

## Electronic supporting information

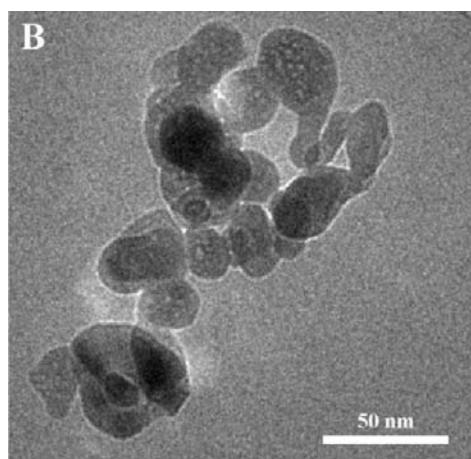
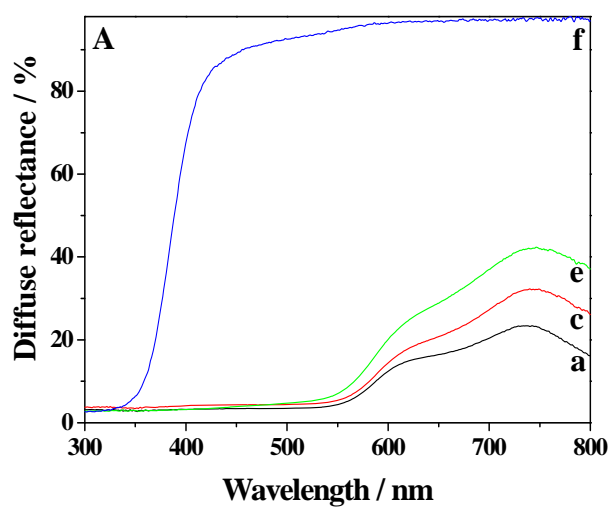
### Synthesis of mesoporous TiO<sub>2</sub>-coupled Fe<sub>2</sub>O<sub>3</sub> as efficient visible nano-photocatalysts for degrading colorless pollutants

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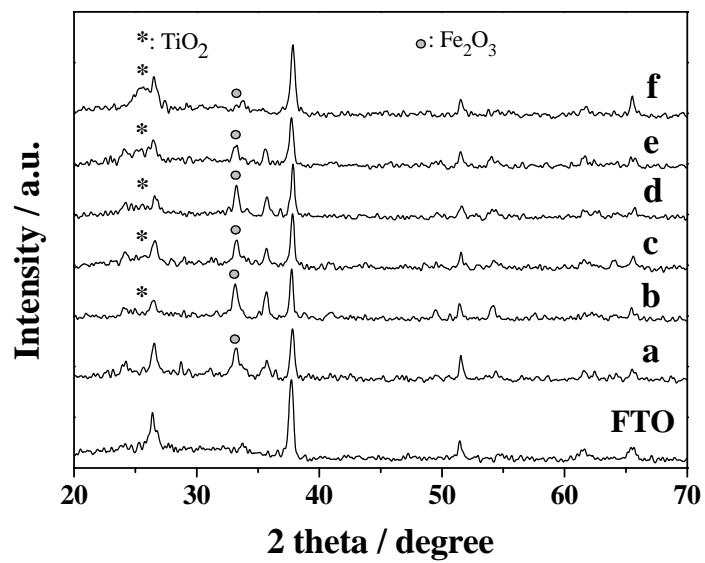
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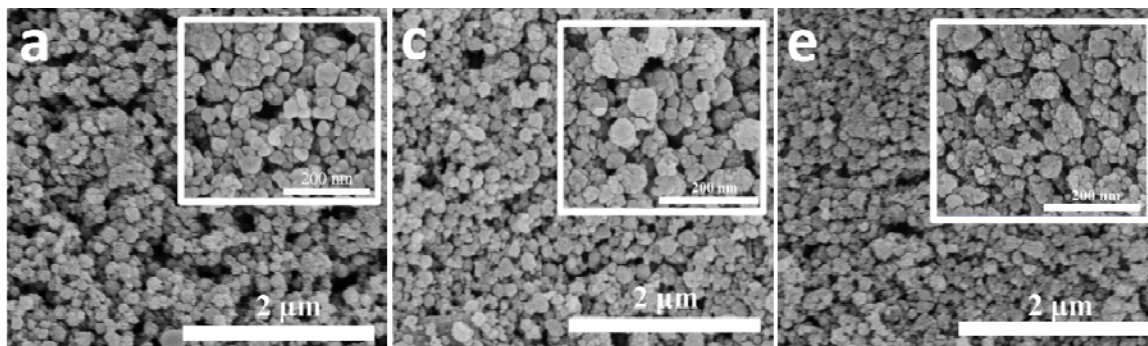
\*Corresponding author, E-mail: [jinglq@hlju.edu.cn](mailto:jinglq@hlju.edu.cn) (L. Jing).



