

Supporting Information

Promoted photo-Fenton reactivity through electron transfer
between non-contacted Au nanoparticle and Fe₂O₃ nanowire in
confined space

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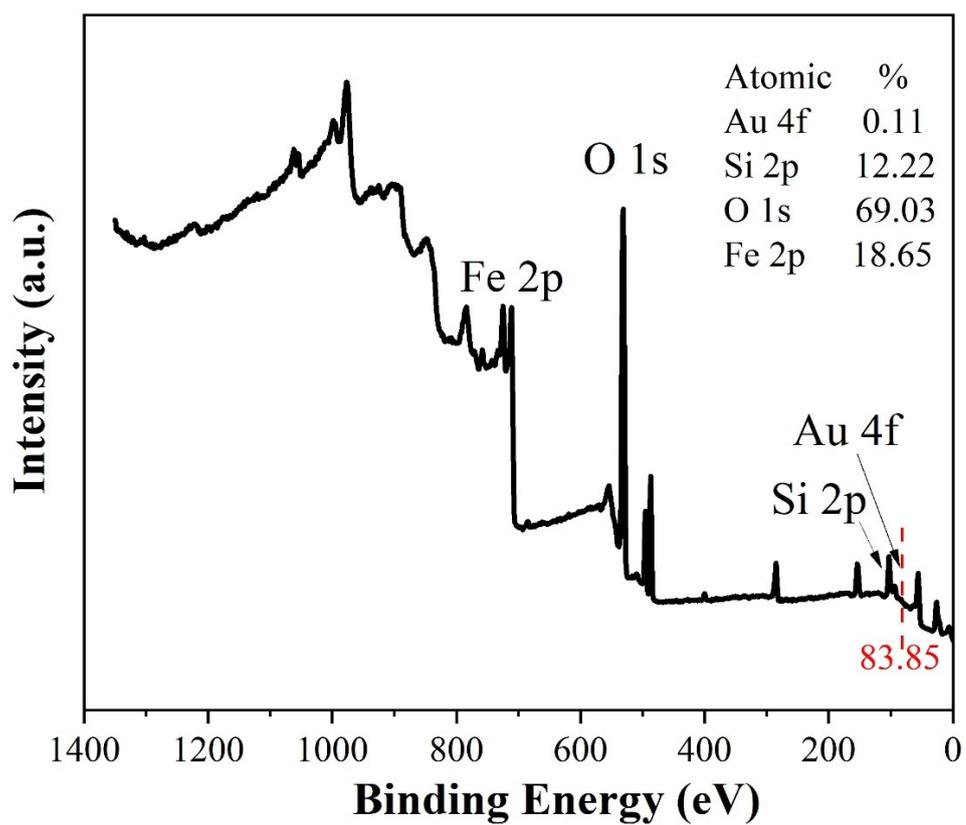


Figure S1. Full-scale XPS spectra of Fe₂O₃-Au@SiO₂.

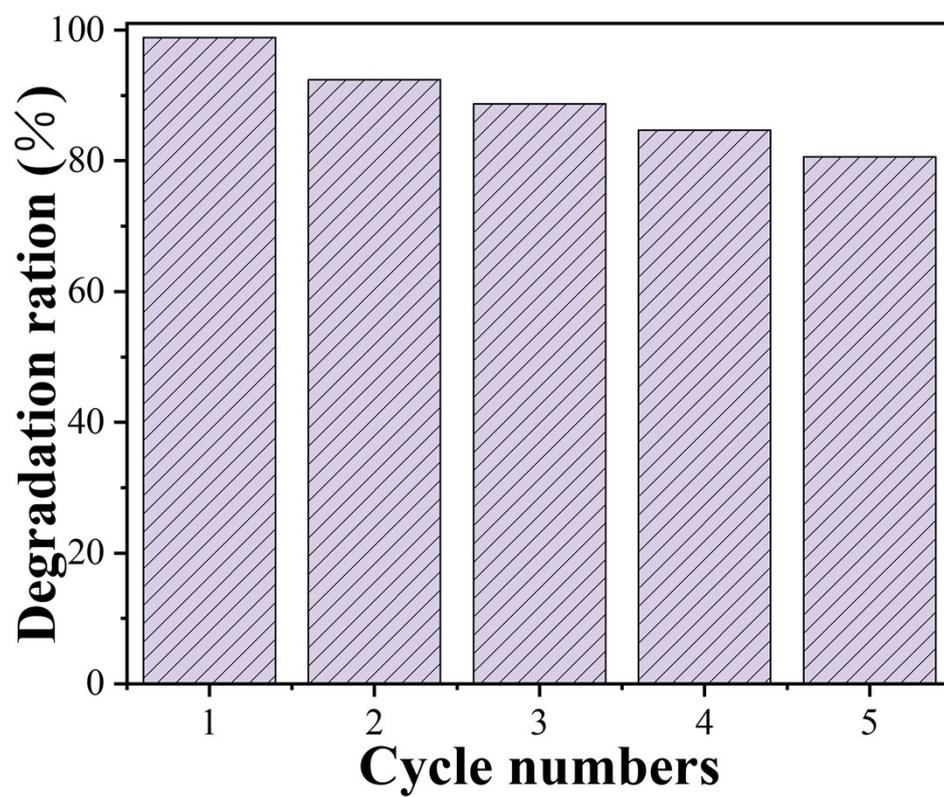


Figure S2. Recyclability tests of Fe₂O₃-Au@SiO₂.

