

Supporting information for

Preparation of TiO₂/Bi₂WO₆ nanostructured heterojunctions on carbon fiber as weaveable visible-light photocatalyst/photoelectrode†

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1 Experimental section

1.1 Materials and chemicals

All reagents were analytical grade and used without further purification. Absolute ethanol (CH₃CH₂OH), acetone (CH₃COCH₃), nitric acid(HNO₃), hydrochloric acid(HCl), tetrabutyl titanate (TBT), titanium tetrachloride (TiCl₄), sodium sulphate (Na₂SO₄), bismuth nitrate (Bi(NO₃)₃·5H₂O), and sodium tungstate (Na₂WO₄·2H₂O) were purchased from Sinopharm Chemical Reagent Co., Ltd (P.R. China). Rhodamine B (RhB) was purchased from Sigma (America) and 4-chlorophenol (4-CP) was purchased from J&K CHEMICAL Ltd. (P.R. China). Acid Orange 7 (AO7: C₁₆H₁₁N₂O₄SNa) was purchased from Sigma–Aldrich and

Tetracycline Hydrochloride (TTCH) was purchased from Sangon Biotech (Shanghai) Co., Ltd. The carbon fibers (CFs) were purchased from TOHO (UTS50-12K).

1.2 Characterization

The morphology and size of the resulting represented sample were investigated by using a field emission-scanning electron microscopy (FE-SEM, Hitachi S-4800). X-ray diffraction (XRD) patterns of the samples were recorded on a Bruker D4 X-ray diffractometer by using Cu K α radiation source ($\lambda = 1.5418$ nm). The elemental composition and distribution were also investigated by using energy dispersive X-ray spectroscopy (EDS) on a Bruker Quantax 400 EDS system during SEM characterization. When we measured the UV-vis diffuse reflection spectra of fiber-based samples, plenty of fiber-based samples were adhered tightly on sample stage by the double-sided adhesive tape, resulting in the formation of fiber-based texture/film. Their optical diffuse reflectance spectra were conducted on a UV-vis-NIR scanning spectrophotometer (UV3600, Shimadzu) using an integrating sphere accessory.

1.3 Photocatalytic activities

Photocatalytic reactions were conducted in a customized reactor with a cooling-water-cycle system, and the reaction temperature of the aqueous solution was maintained at 20 ± 2 °C. The photocatalytic activities of the as-prepared photocatalytic material evaluated by degrading RhB, AO7, 4-CP, TTCH in an aqueous solution under visible light irradiation using a 300 W xenon lamp (Beijing Perfect Light Co. Ltd., Beijing) with a cut-off filter as the light source. Prior to irradiation, the suspension was magnetically stirred in the dark for 60 min to ensure that an adsorption/desorption equilibrium was established between the photocatalysts and organic contaminant (RhB, AO7, 4-CP or TTCH). During the reaction process under

visible light illumination, 1 mL of suspension was collected at given irradiation time intervals and filtered (pore size: 0.22 μm) to remove the remaining solids for analysis.

For the photocatalytic test of RhB, AO7 and TTCH, the UV-vis absorption spectra of the solutions were recorded on a U-2910 UV-vis spectrophotometer (Hitachi, Japan), and then RhB, AO7 and TTCH concentration was calculated by analyzing the photoabsorption intensity at wavelength of 554 nm, 485 nm and 355 nm, respectively. For the photocatalytic test of 4-CP, the 4-CP concentrations in the solutions were analyzed by high-performance liquid chromatography (HPLC) using an Dionex Ultimate 3000 series (USA) equipped with a diode array detector (DAD) with wavelength set at 280 nm directly after filtration through a 0.22 μm hydrofacies syringe filter. The mobile phase was methanol (80%) and water (20%) and the flow rate was 0.5 mL min^{-1} .

The explore experiment of main active species were carried out by adding free radical trapping agents (1.0 mmol isopropanol (IPA), 1.0 mmol AgNO_3 , 1.0 mmol ammonium oxalate (AO) or 0.2 mmol benzoquinone) into RhB solution (10 mg L^{-1} , 50 mL) before the photocatalytic tests.

