Electronic Supplementary Information

Hierarchical $FeTiO_3$-TiO_2 hollow spheres for efficient simulated sunlight-driven water oxidation

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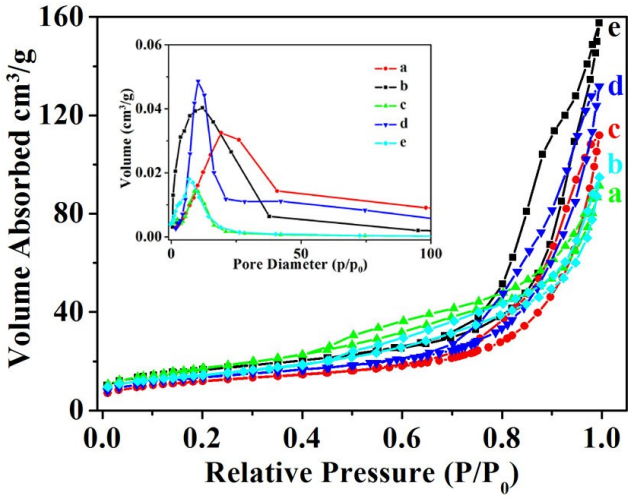

Fig. S1 N_2 adsorption-desorption isotherms curves of the different sanples, (a) TiO_2, (b) $FeTiO_3$-TiO_2 (Ti:Fe=1:0.25), (c) $FeTiO_3$-TiO_2 (Ti:Fe=1:0.5, (d) $FeTiO_3$ (e) $FeTiO_3$-TiO_2 (Ti:Fe=1:0.75).

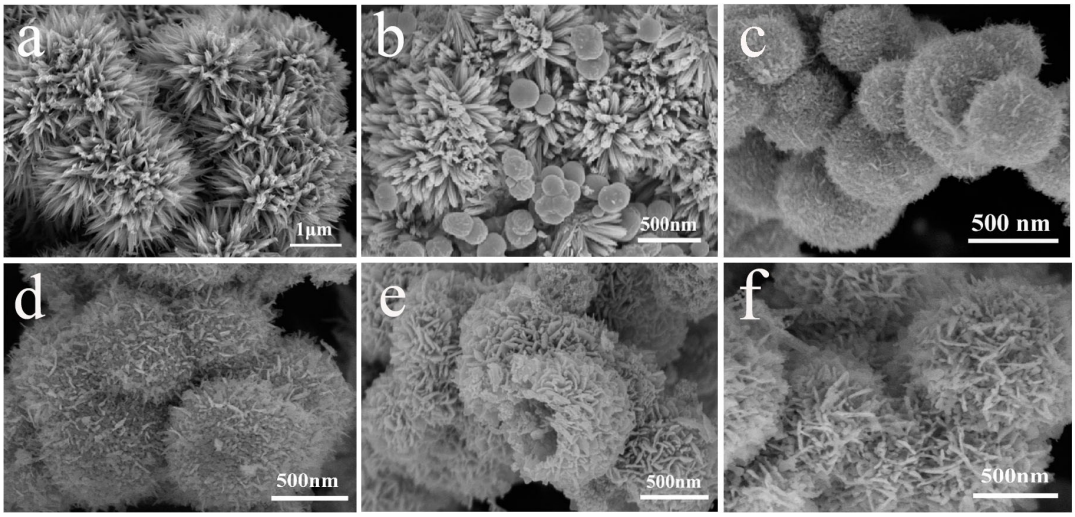

Fig. S2 SEM image obtained precursors prepared from the first solvothermal reaction, (a) SEM images showing the morphological evolution of the obtained precursors prepared from the second solvothermal reaction with different reaction time, (b) 0.5 h, (c) 3 h, (d) 6 h, (e) 9 h, (f) 12 h.

Table S1. BET surface area of the prepared different samples

Samples	TiO_2	$FeTiO_3$-TiO_2 (Ti:Fe=1:0.25)	$FeTiO_3$-TiO_2 (Ti:Fe=1:0.50)	$FeTiO_3$-TiO_2 (Ti:Fe=1:0.75)	$FeTiO_3$ (Ti:Fe=1:1)
Surface area(m^2 g^{-1})	48.8	45.4	51.51	63.26	58.45

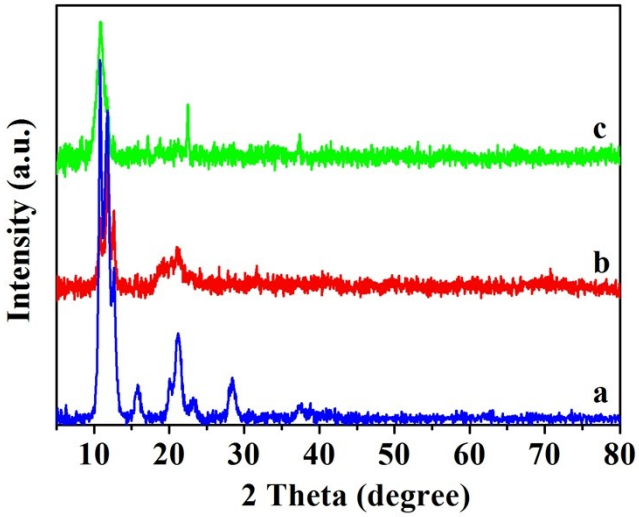

Fig. S3 XRD patterns of the prepared precursors of (a) TiO_2, (b) $FeTiO_3$-TiO_2 (Ti:Fe=1:0.75), and (c) $FeTiO_3$.

Table S2. Fit parameters of the EXAFS spectra for $FeTiO_3$, TiO_2 and $FeTiO_3$-TiO_2.

Sample	shell	N[a]	R[b]	σ^2 (10^{-3} Å^2) [c]	ΔE_0 (eV) [d]
$FeTiO_3$	Fe-O	3	1.92 ± 0.01	6.0 ± 1.0	-5.7
	Fe-O	3	2.05 ± 0.01	12.6 ± 3.4	-5.7
	Fe-Fe/Ti	4	3.00 ± 0.01	11.5 ± 1.1	-3.0
$FeTiO_3$-TiO_2	Fe-O	3	1.92 ± 0.01	7.0 ± 1.0	-5.7
	Fe-O	3	2.04 ± 0.01	11.0 ± 2.6	-5.7
	Fe-Fe/Ti	5.3 ± 1.5	3.01 ± 0.01	15.4 ± 3.3	-3.0
$FeTiO_3$-TiO_2	Ti-O	5.3 ± 0.7	1.96 ± 0.01	5.2 ± 1.2	-0.9
	Ti-Ti	2	3.01 ± 0.01	3.4 ± 1.3	-10.3
	Ti-O	4	3.54 ± 0.04	5.0 ± 5.0	-0.9
	Ti-Ti	4	3.85 ± 0.02	7.5 ± 3.2	-10.3
$FeTiO_3$	Ti-O	6	1.95 ± 0.01	9.4 ± 0.7	-2.8
	Ti-Ti	3	3.09 ± 0.02	11.0 ± 2.1	-2.8
	Ti-Fe/O	3	3.55 ± 0.03	8.3 ± 2.4	-2.8
	Ti-O/Fe	5	3.75 ± 0.05	8.2 ± 7.8	-2.8

[a] Coordination number; [b] Distance between absorber and backscatterer atoms; [c] Debye–Waller factor; [d] Inner potential correction.

The X-ray absorption data at the Ti L_3 - edge and Fe L_3 - edge of the samples were recorded at room temperature in transmission mode using ion chambers or in the fluorescent mode with silicon drift fluorescence detector at beam line BL14W1 of the Shanghai Synchrotron Radiation Facility (SSRF), China. The station was operated with a Si(111) double crystal monochromator. During the measurement, the synchrotron was operated at energy of 3.5 GeV and a current between 150-210 mA. Energy calibrations were calibrated by measuring Fe and Ti metal foil standards, assigning the first inflection point to 7112 eV and 4966 eV, respectively. All fits to the EXAFS data were performed using the program ARTEMIS.30.

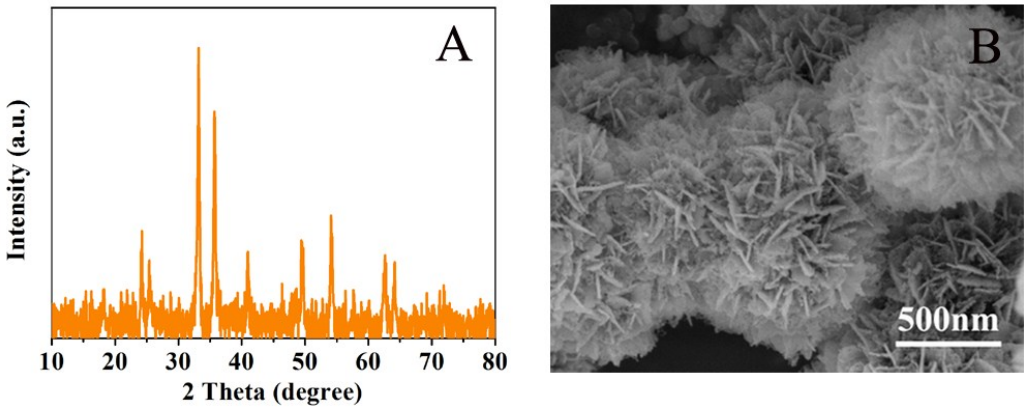

Fig. S4 X-ray diffraction pattern (A) and SEM image (B) after the catalytic reaction of hierarchical $FeTiO_3$-TiO_2 composite hollow spheres.

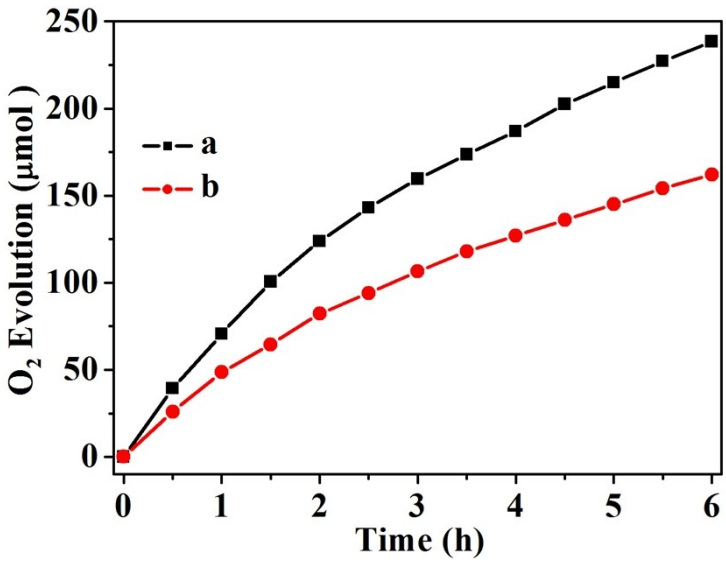

Fig. S5 Comparision of the oxygen evolution of the hierarchical $FeTiO_3$-TiO_2 composite hollow spheres (Ti:Fe=1:0.75) (a), and the corresponding crushed one (b) under simulated sunlight (AM 1.5).

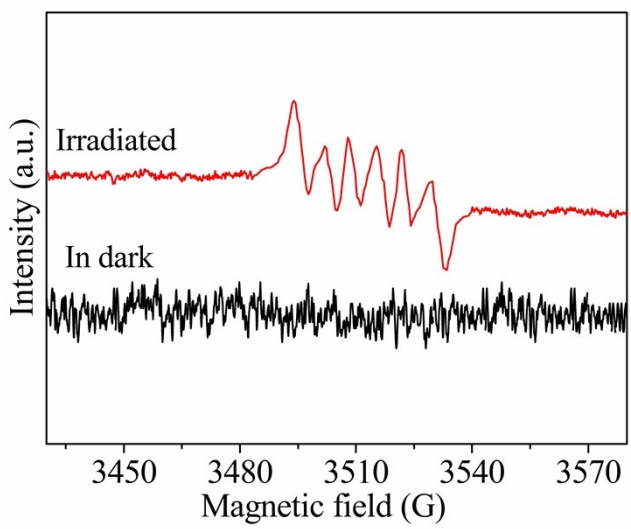

Fig. S6 DMPO spin-trapping ESR spectra recorded at ambient temperature with hierarchical $FeTiO_3$-TiO_2 hollow spheres in methanol dispersion (for DMPO−•O^{2-}) under visible-light irradiation (λ＞400 nm).

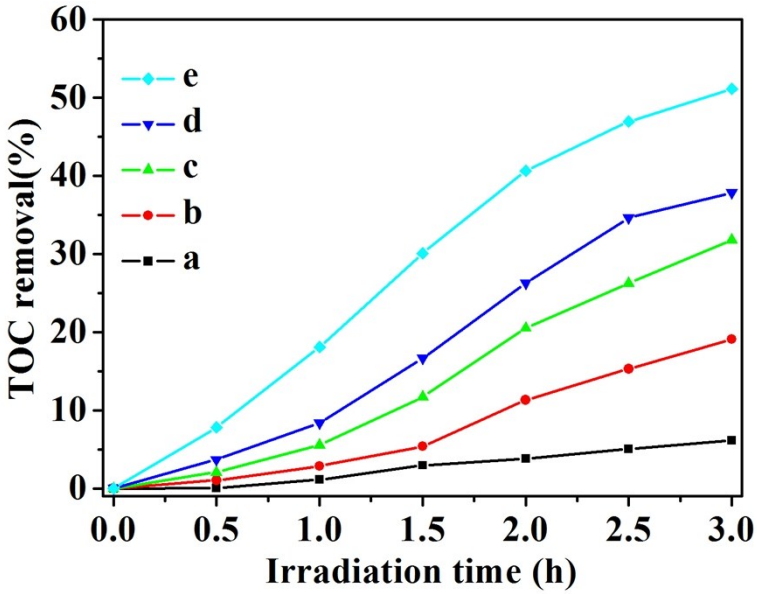

Fig. S7 The removal of TOC during the 2, 4-dichlorophenol photodegradation process in different aqueous dispersions under visible light irradiation: (a) TiO_2, (b) $FeTiO_3$-TiO_2 (Ti:Fe=1:0.25), (c) $FeTiO_3$-TiO_2 (Ti:Fe=1:0.5), (d) $FeTiO_3$ (e) $FeTiO_3$-TiO_2 (Ti:Fe=1:0.75).