

Supporting information

Enhanced photodegradation performance based on surface plasmonic resonance effect of Ag/Ca₂Al₂SiO₇: Pr³⁺ ultraviolet long afterglow driven in photo-Fenton system

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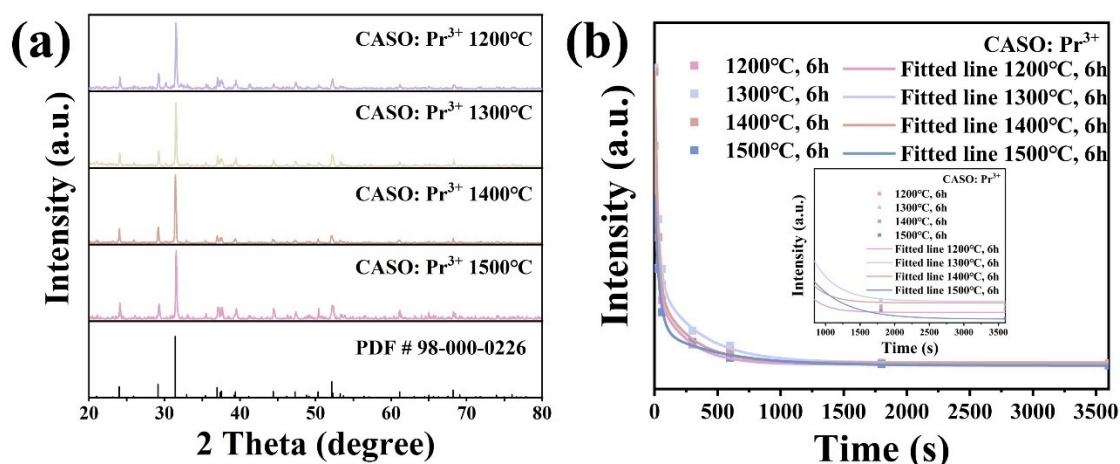


Fig. S1 (a) XRD patterns of CASO: Pr³⁺ in different temperature. (b) Long afterglow luminescence decay curves of the CASO: Pr³⁺ in different temperature.

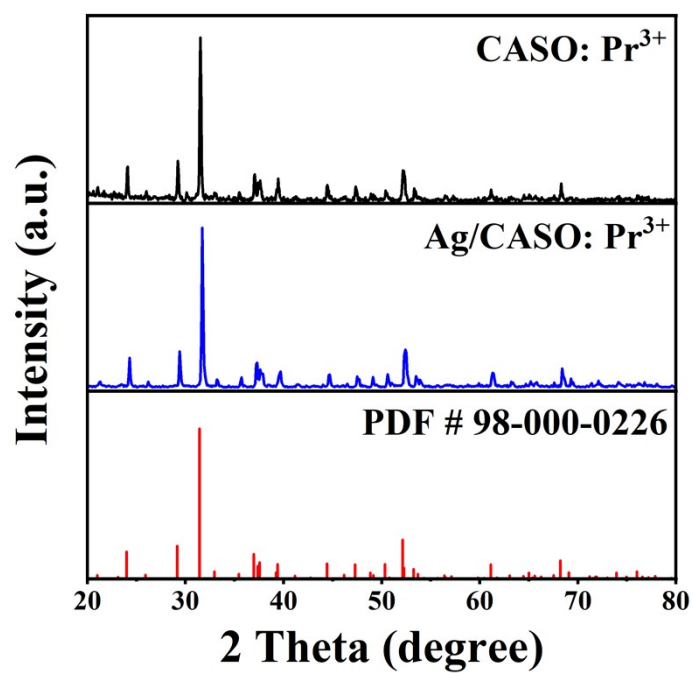


Fig. S2 XRD patterns of CASO: Pr³⁺, Ag/CASO: Pr³⁺ and CASO host (PDF # 98-000-0226).

