

Supporting Information

Bioinspired Pd-Cu Alloy Nanoparticles as Accept Agent for Dye Degradation Performances

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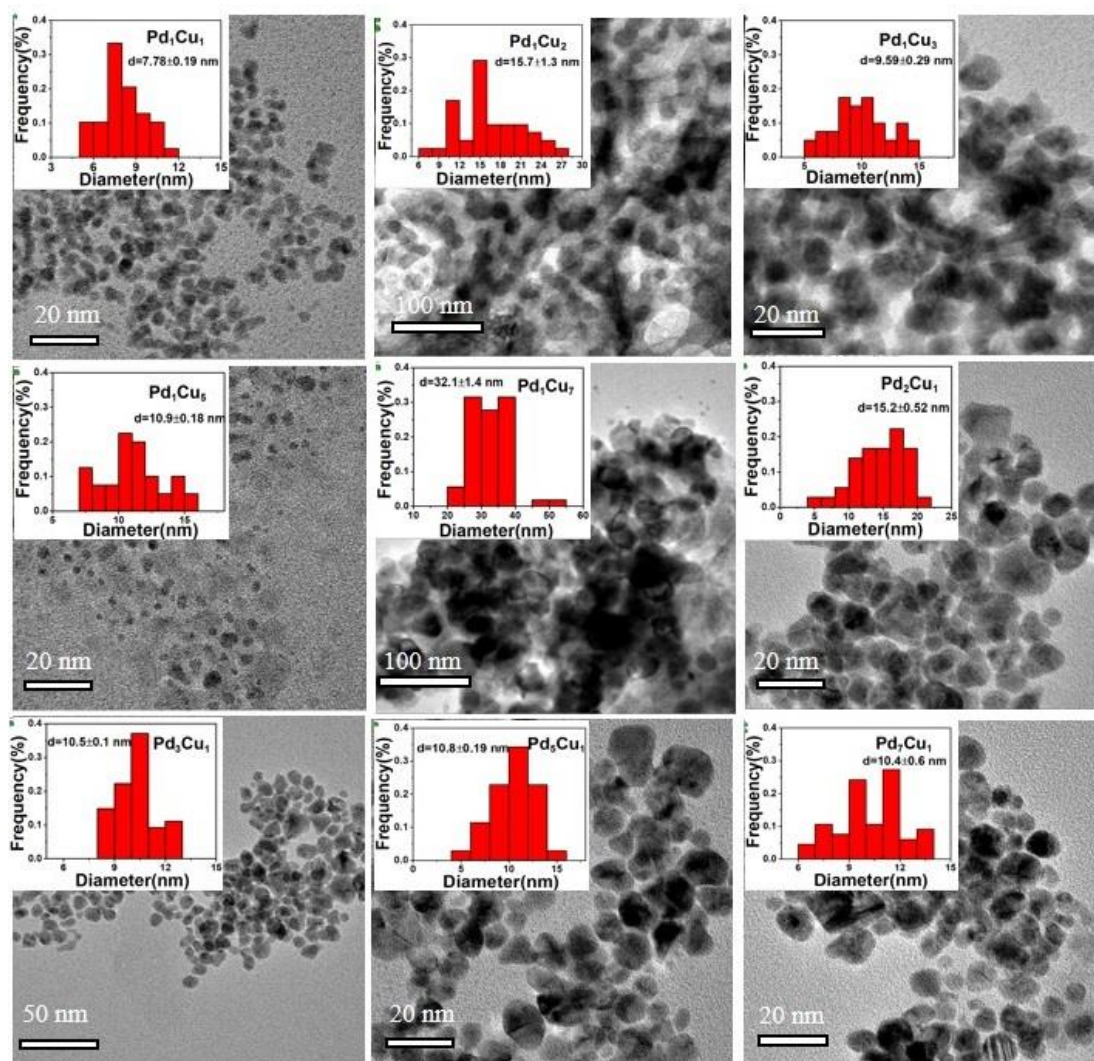


Figure. S1. TEM images and size distribution histogram of the Pd-Cu alloy NPs with different precursor ratios.

