Electronic Supplementary Material (ESI) for Environmental Science: Water Research & Technology.

Supporting Information

Photocatalytic reductive defluorination of perfluorooctanoic acid in water under visible light irradiation: The role of electron donor

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Four Figures (Figure S1-S4);

One Table (Table S1)

1. Characterization of Materials

Crystallographic structures of the products were examined by X-ray diffractometer (XRD) (Cu Kα, D/max-Ultima IV). UV-vis absorption spectra were obtained by UV-3600 Plus spectrophotometer (Shimadzu, Japan). Morphologies and microstructures of the as-prepared materials were observed by scanning electron microscopy (SEM) (SU8220, Hitach, Japan) and transmission electron microscopy (TEM) (FE-HRTEM, Talos F200s, FEI Company). High-angle annular dark field (HAADF) images and Energy dispersive X-ray spectroscopy (EDS) were obtained by scanning TEM (Talos F200s, FEI Company). The X-ray photoelectron spectroscopy (XPS) was used to analyze surface electronic states (Escalab 250Xi, Thermo Fisher Scientific). All binding energies were calibrated using contaminant carbon (C1s = 284.8 eV).

2. Photoelectrochemical measurements

Electrochemical impedance spectroscopy (EIS) and photocurrent tests were conducted on an electrochemical workstation (CHI 650E, Shanghai Chenhua Instruments, China) with a standard three-electrode cell, using a Pt plate and a saturated Ag/AgCl electrode as counter electrode and reference electrode, respectively The working electrodes were prepared on the fluorine doped tin oxide (FTO) glass. The electrolyte used was 0.1 M Na_2SO_4 aqueous solution. 7 mg catalyst was mixed with 0.25 mL ethanol and 10 μL nafion solution by ultrasonicating for 30 min. The mixture was loaded on FTO glass and dry at 60 ^oC under atmospheric air. A 300 W Xe lamp with a 420 nm cut-off filter acted as the light source in the tests.

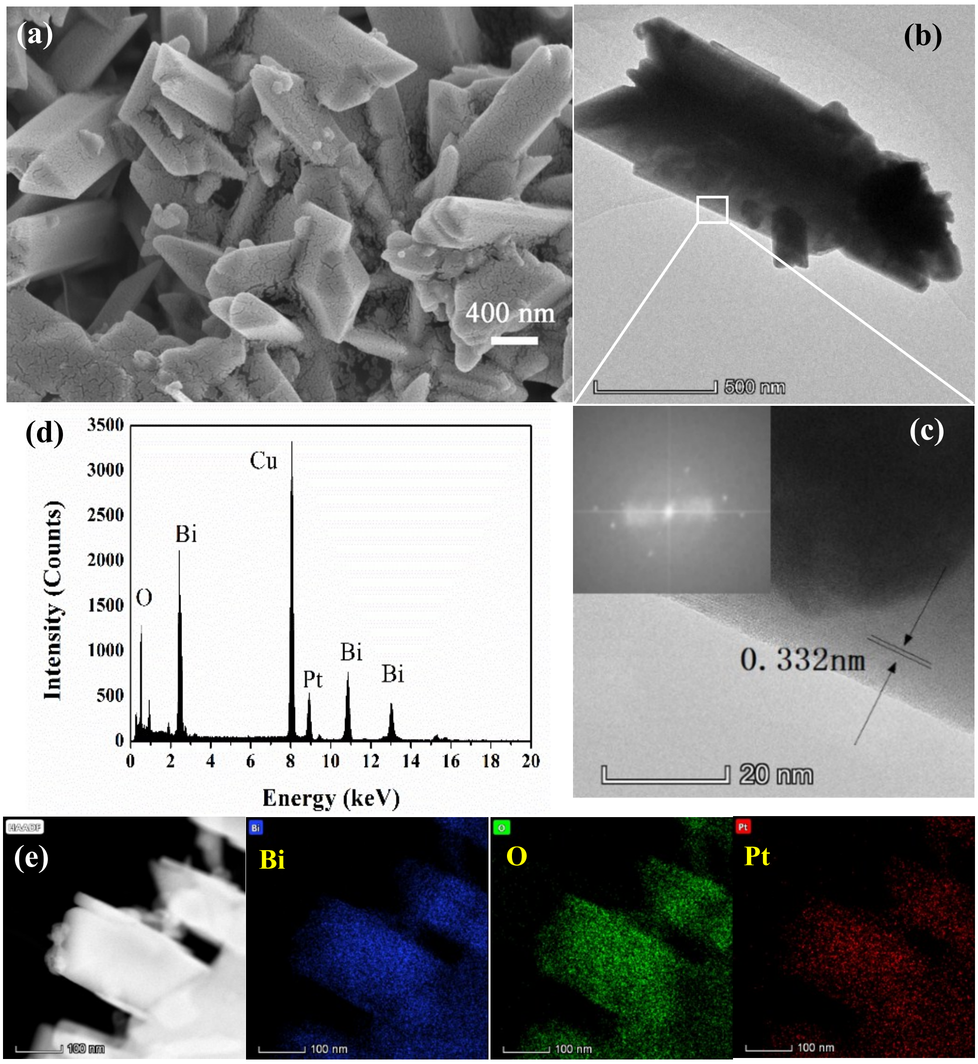

Fig. S1. (a) Scanning electron microscopy (SEM) image; (b) Transmission electron microscopy (TEM) image; (c) High-resolution transmission electron microscopy (HR-TEM) image; (d) Energy dispersive spectroscopy (EDS) spectrum; (e) High-angle annular dark field (HAADF) images and elemental mapping of the Pt-Bi_2O_4.

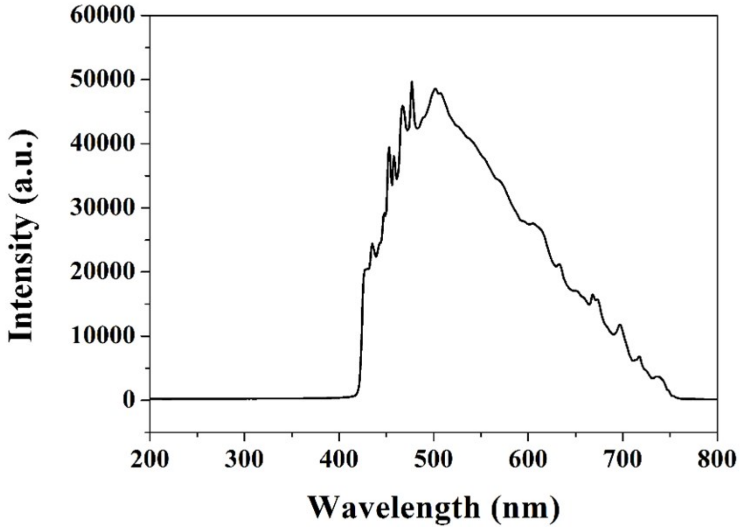

Fig. S2. Visible light spectrum used in the photocatalytic treatment of PFOA showing no UV light illumination (λ > 420 nm).

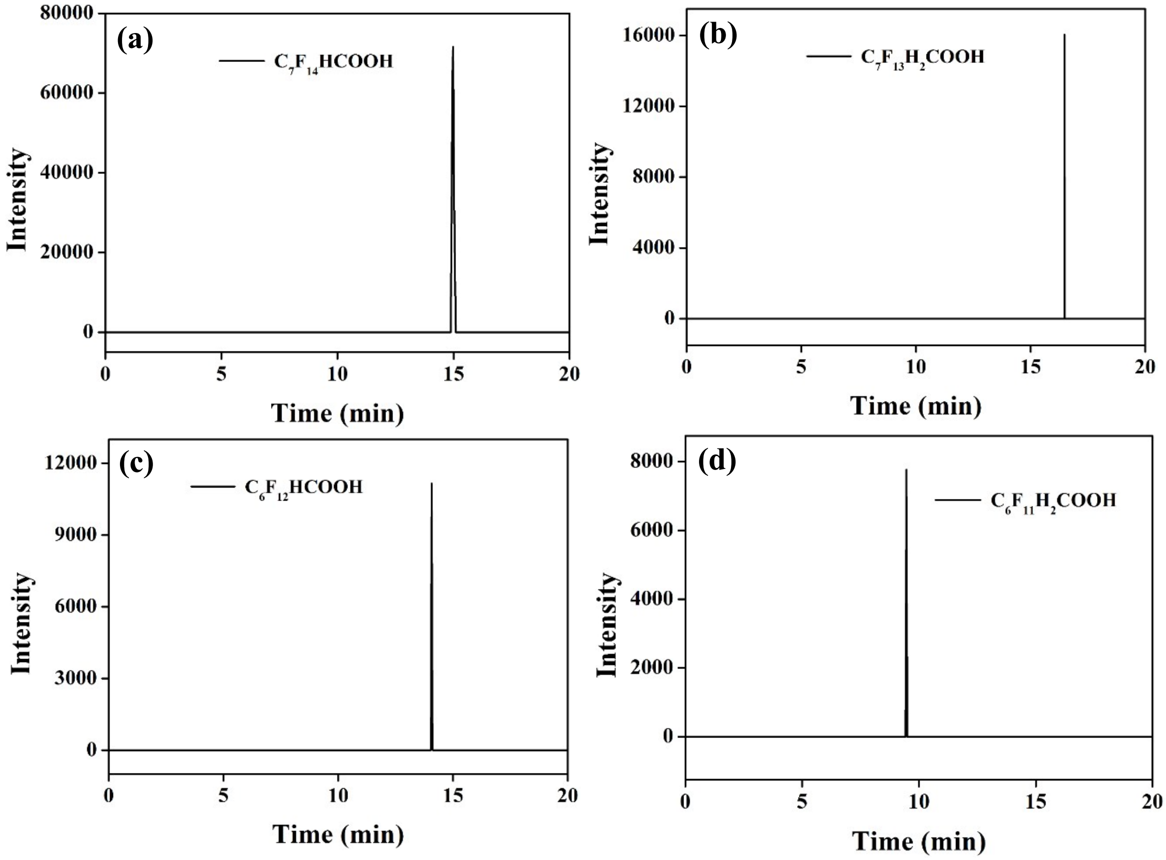

Fig. S3. Chromatogram peaks of less fluorinate carboxylic acids intermediates: (a) $C_7F_{14}HCOOH$, (b) $C_7F_{13}H_2COOH$, (c) $C_6F_{12}HCOOH$ and (d) $C_6F_{11}H_2COOH$.

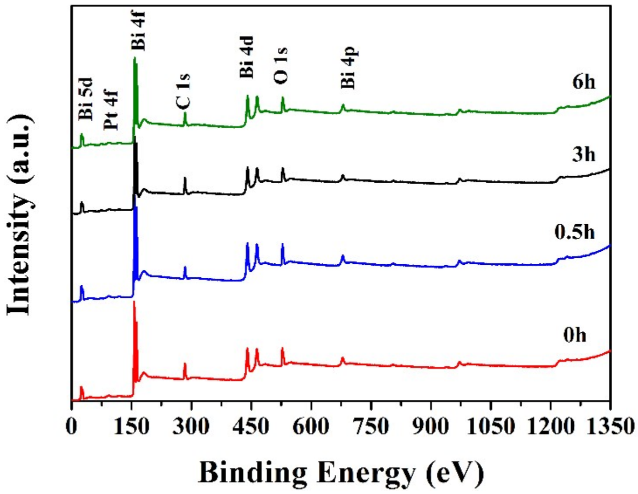

Fig. S4. X-ray photoelectron spectroscopy (XPS) survey spectra of Pt-Bi_2O_4 before and after the PFOA defluorination reaction.

Table S1. The mass spectrometer parameters of identified intermediates during photocatalytic reduction of perfluorinated acids (PFCAs).

Compound		**Abbr.**	**m/z**
Pentafluoropropionic acid	(C3)	PFPrA	162.98239
Perfluorobutyric acid	(C4)	PFBA	212.97920
Perfluoropentanoic acid	(C5)	PFPeA	262.97601
Perfluorohexanoic acid	(C6)	PFHxA	312.97281
Perfluoroheptanoic acid	(C7)	PFHpA	362.96962
Perfluorooctanoic acid	(C8)	PFOA	412.96642