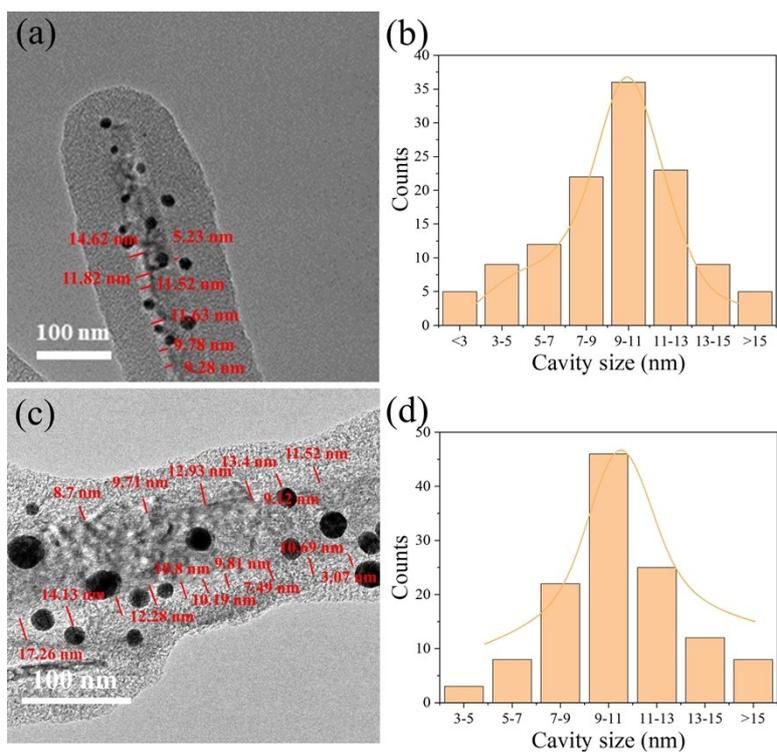


Figure S3. HRTEM images of $\text{Fe}_2\text{O}_3\text{-Au@SiO}_2$ and size histogram of the cavity (a, b) before reaction. (c, d) after reaction.

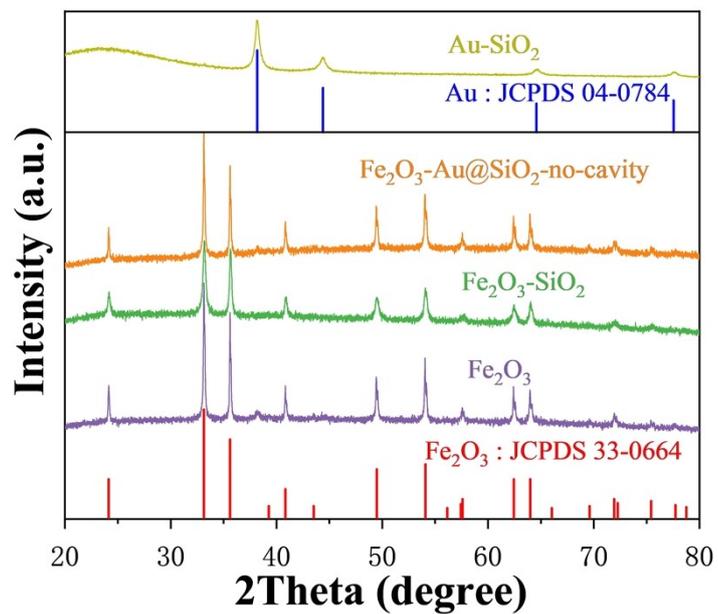


Figure S4. The XRD pattern of Fe₂O₃, Fe₂O₃-SiO₂, Au-SiO₂ and Fe₂O₃-Au@SiO₂-no-cavity.