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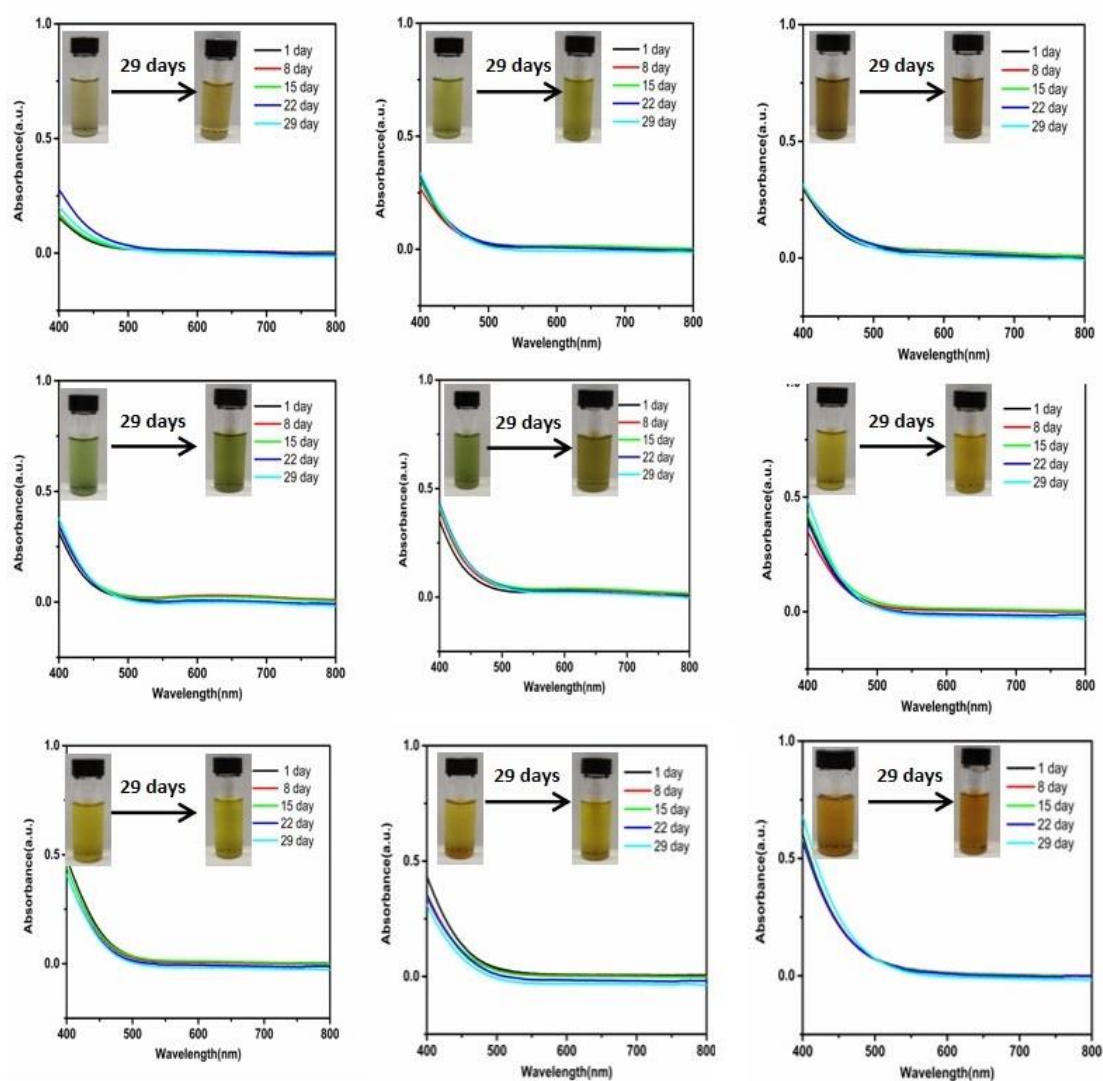


Figure. S2. UV-*vis* images and colloidal states of the Pd-Cu alloy NPs with different precursor ratios.