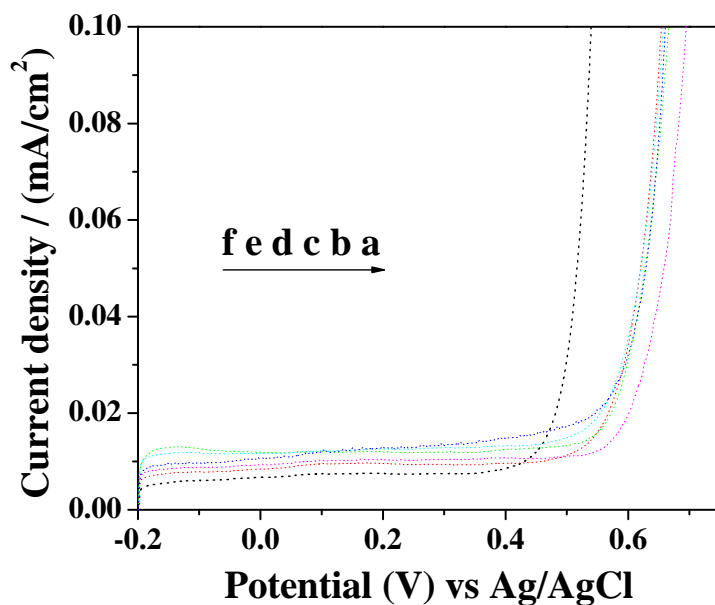
**Fig. S1** DRS spectra (A) and TEM image of F (B), (a: F, c: 20T-F, e: 50T-F, f: T).



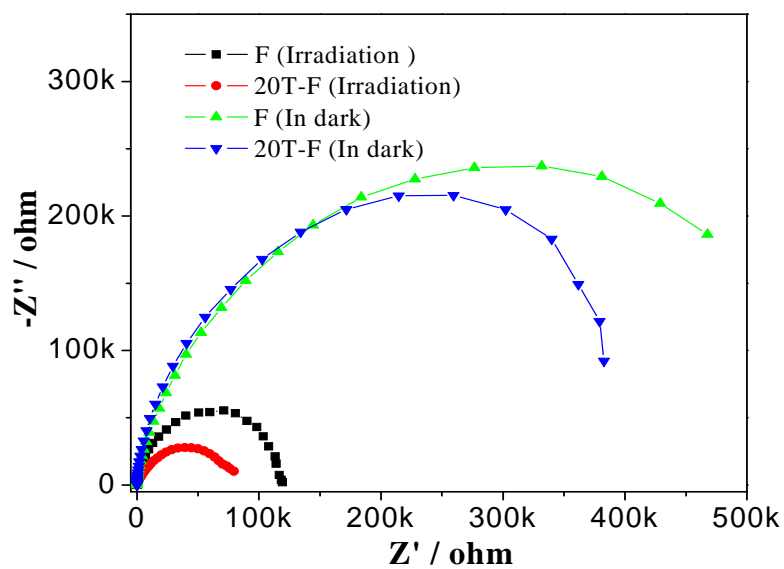
**Fig. S2** XRD patterns of films (FTO: fluorine doped tin oxide-coated glass, a: FF, b: 10T-FF, c: 20T-FF, d: 30T-FF, e: 50T-FF, f: TF and the same elsewhere unless stated).



