

***Supporting Information***

**Photocatalytic activation of persulfate by a  $\text{TiO}_2/\text{ZnFe}_2\text{O}_4$  Z  
heterojunction photocatalyst for efficient degradation of tetracycline  
hydrochloride**

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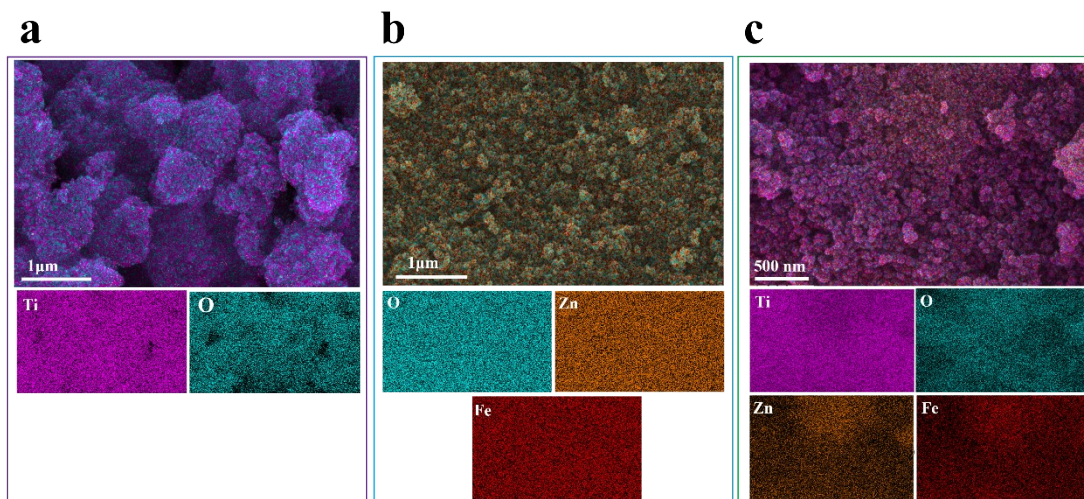
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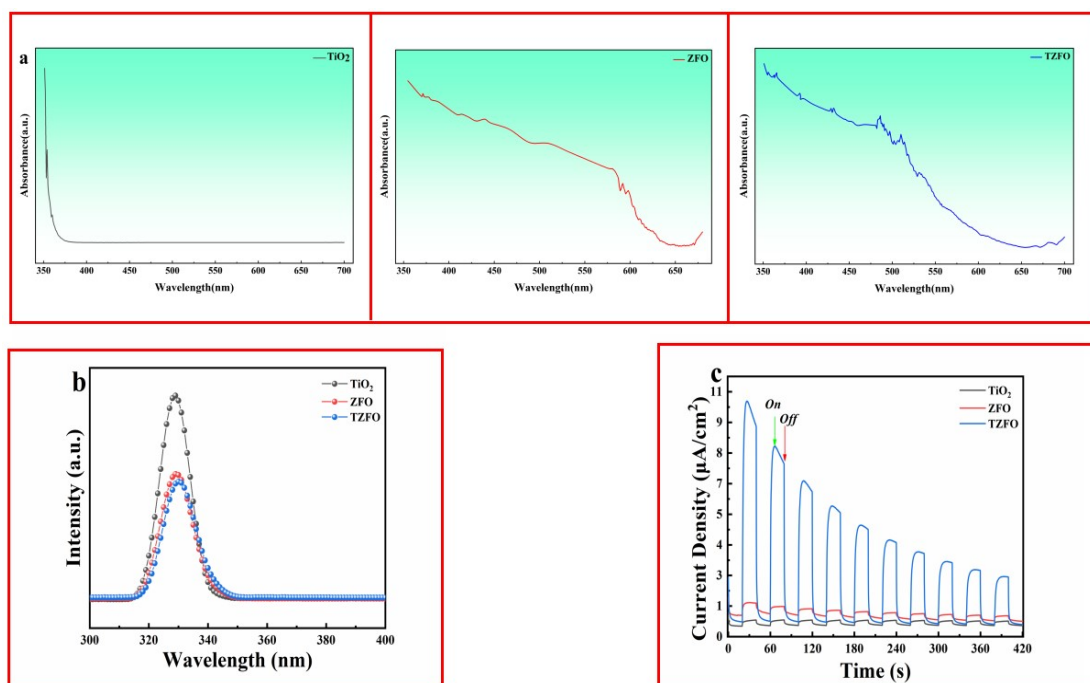
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**Figure S1.** The EDS images of representative particle samples: (a) TiO<sub>2</sub>, (b) ZFO, (c) TZFO



