Supporting Information

1. Experimental section

1.1 Characterizations

Powder X-ray diffraction (XRD) patterns were analyzed by Bruker D8 Advance diffractometer with monochromatic Cu Kα Radiation (λ = 1.5406, acceleration voltage 40 kV, applied current 20 mA). Raman spectra were presented by Jobin Yvon HR 800 micro Raman spectrometer at 457.9 nm. The refined structure and morphology of the samples were recorded on scanning electron microscopy (SEM, FEI Sirion 200 instrument operated at 15 kV) and transmission electron microscopy (TEM, Tecnai G2 F20, acceleration voltage 200 kV). By X-ray electron spectroscopy (XPS), Al Kα (1253.6 eV) was studied Super axial DLD surface state of the achromatic X-ray source. An ultraviolet-visible spectrophotometer (λ950 (Perkin Elmer, USA)), diffuse reflectance spectroscopy (DRS) was performed in the range of 200-1800 nm, with barium sulfate fine powder as the reference. The nitrogen adsorption-desorption isotherms at 77 K were collected on the AUTOSORB-1 (Quantachrome instrument) nitrogen adsorption instrument. The Bruner Emmett Taylor equation is used to estimate the specific surface area. The pore size distribution was measured using Barrett–Joyner–Halenda (BJH) measurements from the isotherm adsorption branch. Fourier transform infrared spectroscopy (FT-IR) was recorded on Perkin-Elmer Spectrum One spectrometer using KBr particles.

1.2 Photocatalytic activity measurements

The photocatalytic activity of BiOCl was tested in norfloxacin ($C_{16}H_{18}FN_3O_3$) degradation process. A 300 W Xe lamp (Beijing Porphyry Co., Ltd.) with an AM 1.5 filter was used as the light source. The calibrated light intensity was 100 MW cm^{-2} before the measurements. Typically, the prepared photocatalyst (50 mg) was first added to 50 mL of norfloxacin solution (10 mg/L). To achieve adsorption-desorption equilibrium, the suspension was placed in dark at room temperature for 60 min. Then, the suspension was irradiated and vigorously stirred 4 mL of the reaction mixture was taken every 30 min and filtered through a 0.22 μm microporous filter to remove the photocatalyst from the solution. The UV-Vis absorption spectra of the residual norfloxacin were recorded with a UV-Vis spectrophotometer (Shanghai Mepro Delta UV-1800 BPC).

1.3 Photoelectrochemical measurements

With Ag/AgCl as reference electrode, platinum plate as a counter electrode, FTO glass sprayed with BiOCl or Bi/BiOCl material as photoanode, 0.2 M Na_2SO_4 aqueous solution as electrolyte (the solution is degassed with nitrogen for one hour

before use), the photoelectrochemical properties are analyzed by an electrochemical workstation (Princeton VersaSTAT) in the three-electrode system. The electrochemical test conditions are as follows: the AC characteristic is set as the starting frequency of 10000 Hz, the ending frequency of 0.1 Hz, DC potential vs OC potential, and the overvoltage is 600 mV. The preparation of photoanode is carried out by the traditional spraying method. 50 mg sample is dispersed into 5 ml ethanol solution and sonicated for more than 1 hour to achieve uniform dispersion. Then spray the uniformly dispersed solution on the transparent FTO glass substrate (TCO, fluorine-doped tin oxide layer, Nippon flat glass in Japan) with a spray gun. The sprayed FTO glass was calcined at 350 ℃ for 2 h at a constant heating rate of 5 ℃/min^{-1} in N_2 atmosphere. In the photoelectrochemical test, the coating area and illumination area are 1.5 cm^2, and AM 1.5 power supply system (Orier, USA) is used as the light irradiation source.