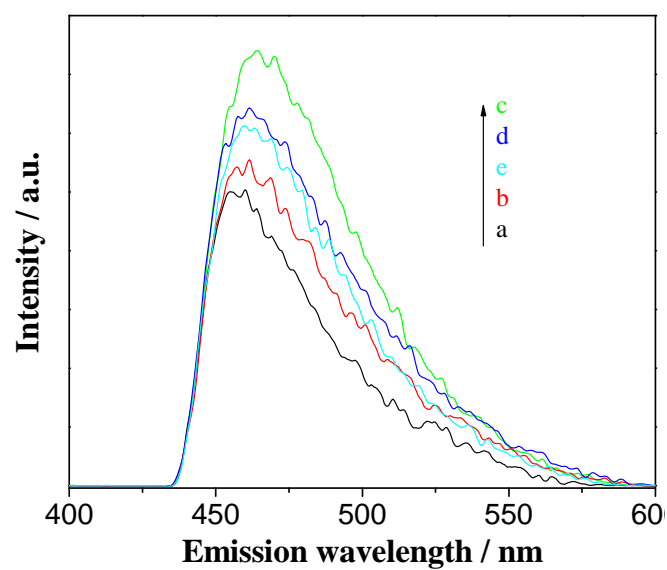
**Fig. S3** SEM images of films (a: FF, c: 20T-FF, e: 50T-FF).



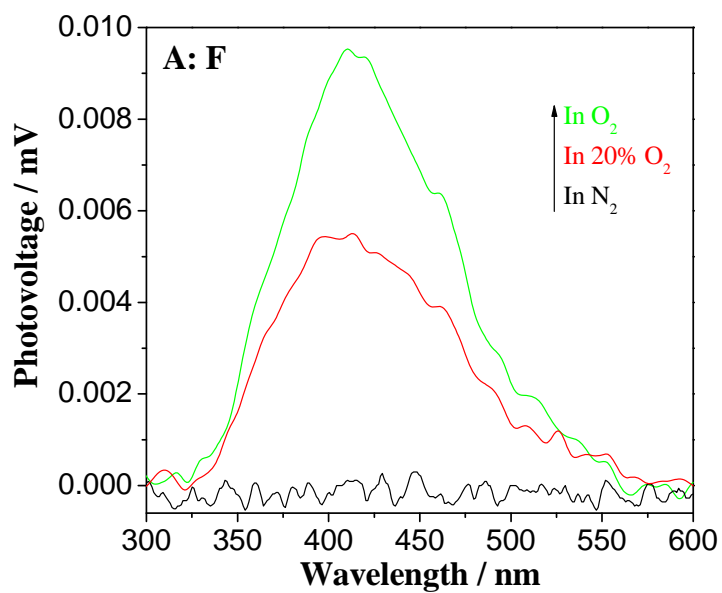
**Fig. S4** Variation of current density vs applied voltage (I-V curves in the dark), (a: FF, b: 10T-FF, c: 20T-FF, d: 30T-FF, e: 50T-FF, and f: TF, and the same elsewhere unless stated).

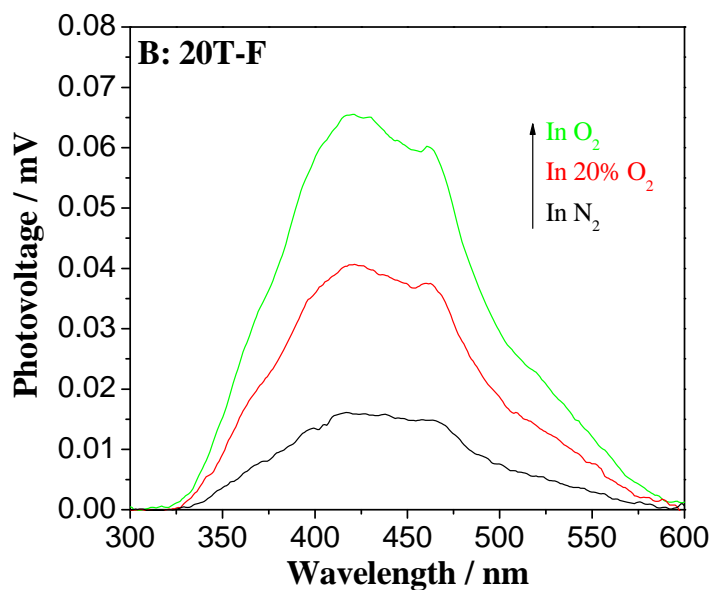


**Fig. S5** Electrochemical impedance spectra (EIS) in the dark and under visible irradiation at 0.4 V bias.

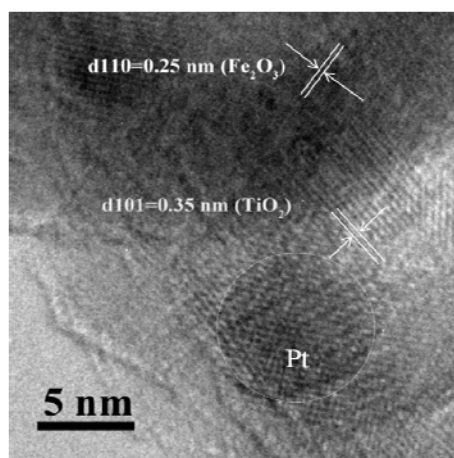


**Fig. S6** Fluorescence spectra related to the formed hydroxyl radical amount after visible irradiation for 1 h.

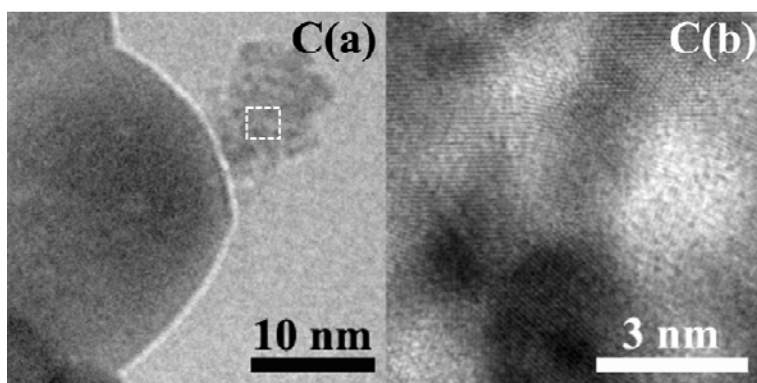
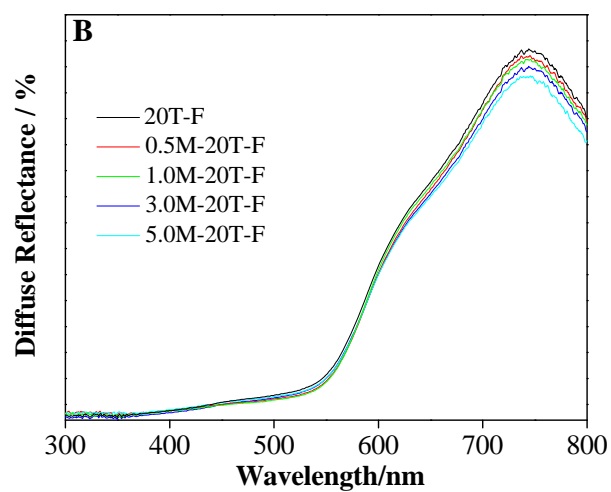
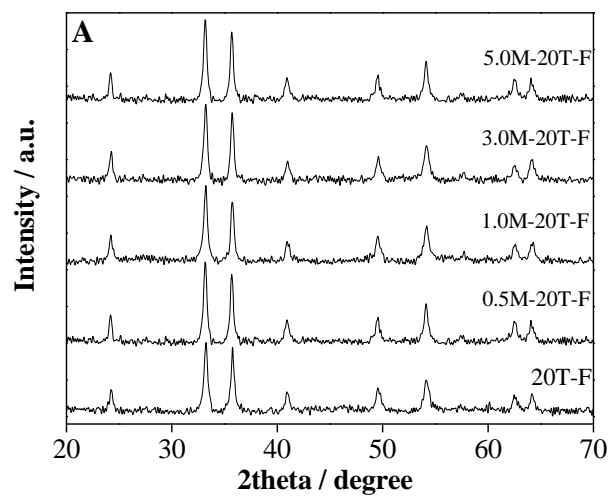




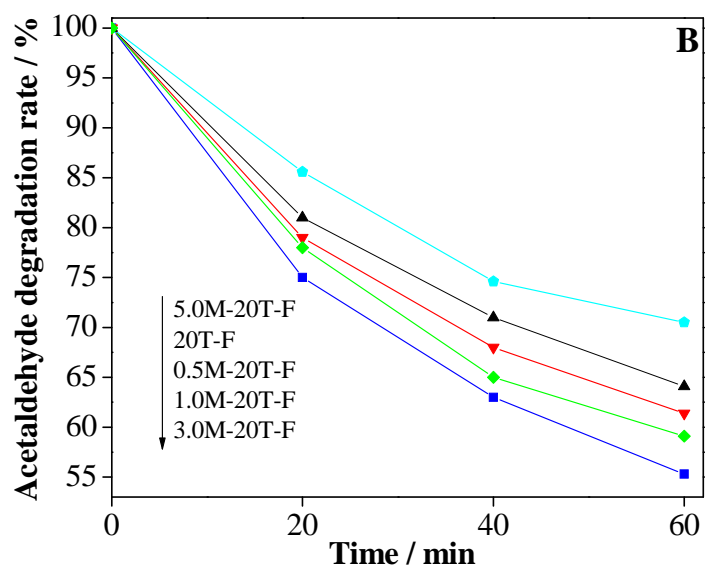
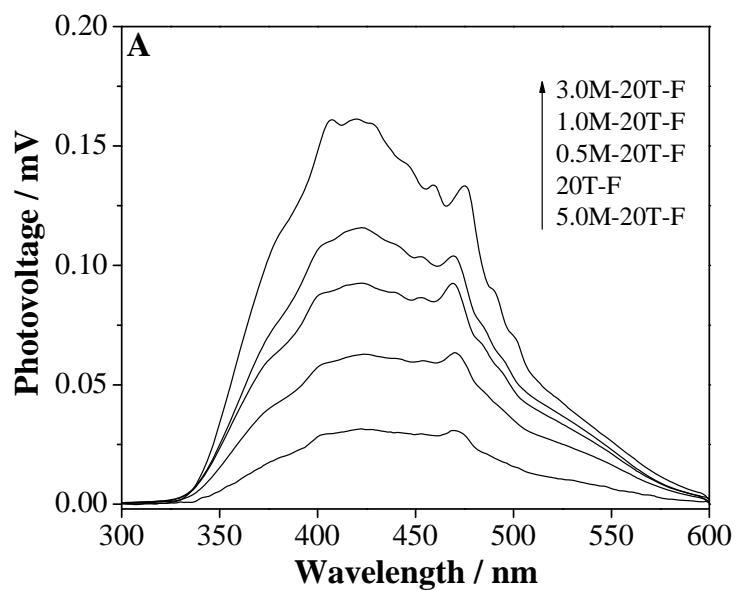
**Fig. 7** SS-SPS responses in different atmospheres (A: F and B: 20T-F).



**Fig. S8** HRTEM image of the 20T-F with 1 wt % Pt deposition. Pt was loaded to the as-prepared samples by a widely-employed photodeposition method using  $\text{H}_2\text{PtCl}_6$  aqueous solution as Pt resource was performed [36]. In a typical reaction, 0.1 g photocatalyst was suspended in a mixture of 80 mL distilled water, 20 mL methanol and 0.5 mL 0.01 M  $\text{H}_2\text{PtCl}_6$  solution under stirring. The mixed solution was vacuumed to remove  $\text{O}_2$  dissolved in water, and then irradiated by a 300 W Xenon lamp with a 420-cutoff filter for 1 h. Finally, after centrifugation, washing and drying, the 1% Pt-loaded  $\text{Fe}_2\text{O}_3$ -based photocatalyst was obtained.



**Fig. S9** XRD patterns (A), DRS spectra (B) of mesoporous TiO<sub>2</sub>-Fe<sub>2</sub>O<sub>3</sub> samples and TEM images of 3M-20T-F (C).



**Fig. S10** SS-SPS in air (A) and photocatalytic degradation rates acetaldehyde (B) under visible irradiation (B) of mesoporous  $\text{TiO}_2\text{-Fe}_2\text{O}_3$  samples.