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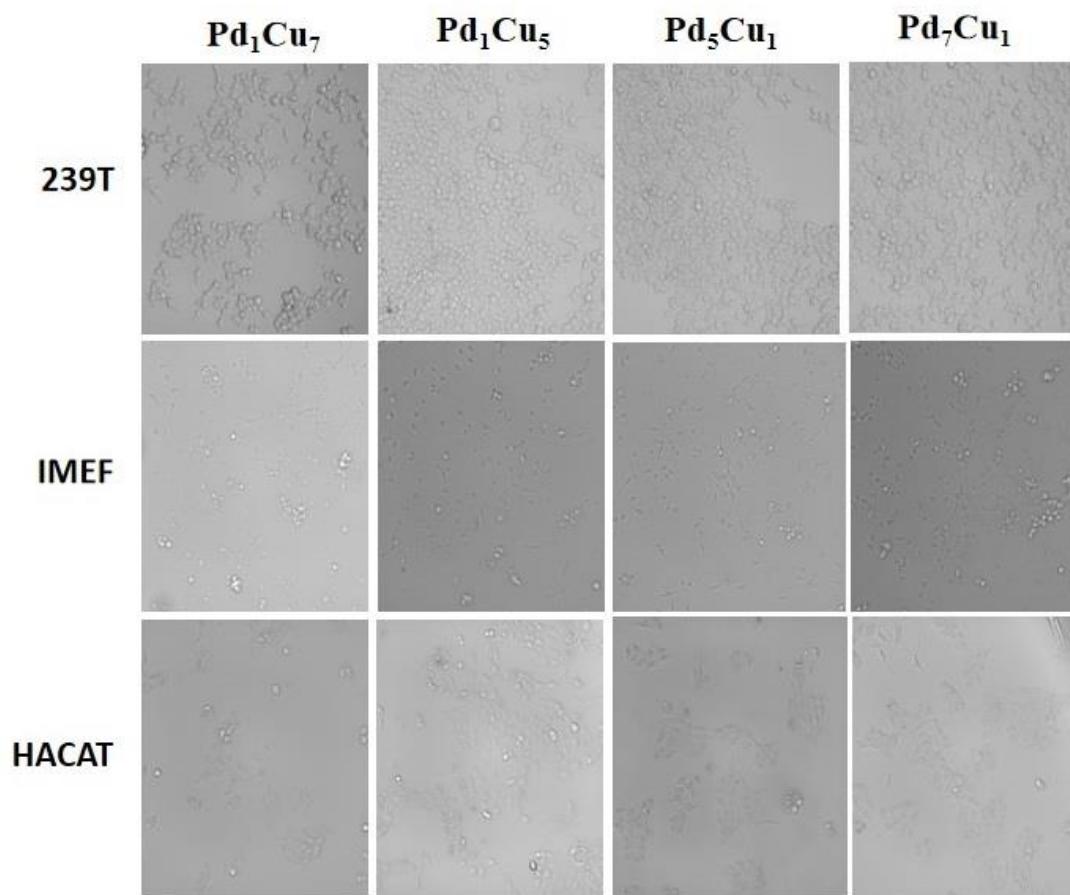


Figure. S3. Representative light microscopy images of 239T cell, IMEF cell, HACAT cell, which were treated by using $50 \mu\text{g mL}^{-1}$ colloidal solutions (Pd_1Cu_5 , Pd_1Cu_7 , Pd_5Cu_1 , Pd_7Cu_1 alloy NPs).

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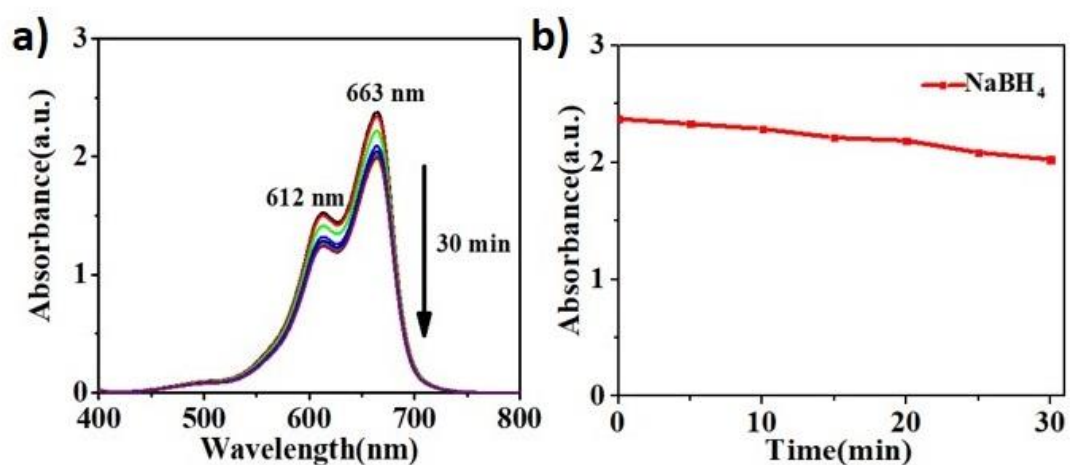


Figure. S4. a) Absorption spectra of MB in the presence of 0.1 mL of 0.2 M NaBH₄. b) Absorption spectra recorded at 400 nm was affected by time.

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Table S1: The concentration of substrate MB was controlled at 0.07 mM, and the content of catalyst was controlled at 0.01 mg. The influence of different catalysts on the reaction rate was compared, and the result was represented by K_{app} , and the higher the value of K_{app} , the faster the reaction rate.