**Figure S2.** (a) UV-vis DRS patterns, (b) PL spectra, (c) PC spectra of TiO<sub>2</sub>, ZFO and TZFO

In order to better analyze the kinetic process of TZFO degradation of TCH, we carried out first-order and second-order kinetic fitting of the degradation process according to two kinetic reaction equations.

$$-\ln(C_t/C_0)=K_1t \text{ (First order kinetic reaction equation)} \quad (1.1)$$

$$1/C_t-1/C_0=K_2t \text{ (Second order kinetic reaction equation)} \quad (1.2)$$

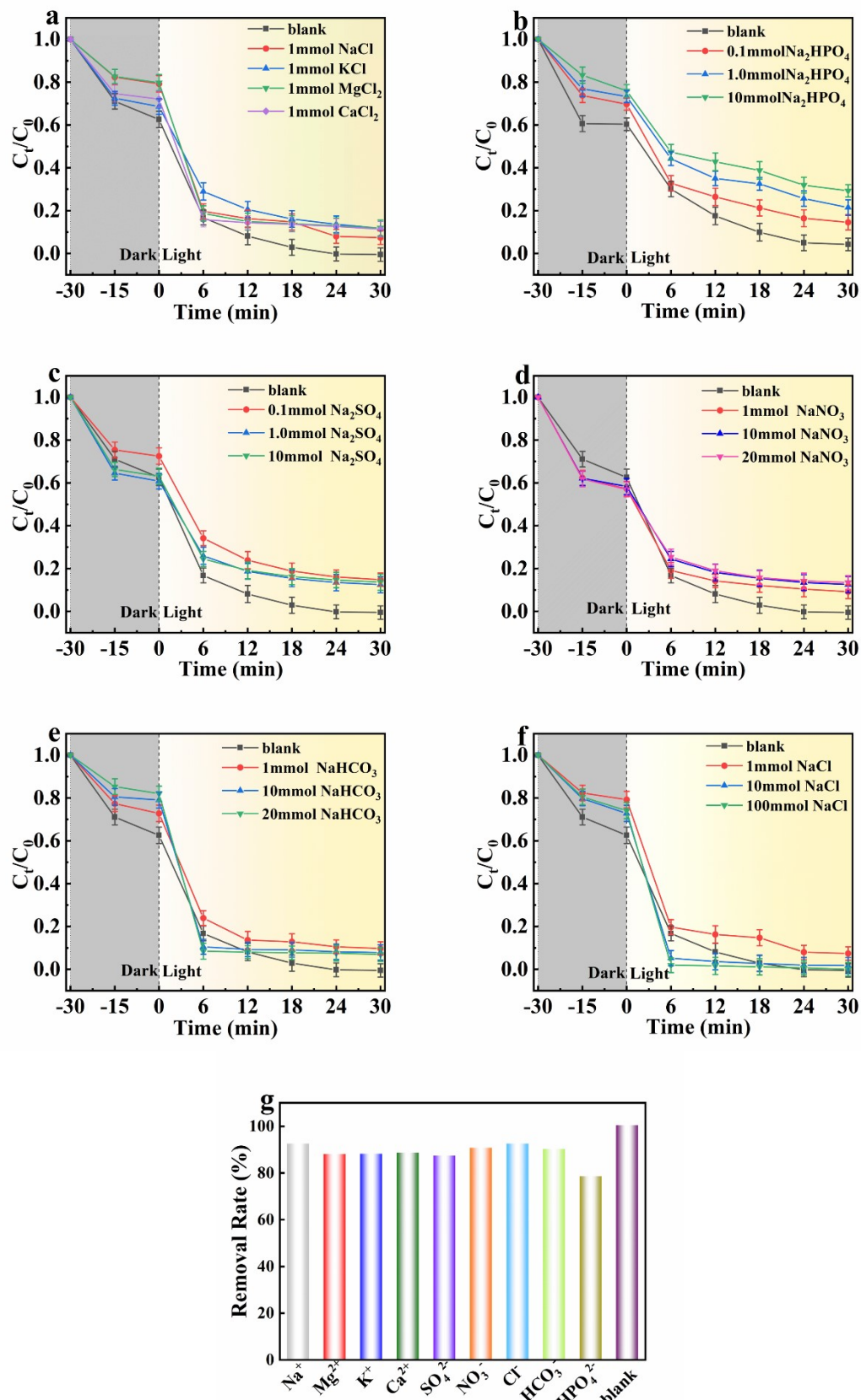
Where  $t$  is the reaction time (min),  $C_0$  and  $C_t$  are the initial concentration of pollutants and the concentration of pollutants at the moment  $t$ ,  $k_1$  and  $k_2$  are the reaction rate constants of the first and second order kinetic equations, respectively.