2 Figures

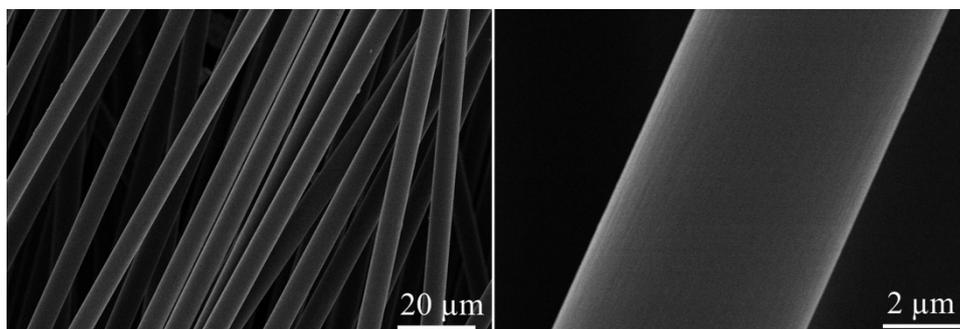


Fig. S1 The SEM image of original pure CFs.

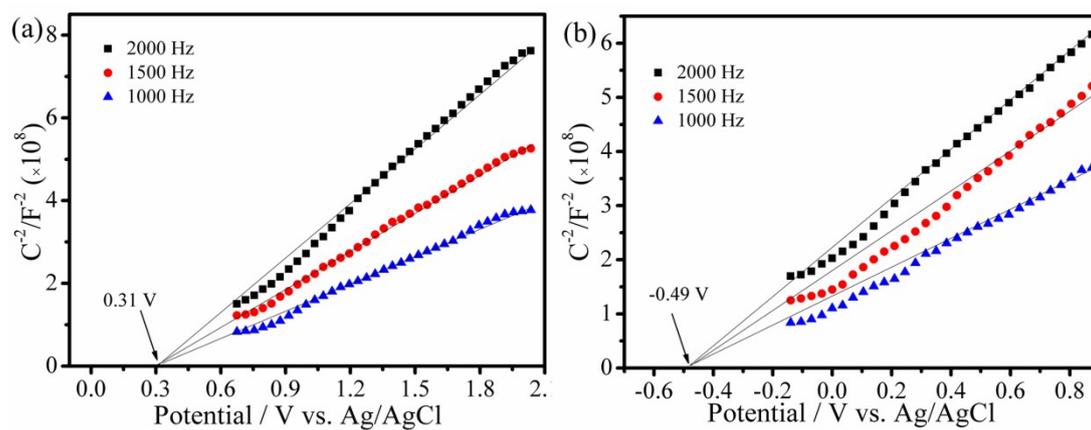


Fig. S2 Mott-Schottky plots of pure Bi₂WO₆ (a) and TiO₂ (b) at the selected frequencies of 1000, 1500 and 2000 Hz.

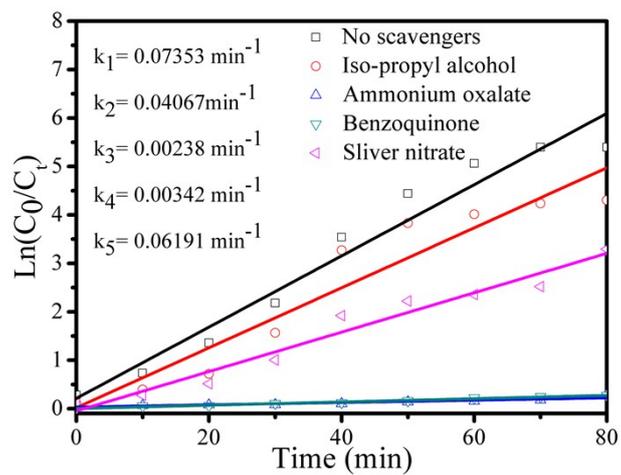


Fig. S3 The rate constants of the photocatalytic degradation of RhB in the presence of sliver nitrate (AgNO_3), ammonium oxalate (AO), isopropyl alcohol (IPA) or benzoquinone (BQ) under visible light ($\lambda > 400 \text{ nm}$)

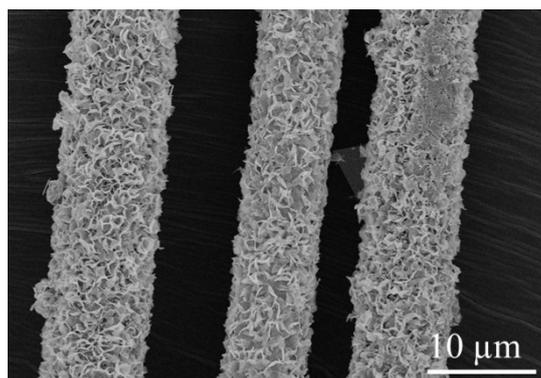


Fig. S4 The SEM images of $\text{CFs/TiO}_2/\text{Bi}_2\text{WO}_6$ sample after the test.