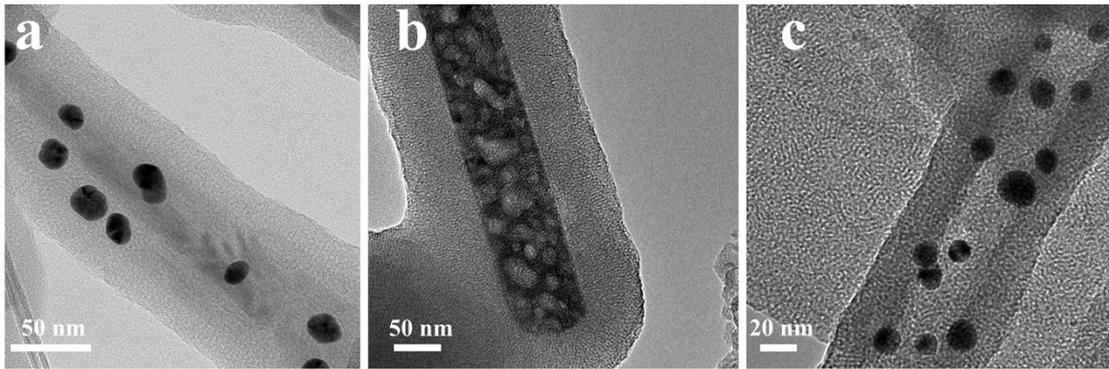


Figure S5. (a-c) The TEM images of $\text{Fe}_2\text{O}_3\text{-Au@SiO}_2\text{-no-cavity}$, $\text{Fe}_2\text{O}_3\text{-SiO}_2$ and Au-SiO_2 .

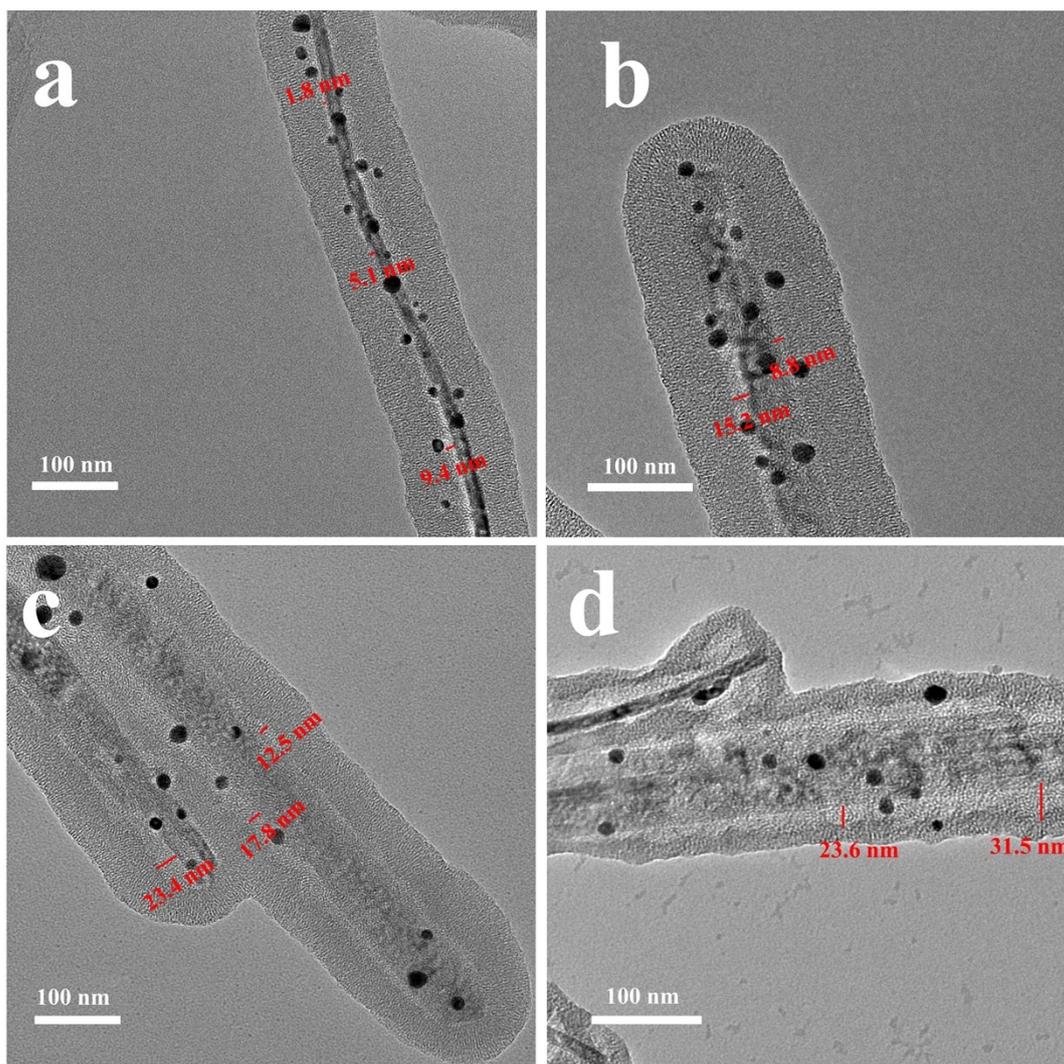


Figure S6. The TEM images of $\text{Fe}_2\text{O}_3\text{-Au@SiO}_2$ catalysts with different cavity sizes (a-d) 5 nm, 10 nm, 15 nm, 30 nm.