Samples	Reduction time(s)	Apparent rate constant (K_{app} , $10^{-3} s^{-1}$)	Activity parameter (K , $s^{-1} g^{-1}$)
Pd ₁ Cu ₁	270	12.9	1290
Pd ₁ Cu ₂	240	14.6	1460
Pd ₁ Cu ₃	210	17.1	1710
Pd ₁ Cu ₅	180	20.0	2000
Pd ₁ Cu ₇	150	24.0	2400
Pd ₂ Cu ₁	90	41.1	4110
Pd ₃ Cu ₁	60	66.7	6670
Pd ₅ Cu ₁	40	75.0	7500
Pd ₇ Cu ₁	30	100.0	10000

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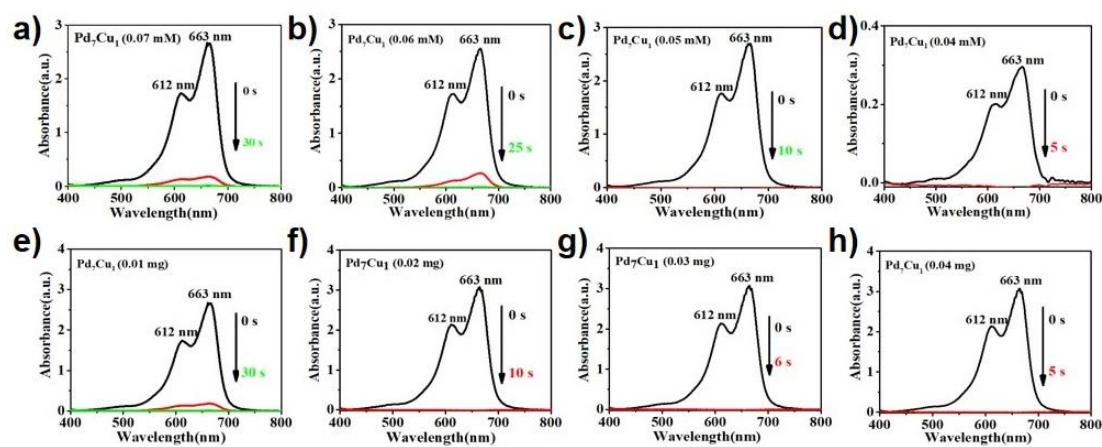


Figure. S5. UV-*vis* absorption spectra of degradation of a-d) with varying concentration of MB (0.04 - 0.07 mM) and constant amount (0.01 mg) of catalyst, e-h) with varying amount of catalyst (0.01 - 0.04 mg), and constant amount (0.07 mM) of MB dye.

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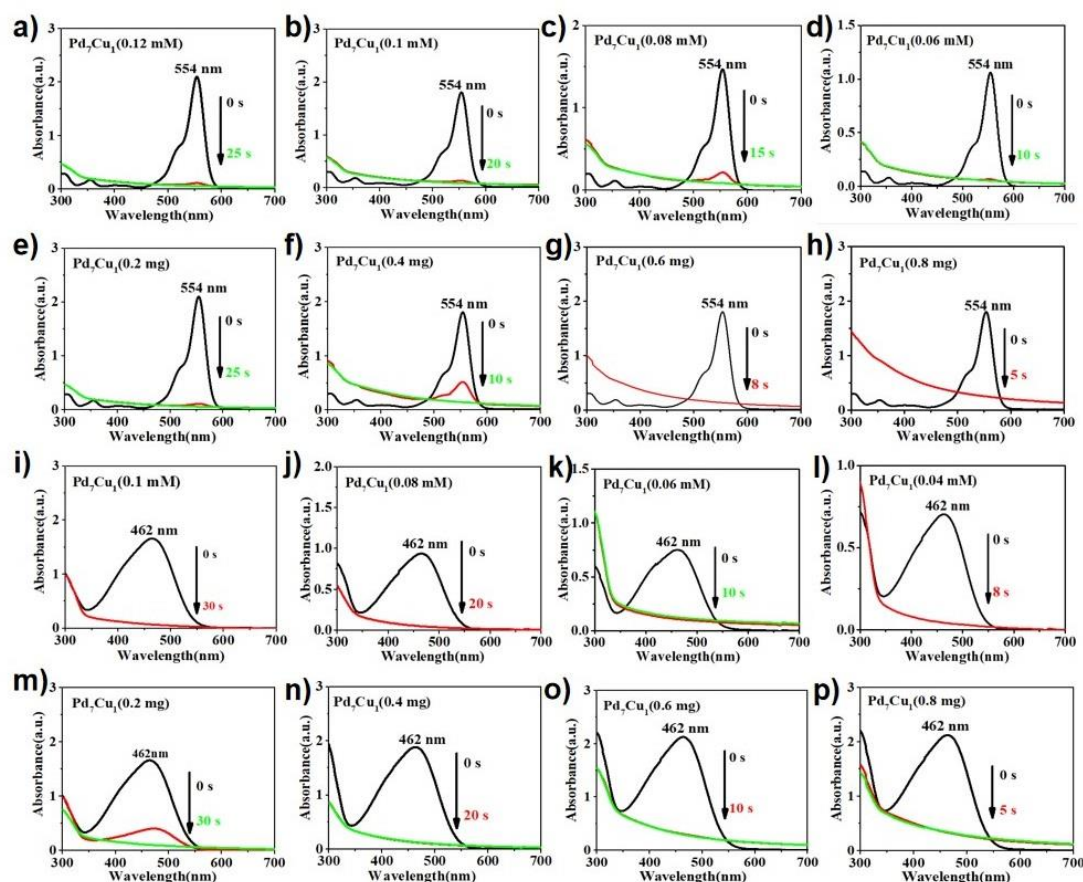