The first order kinetics and second order kinetics fitting results of TZFO degradation TCH are detailed in Table S1.

Table S1. Kinetic fitting results of TZFO degradation of TCH

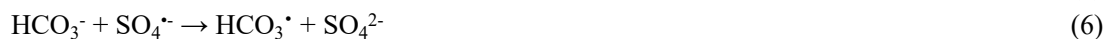
Amount of	first-order reaction kinetics	Second-order reaction kinetics
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photocatalyst (g/L)	$K_1$ (min <sup>-1</sup> )	$R^2$	$K_2$ (min <sup>-1</sup> )	$R^2$
0.5	0.03115	0.84981	0.00358	0.90832
0.7	0.03705	0.87599	0.00497	0.95693
1.0	0.03315	0.87834	0.00467	0.95727
1.5	0.03779	0.84926	0.00630	0.91087
2.0	0.02785	0.90473	0.00309	0.94198



**Figure S3.** the effect of (a) positive ion, (b) HPO<sub>4</sub><sup>2-</sup>, (c) SO<sub>4</sub><sup>2-</sup>, (d) NO<sub>3</sub><sup>-</sup>, (e) HCO<sub>3</sub><sup>-</sup>, and (f) Cl<sup>-</sup> on the photocatalytic performance, (g) comparison of effects of different ions on photocatalytic systems

The interaction between active species and ions is shown in the following equation:



Tauc Plot method was used to further process the UV-vis DRS test data, and the band gap value of semiconductor material was calculated according to Kubelka-Munk formula (1.3).

$$(\text{ah}\nu)^{1/n} = A(\text{h}\nu - E_g) \quad (1.3)$$

Where  $a$  is the absorption coefficient,  $h$  is the Planck constant,  $\nu$  is the optical frequency,  $E_g$  is the bandgap energy,  $n$  is determined by the type of semiconductor material, when the semiconductor is a direct bandgap,  $n=1/2$ ; When the semiconductor has an indirect band gap,  $n=2$ .

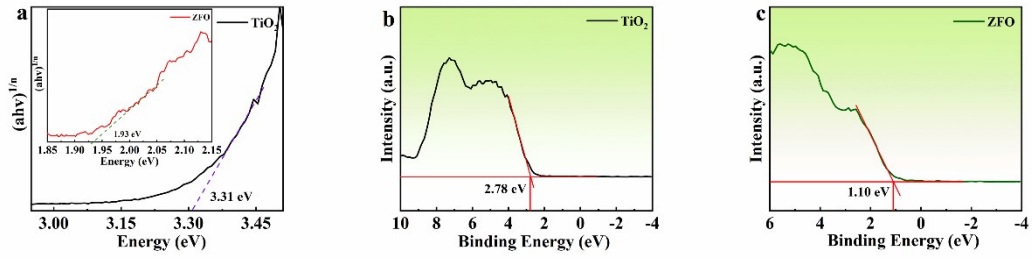
The  $E_{\text{VB-XPS}}$  values of  $\text{TiO}_2$  and ZFO can be obtained according to the results of XPS valence band spectrum, and the valence band potential ( $E_{\text{VB-NHE}}$ ) corresponding to the standard hydrogen electrode potential can be calculated by formula (1.4).

$$E_{\text{VB-NHE}} = \varphi + E_{\text{VB-XPS}} - 4.44 \quad (1.4)$$

Where  $E_{\text{VB-NHE}}$  is the valence band potential corresponding to the standard hydrogen electrode potential, and  $E_{\text{VB-XPS}}$  is the valence band value  $\varphi$  obtained in the XPS valence band spectrum and the work function of the test instrument ( $\varphi=4.2$ ). Given the valence band value ( $E_{\text{VB}}$ ) of the material, the conduction band potential ( $E_{\text{CB}}$ ) of the material is calculated according to the formula (1.5).

$$E_{\text{CB}} = E_g - E_{\text{VB}} \quad (1.5)$$

Where  $E_{\text{CB}}$  is the conduction band potential,  $E_{\text{VB}}$  is the valence band potential, and  $E_g$  is the band gap energy.



**Figure S4.** (a) Band gap energy calculation, (b,c) XPS valence band spectra of TiO<sub>2</sub> and ZFO

The photocatalytic mechanism can be simply summarized as the following formula:

