Electronic Supplementary Material (ESI) for RSC Advances

Enhanced visible photocatalytic activity of hybrid Pt/α-Fe_2O_3 nanorods

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Fig.S1a shows the powder XRD pattern of the product obtained after the hydrothermal treatment for 10 h. The characteristic peaks in XRD can be well indexed as β-FeOOH (JCPDS Card No.34-1266). After annealing the precursor at 450□ for 1h, the pure hexagonal phase of α-Fe_2O_3 with lattice parameters of a = 0.5035 nm and c = 1.376 nm (JCPDS No. 33-0664) is obtained (Fig. S1b). No other diffraction peaks are observed in both β-FeOOH and α-Fe_2O_3, suggesting a high purity of the prepared samples.

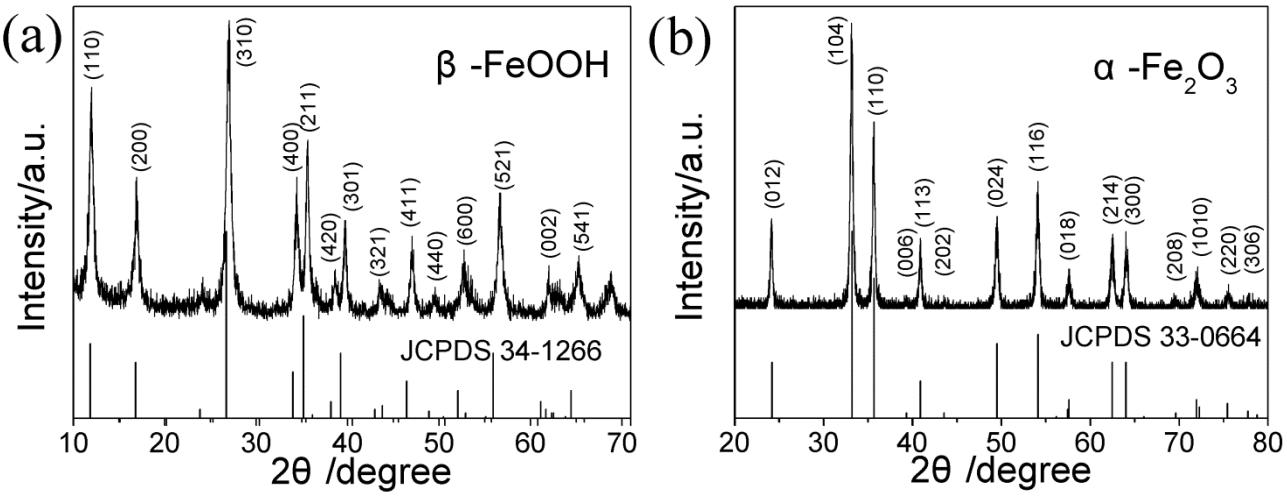

Fig.S1 Powder XRD patterns of the pre-prepared β-FeOOH and α-Fe_2O_3 nanorods, respectively.

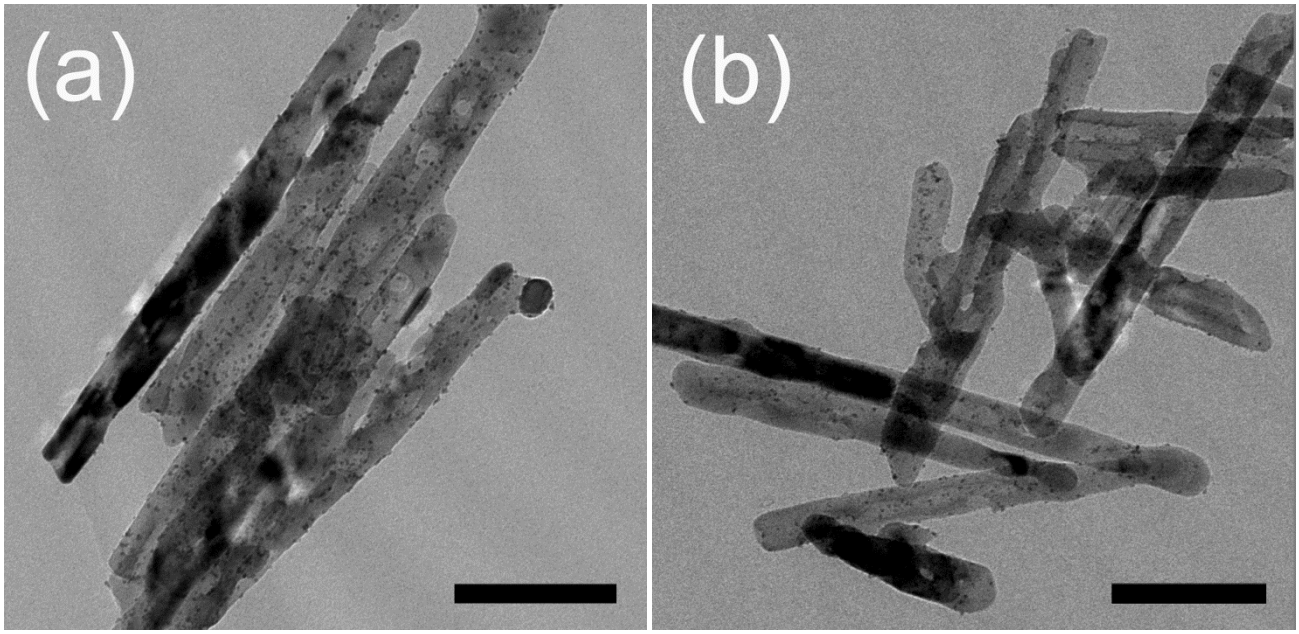

Fig.S2 TEM image of Pt/α-Fe_2O_3 hybrid (PHH4). Fig.S2a shows the incomplete separation of bundle-like α-Fe_2O_3 nanorods and Fig.S2b shows that the inordinance and fractal α-Fe_2O_3 nanorods have formed after ultrasonic treatment. Both of them exhibit that homodisperse Pt nanoparticles can load on the whole exposed surface, particularly at edge of cavity-like and ditch-like pores. Scan bar: 150nm.

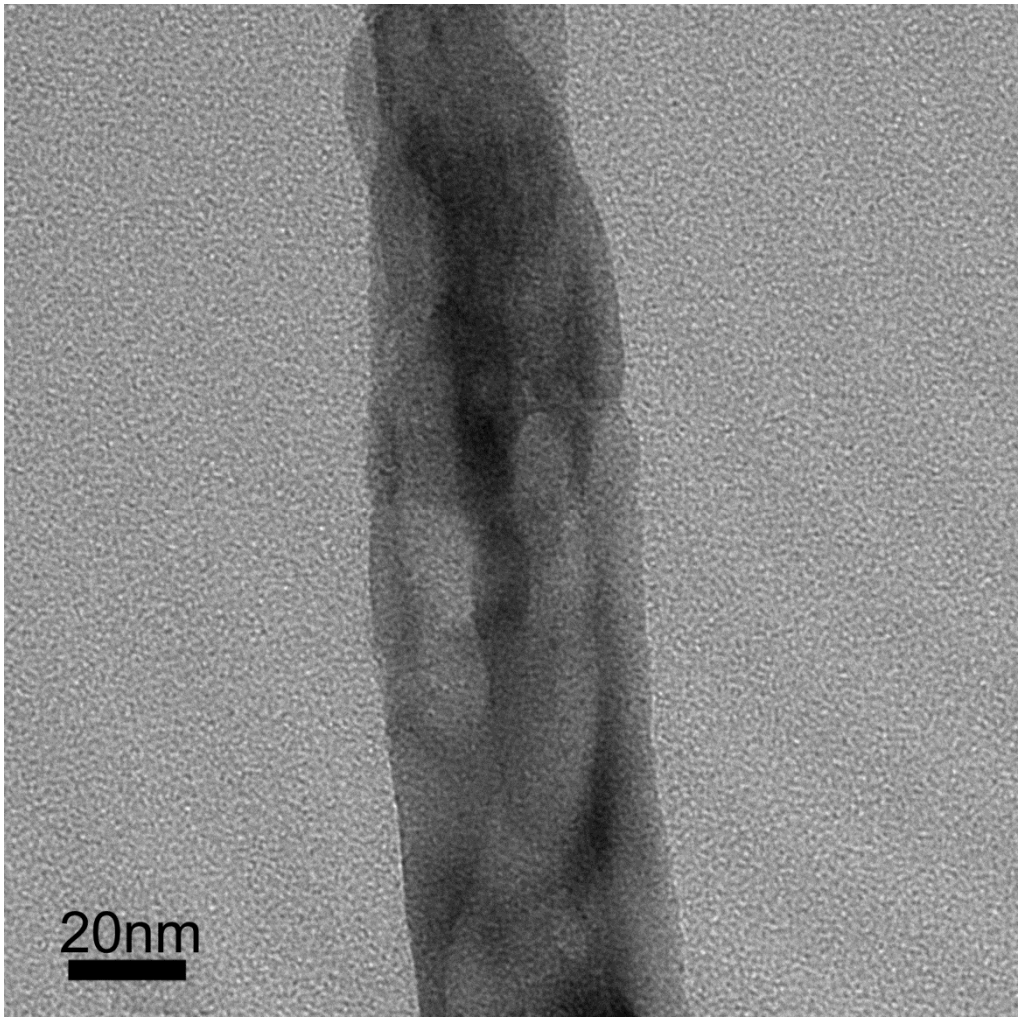

Fig.S3 TEM image of PHH1. The surface Pt at.% of PHH1 is 0.14%. However, the Pt nanoparticles are too small to be observed and statistical analyzed. So we roughly describe their average size as <1nm.

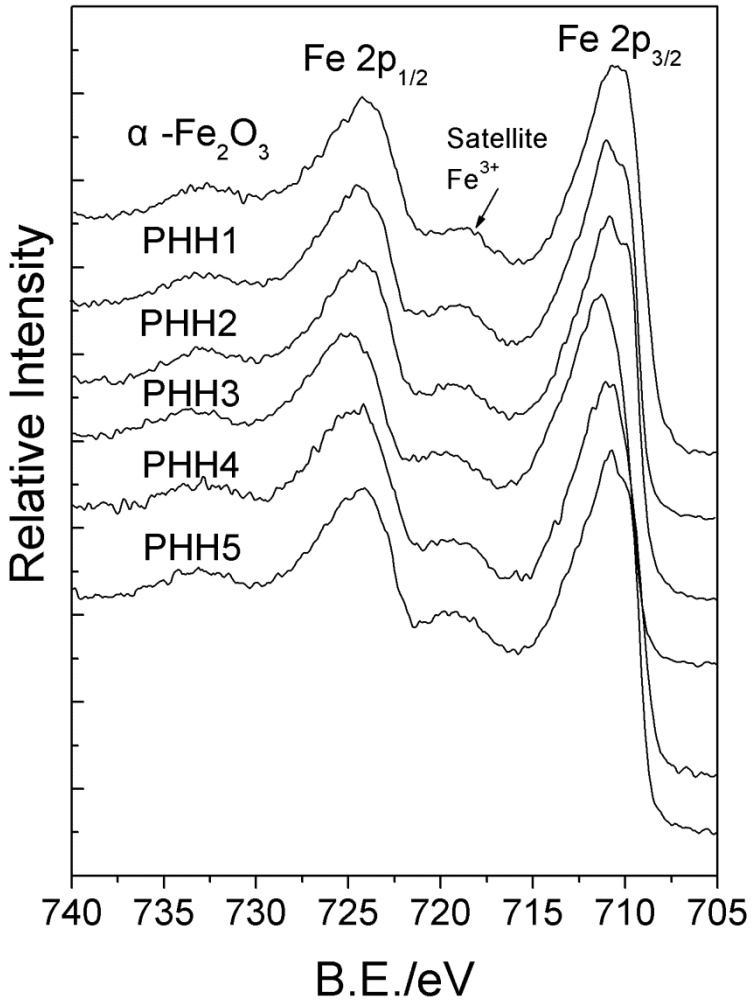

Fig.S4 XPS spectra of the Fe 2p region registered for α-Fe_2O_3 and Pt/α-Fe_2O_3 hybrids. The Fe $2p_{3/2}$ peak positions are mainly located at 710.9±0.3eV with a shake-up satellite peak at 718eV.

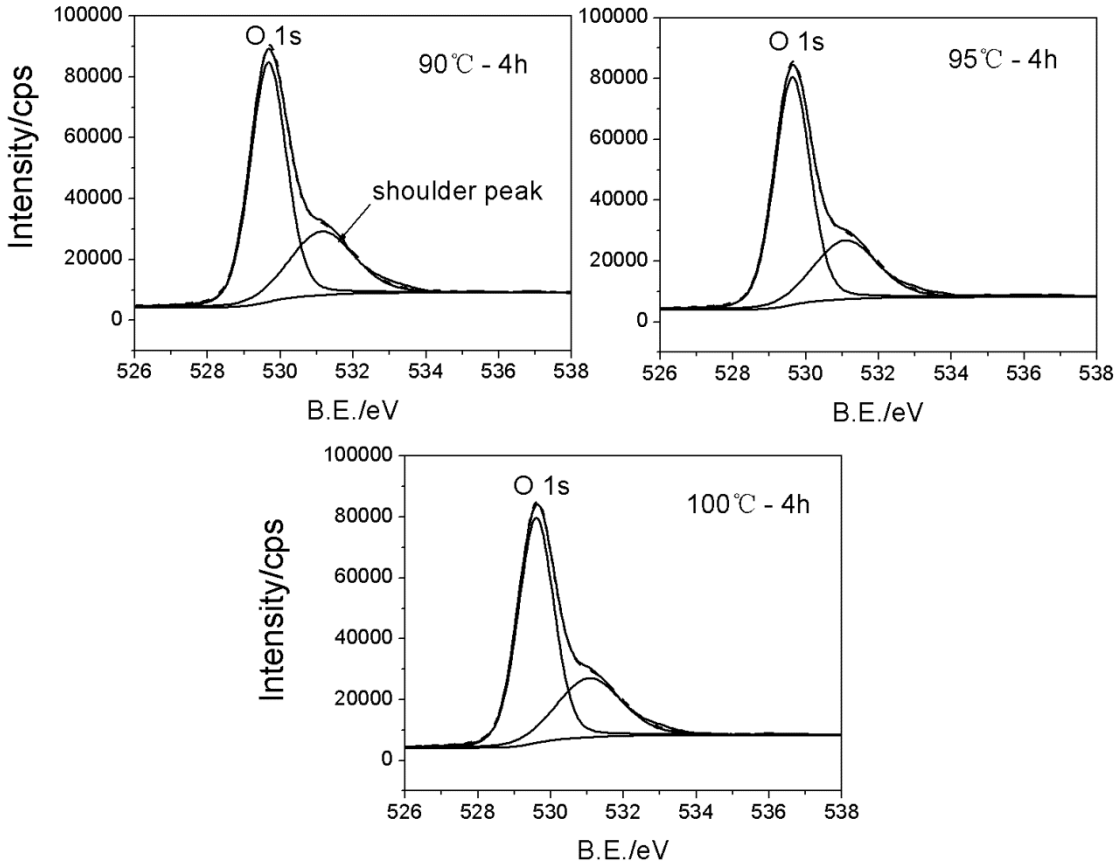

Fig.S5 XPS spectra of the O 1s region registered for α-Fe_2O_3. These samples have been processed by the following steps. Briefly, 0.1g α-Fe_2O_3 powder was immersed in a mixed solution containing 2mL distilled water and 8mL ethanol, and then the slurry was dried at 60℃ after ultrasonication for 30 min. The succedent experiments were the same as the polyol reduction method. Here, we only choose three reaction conditions. As revealed in Fig.S5, the main parameters are list as follows.

Samples	O 1s B.E./eV	Shoulder peak B.E. /eV	R_{so}
90℃-4h	529.67	531.14	0.47
95℃-4h	529.63	531.09	0.46
100℃-4h	529.6	531.05	0.47

R_{so}: defined as the area ratio of shoulder peak to the main peak of O 1s

We assume the every Pt nanoparticles are present in ideal hemisphere on α-Fe_2O_3 surface and use the maximal periphery length (πr_m) of every Pt nanoparticles to simplify the model. The specific periphery density (SPD) can be expressed as follows:

$$SPD = \pi r_m \times \tilde{n}\ (nm \cdot nm^{-2})$$

Where r_m and are the average size of Pt nanoparticles, and ñ is the number of the Pt nanoparticles per unit area of the α-Fe_2O_3 in PHHs, respectively. The corresponding data are list as follows:

Samples / Data	PHH2	PHH3	PHH4	PHH5
r_m/nm	1.5	2.8	3.9	5.1
ñ/nm^{-2}	39/(60×60)	48/(60×60)	55/(60×60)	27/(60×60)
SPD/(nm/nm^{-2})	0.051	0.117	0.187	0.12

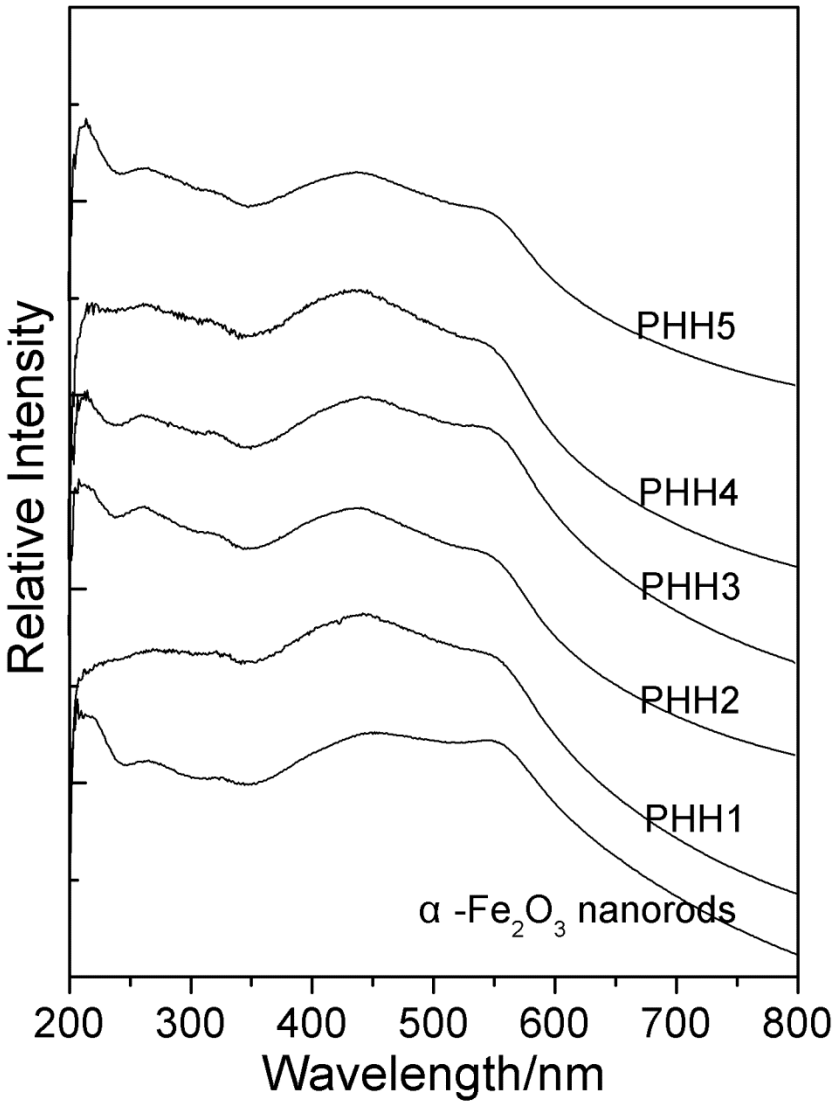

Fig.S6 UV–vis absorbance spectra of α-Fe_2O_3 bundle-like nanorods and Pt/α-Fe_2O_3 hybrids. All the samples diluted in ethanol (~0.1mgmL^{-1}) were measured by a UV-vis spectrophotometer (Unico UV-2400AH).