Figure. S6. UV-*vis* absorption spectra of degradation of a-d) with varying concentration of RhB (0.06 - 0.12 mM) and constant amount (0.2 mg) of catalyst, e-h) with varying amount of catalyst (0.2 - 0.8 mg), and constant amount (0.12 mM) of RhB dye, i - l) with varying concentration of MO (0.04 - 0.1 mM) and constant amount (0.2 mg) of catalyst, m - p) with varying amount of catalyst (0.2 - 0.8 mg), and constant amount (0.1 mM) of MO dye.

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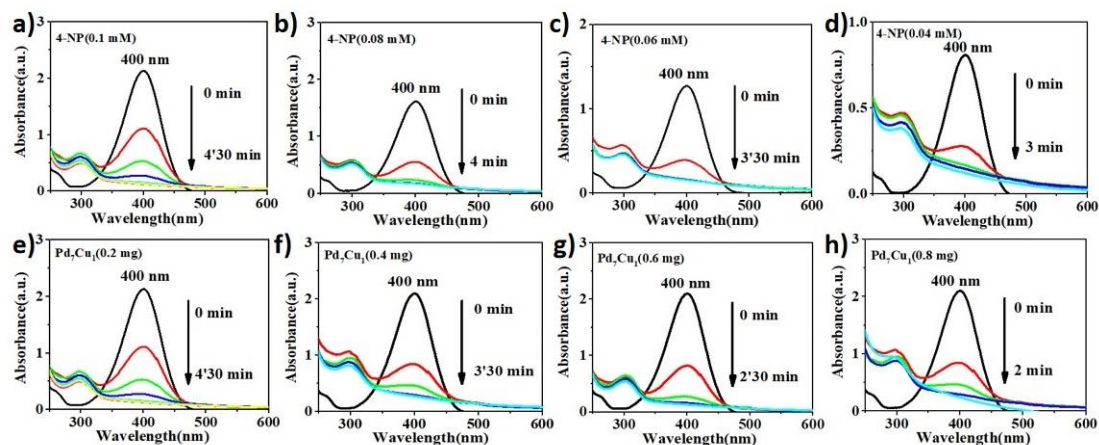


Figure. S7. UV-vis absorption spectra of degradation of a-d) with varying concentration of 4-NP (0.04 – 0.1 mM) and constant amount (0.2 mg) of catalyst, e-h) with varying amount of catalyst (0.2 - 0.8 mg), and constant amount (0.1 mM) of 4-NP.

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Table S2. Summary of Reaction Time (s), Apparent Rate Constant (K_{app}) and Activity Parameter (K) for Degradation of 4-NP with Varying Concentration and Catalytic Loading.

concentration of 4-NP (mM)	amount of catalyst (mg)	reaction (s)	Apparent rate constant (K _{app} , 10 ⁻³ s ⁻¹)	Activity parameter (K, s ⁻¹ g ⁻¹)
0.04	/0.2	180	11.2	56
0.06	0.2	210	9.9	49.5
0.08	0.2	240	8.7	43.5
0.1	0.2	270	6.9	34.5
0.1	0.4	210	8.5	21.25
0.1	0.6	150	19.1	31.83
0.1	0.8	120	26.2	32.75

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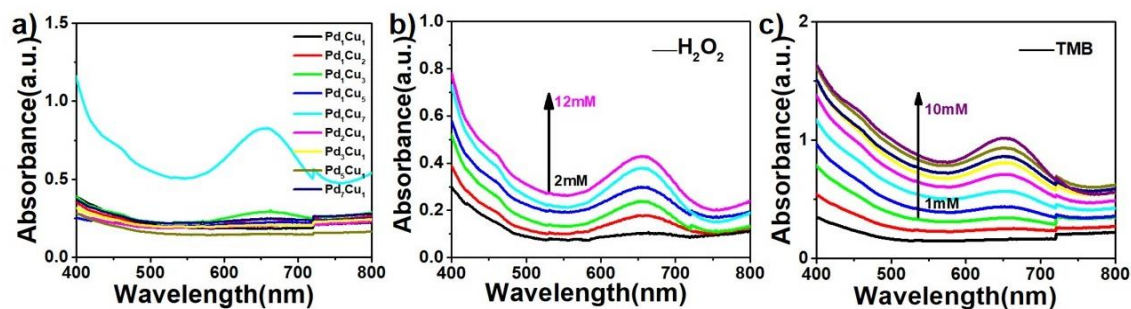


Figure. S8. a) UV-*vis* absorbance spectra of peroxidase-like activity in different concentrations of the Pd-Cu alloy NPs with different precursor ratios; b) UV-*vis* absorbance spectra of peroxidase-like activity in different concentrations of H₂O₂; c) UV-*vis* absorbance spectra of peroxidase-like activity in different concentrations of TMB.