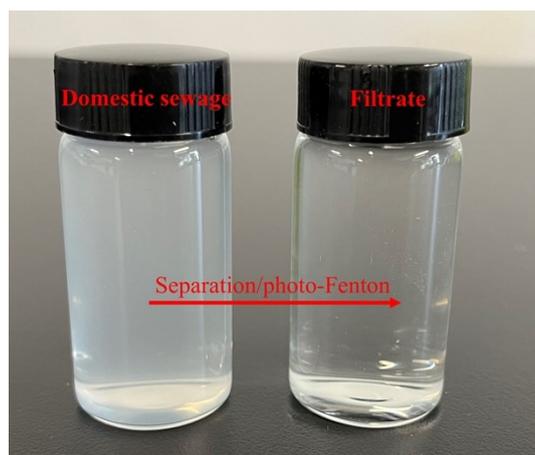


Figure S7. The contaminants removal from domestic sewage treatment by Fe_2O_3 - Au@SiO_2 .

Text S1 The preparation process of Fe_2O_3 , $\text{Fe}_2\text{O}_3\text{-SiO}_2$, Au-SiO_2 and $\text{Fe}_2\text{O}_3\text{-Au@SiO}_2\text{-no-cavity}$.

$\text{Fe}_2\text{O}_3\text{-SiO}_2$: Typically, the $\text{Fe}_2\text{O}_3\text{@PDA}$ composite was dispersed in the mix solution composed of 60 mL of ethanol, 0.28 g CTAB, 14 mL ammonia (25 wt.%) and 80 ml water. Then 250 μL of TEOs was added to with vigorously stirring for 6 hours. The precipitates were collected by centrifugation and washed with water and ethanol, and dried in oven at 80°C for 6 hours to obtain $\text{Fe}_2\text{O}_3\text{@PDA @SiO}_2$ composite. After calcinated in a muff furnace at 400°C for 4 hours, the final catalyst was prepared and denoted as $\text{Fe}_2\text{O}_3\text{-SiO}_2$.

Au-SiO_2 : The 200 mg $\text{Fe}_2\text{O}_3\text{-Au@SiO}_2$ was put into 20mL 2mol/L HCl solution and stirred for 24h to corrode the Fe_2O_3 wires. The precipitates were collected by centrifugation and washed with ultrapure water, and dried in oven at 80°C for 6 hours to obtain Au-SiO_2 composite.

$\text{Fe}_2\text{O}_3\text{-Au@SiO}_2\text{-no-cavity}$: The synthesis method of $\text{Fe}_2\text{O}_3\text{-Au@SiO}_2\text{-no-cavity}$ was similar with $\text{Fe}_2\text{O}_3\text{-Au@SiO}_2$ except that the step of dopamine polymerization was omitted.

Table S1. Chemical formulas and detailed information for HPLC analysis.

Compounds	Formula	Mobile phase (%)			Wavelength
		Milli-Q water	Milli-Q water (0.1% HCOOH)	Methanol	
Bisphenol A	C ₁₅ H ₁₆ O ₂	30		70	225
2-chlorophenol	ClC ₆ H ₄ OH	40		60	275
4-chlorophenol	C ₆ H ₅ OCl	30		70	280
2,4-dichlorophenol	C ₆ H ₄ Cl ₂ O	30		70	220
2,4,6-trichlorophenol	C ₆ H ₃ Cl ₃ O	30		70	290
Ciprofloxacin	C ₁₇ H ₁₈ FN ₃ O ₃		80		278
Atrazine	C ₈ H ₁₄ C ₁ N ₅	30		70	220
Carbamazepine	C ₁₅ H ₁₂ N ₂ O	40		60	210
Sulfamethoxazole	C ₁₀ H ₁₁ N ₃ O ₃ S		55		265
hydroxybenzoic acid	C ₇ H ₆ O ₃		65		255

Table S2. The concentration of $\cdot\text{O}^{2-}$ in the heterogeneous photo-Fenton reaction with different catalysts.

Materials	Concentration (spins/ml)
$\text{Fe}_2\text{O}_3\text{-Au@SiO}_2$	1.827×10^7
$\text{Fe}_2\text{O}_3\text{-Au@SiO}_2\text{-no cavity}$	1.200×10^7
$\text{Fe}_2\text{O}_3\text{-SiO}_2$	6.269×10^6
Au-SiO_2	5.293×10^6
Blank	/