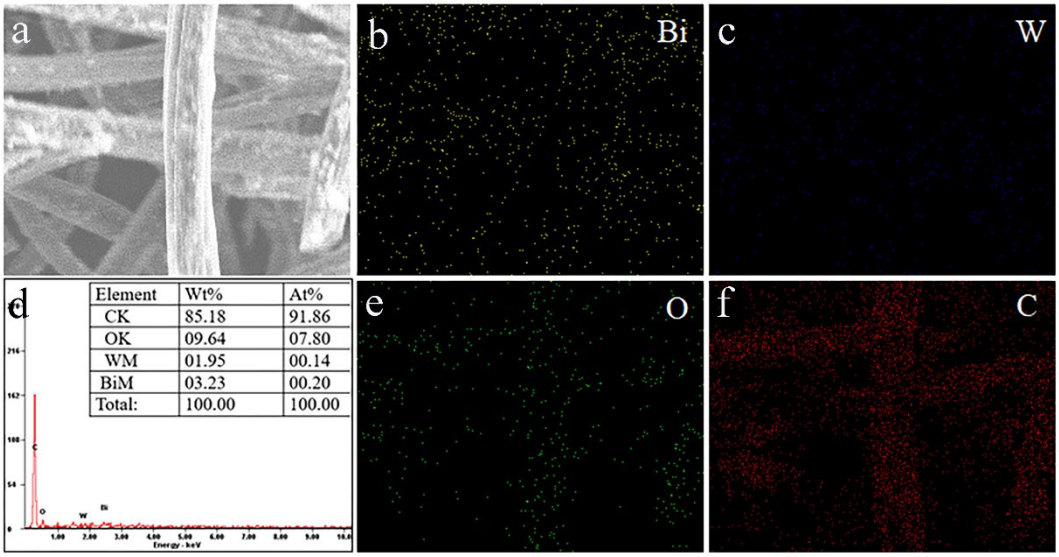


Fig. S3. The SEM-EDS spectrum and mapping of CFb with Bi_2WO_6 seeds sample.

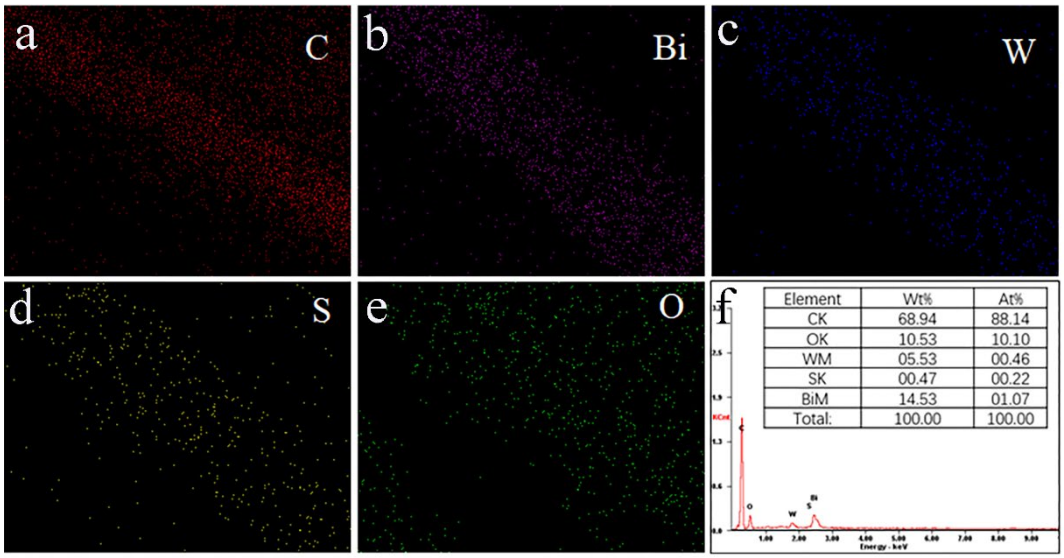


Fig. S4. The SEM-EDS spectrum and mapping of Bi_2WO_6/Bi_2S_3/CFb sample.