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Table S3: Kinetic parameters of Pd₇Cu₁ alloy NPs.

Enzyme	Substrate	K _m (mM)	V _{max} (mM s ⁻¹)
Pd ₁ Cu ₇ alloy NPs	H ₂ O ₂	18.26	4.34
Pd ₁ Cu ₇ alloy NPs	TMB	10.62	7.69

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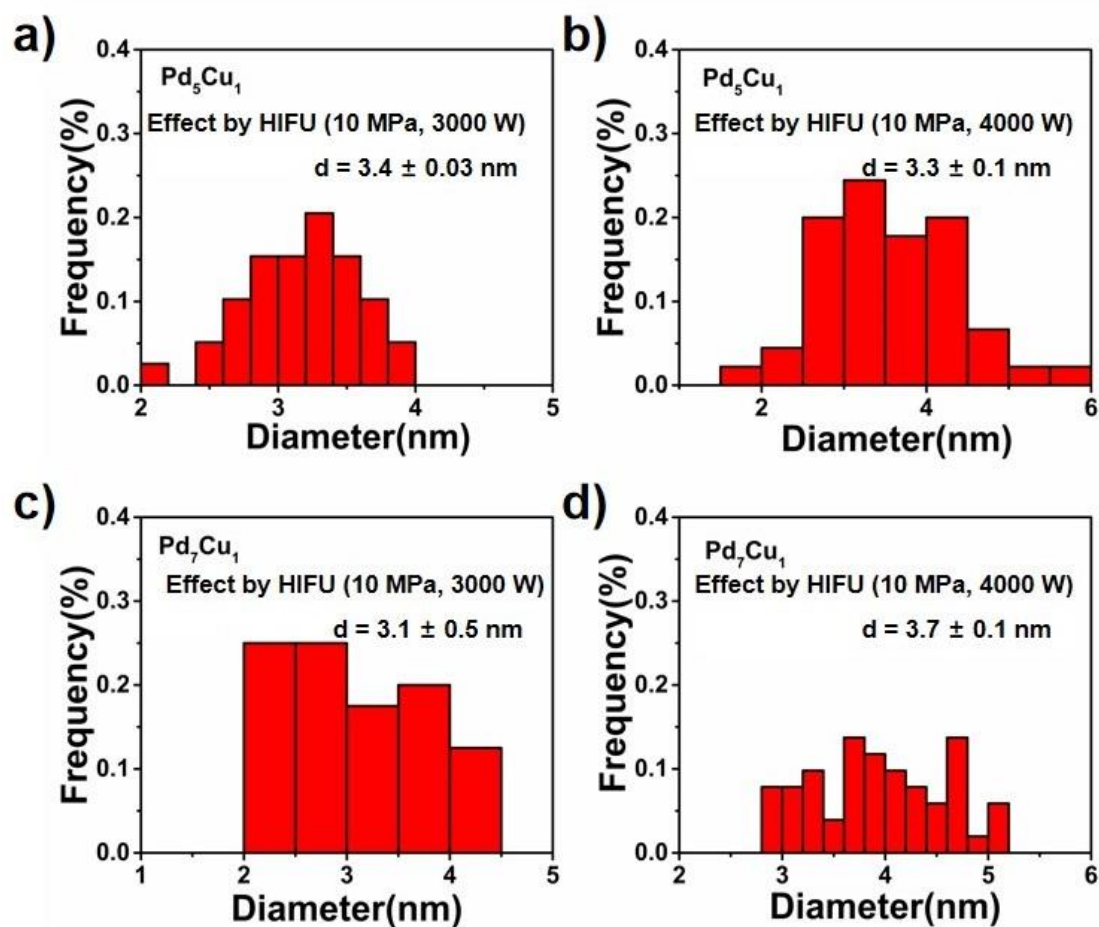


Figure. S9. Size distribution histogram of Pd_5Cu_1 alloy NPs and Pd_7Cu_1 alloy NPs effected by HIFU with different ultrasonic parameters.

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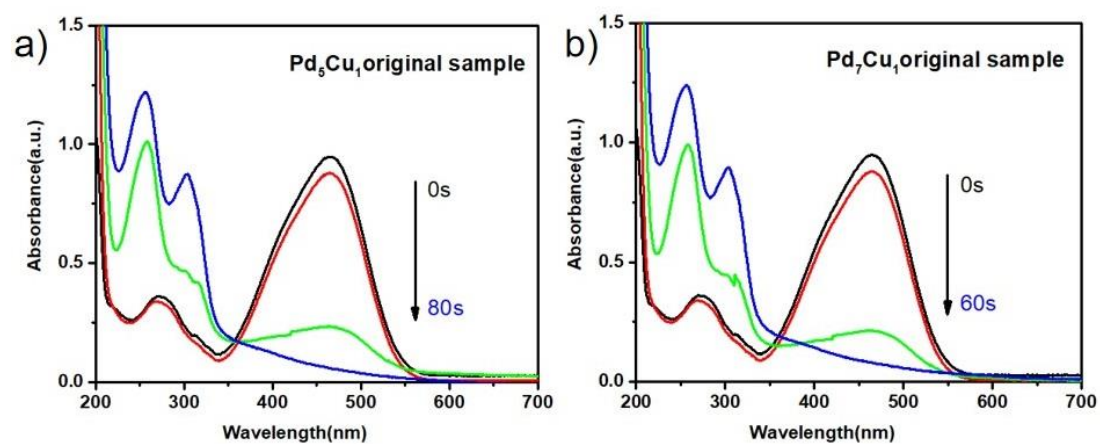


Figure. S10. UV-*vis* absorbance spectra of degradation of 0.06 mM MO by NaBH₄ in the presence of 100 μ L of Pd₅Cu₁ and Pd₇Cu₁ alloy NPs.

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Table S4: Summary of Comparative Reduction Time (t), Apparent Rate Constant (k_{app}), and Activity Parameter (K) for Different MTANP Samples. The concentration of substrate MO was controlled at 0.06 mM, and the content of NaBH₄ was controlled at 100 μ L (0.1 mM). The effect of different catalysts on reaction rates can be observed in the table below.

Sample name	Reduction time(s)	Apparent rate constant (K_{app} , $10^{-3}s^{-1}$)
Pd ₅ Cu ₁	80	40.1
Pd ₇ Cu ₁	60	53.5
Pd ₅ Cu ₁ (10MPa,3000W)	30	107
Pd ₅ Cu ₁ (10MPa,4000W)	18	178.3
Pd ₇ Cu ₁ (10MPa,3000W)	20	160.5
Pd ₇ Cu ₁ (10MPa,4000W)	9	356.7

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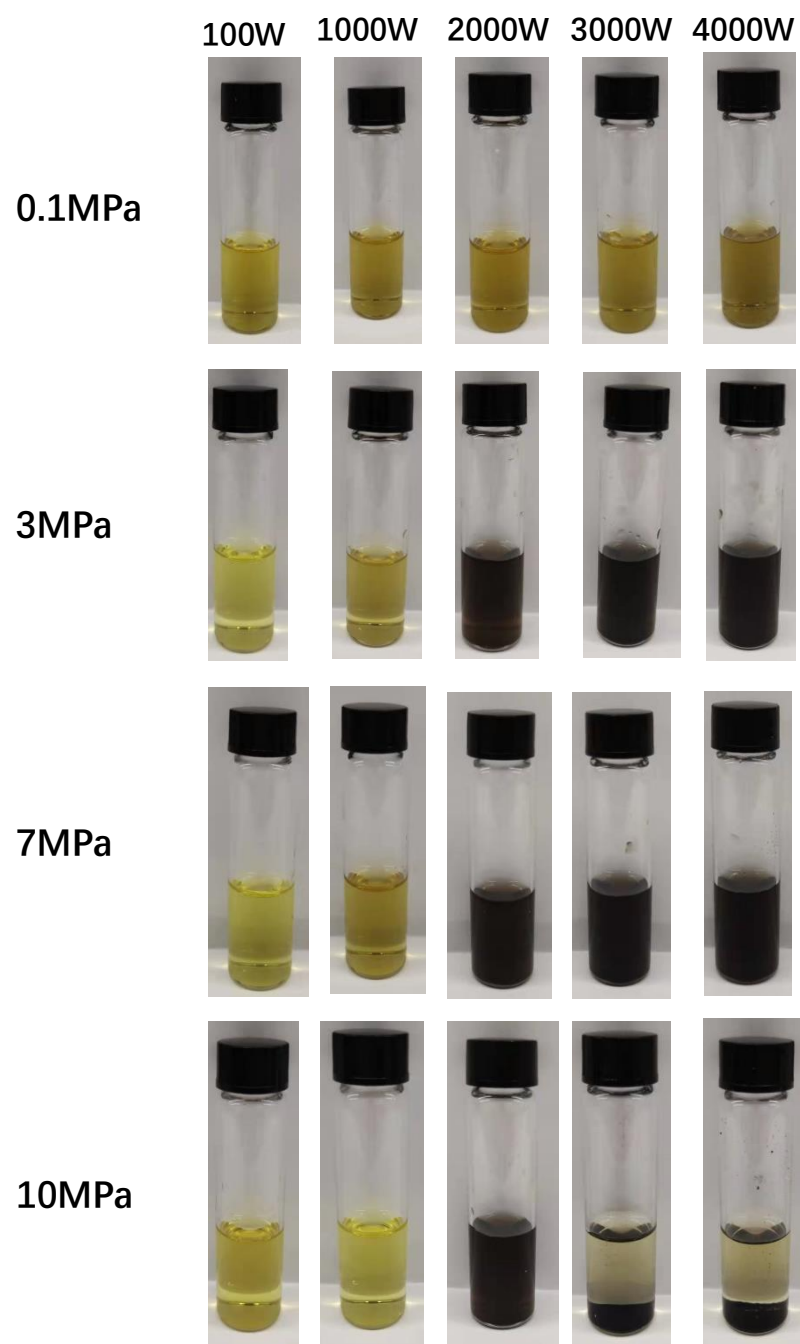


Figure. S11. Solution states of Pd₅Cu₁ alloy NPs affected by different ultrasonic parameters.

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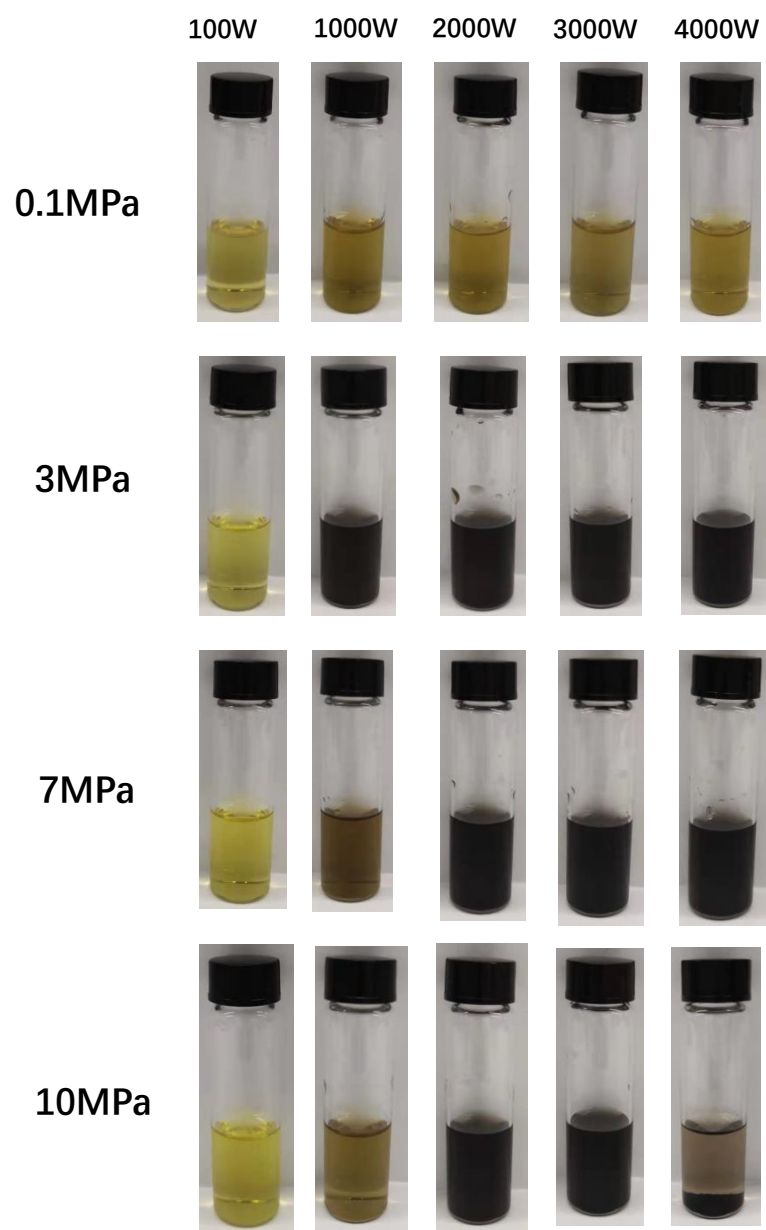


Figure. S12. Solution states of Pd₇Cu₁ alloy NPs affected by different ultrasonic parameters.