Fig. 4 SEM-EDS image of Bi_2WO_6/Bi_2S_3/CFb sample

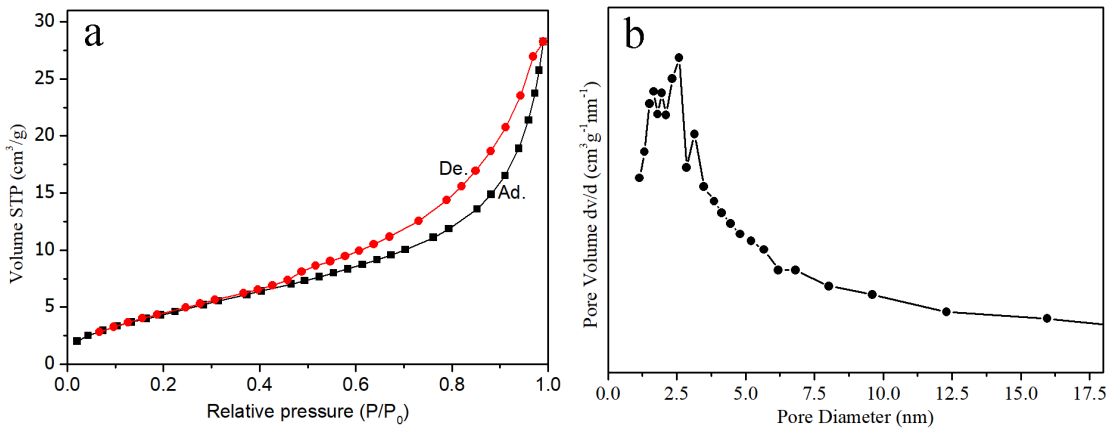


Fig. S5. Nitrogen adsorption/desorption isotherm (a) and mesoporous distribution (b) of Bi_2WO_6/Bi_2S_3/CFb.

Fibers are generally considered to have a relatively large comparative area, and here the specific surface area and internal pore size of Bi_2WO_6/Bi_2S_3/CFb photocatalytic fibers were determined by BET nitrogen adsorption capacity method[4]. As shown in Fig. S5a, the specific surface area of the fibrous material was obtained as 18.058 cm^2/g by the BET calculation model. As shown in Fig. S5b, the average pore diameter of the Bi_2WO_6/Bi_2S_3/CFb photocatalytic fiber calculated by the Barrett-Joyner-Halenda (BJH) equation was about 3.797 nm.

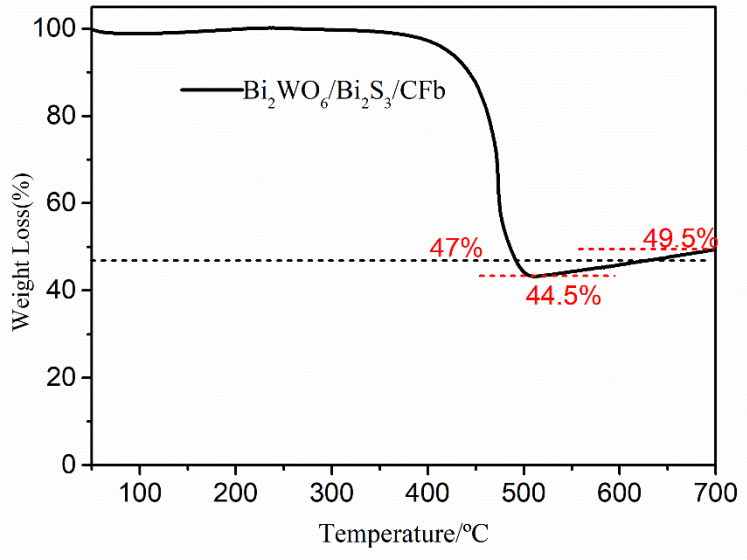


Fig. S6. TG curve of Bi_2WO_6/Bi_2S_3/CFb.

The content of carbon fibers in Bi_2WO_6/Bi_2S_3/CFb specimens was investigated by thermogravimetric analysis. As shown in Fig. S6, the content of Bi_2WO_6/Bi_2S_3 wrapped around the carbon fibers was determined by thermogravimetric analysis (TGA) in air at temperatures ranging from 30°C to 700°C. There was a significant weight loss of more than 50 wt% of Bi_2WO_6/Bi_2S_3/CFb over the temperature range of 360°C to 520°C, which was mainly due to the combustion of carbon fibers in oxygen. Based on the changes in the weight loss curve of Bi_2WO_6/Bi_2S_3/CFb, the content of Bi_2WO_6/Bi_2S_3 in the Bi_2WO_6/Bi_2S_3/CFb composite photocatalysts was estimated to be around 47 wt%, and the content of the carbon fibers was about 53%. Based on the mol ratio of Bi_2WO_6 to Bi_2S_3 when preparing Bi_2WO_6/Bi_2S_3/CFb, it can be surmised that the content of Bi_2S_3 is about 4 wt%. In addition, the last part of the TGA curve rose weakly, which may be attributed to the instability of the machine.

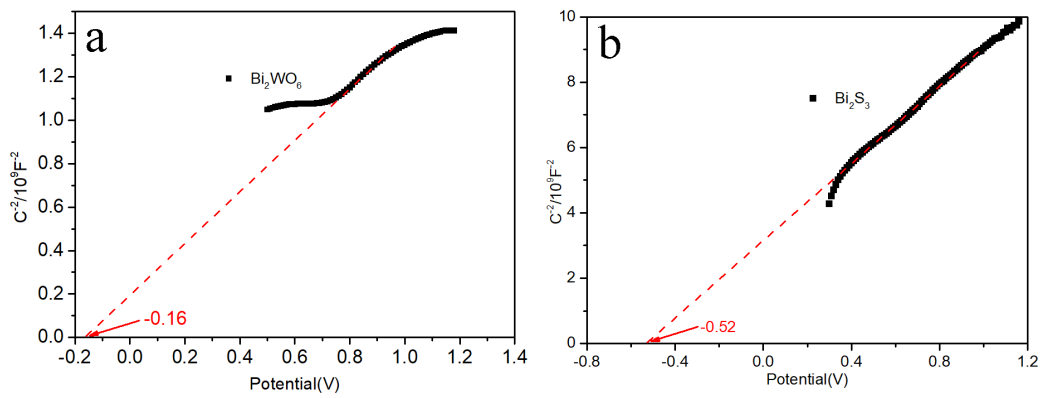


Fig. S7. The Mott-Schottky plots of Bi_2WO_6 (a) and Bi_2S_3 (b).

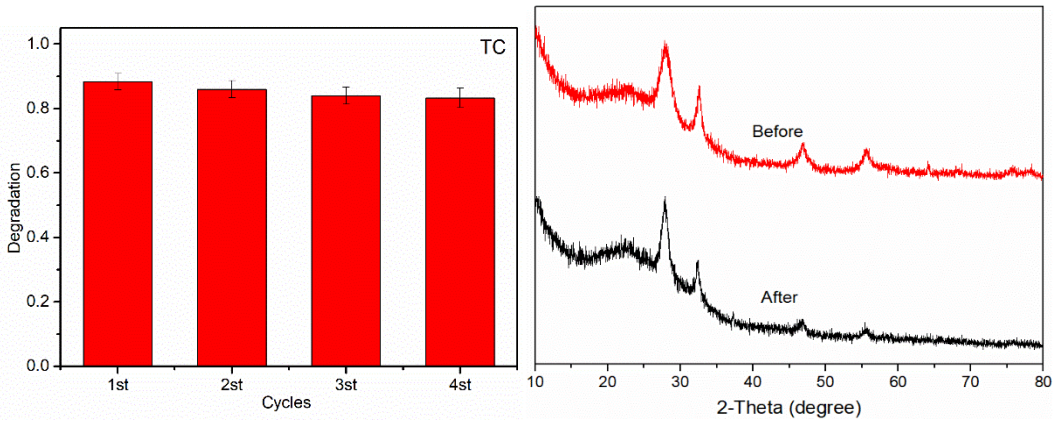


Fig. S8. (a) The repeated cycling performance of Bi_2WO_6/Bi_2S_3/CFb for TC removal with 50 minutes every, (b) the XRD spectrum of $Bi_2WO_6/Bi_{(2)}S_3$/CFb before and after photocatalytic experiment.

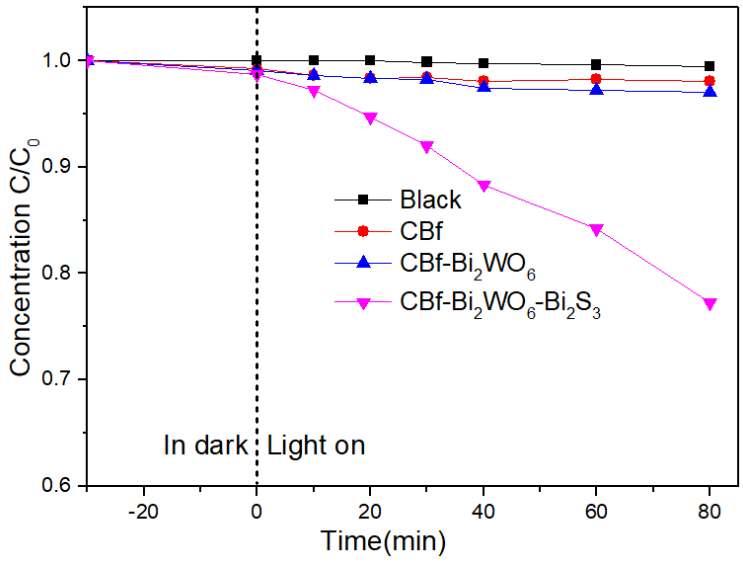


Fig. S9. Photodegradation of p-nitrophenol (20 mg/L) under simulated sunlight.

References

1. Ma, J.; Chen, J.; Wang, B.; Cai, S. The in-situ growth of $BiVO_4$ coatings on carbon fibers and their photocatalytic performance. *Materials Research Bulletin* **2016**, *77*, 253-257, doi:10.1016/j.materresbull.2016.01.047.
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