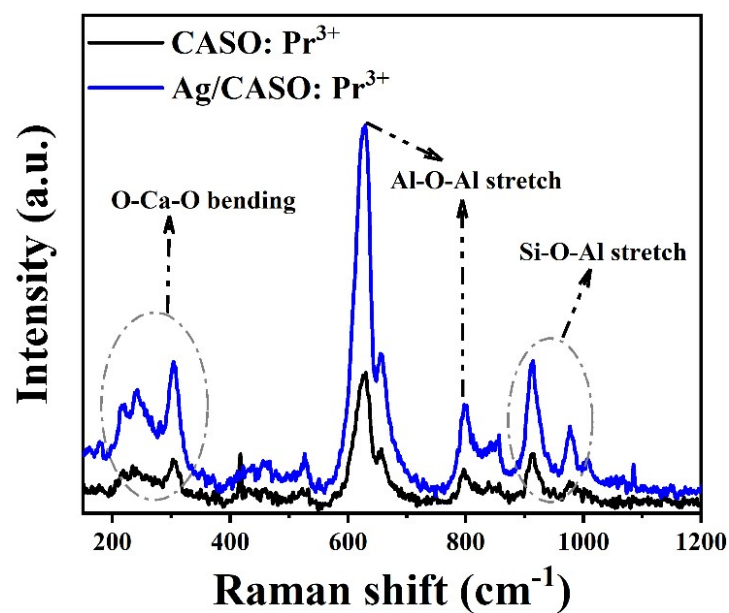


Fig. S3 Raman spectra of CASO: Pr³⁺ and Ag/CASO: Pr³⁺.

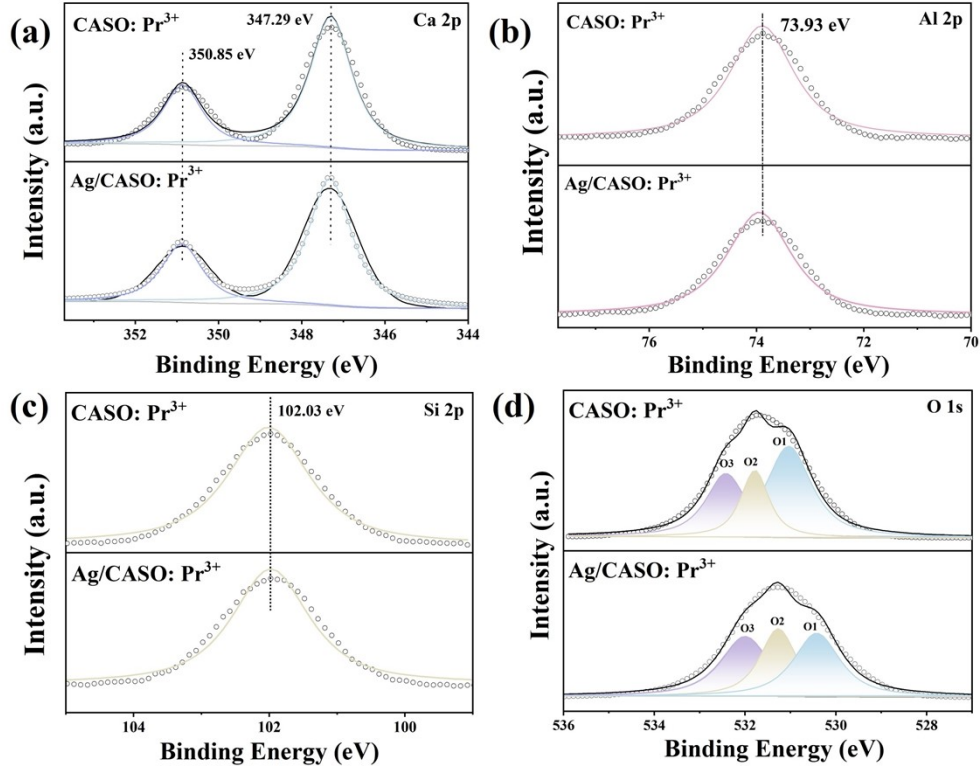


Fig. S4 XPS of (a) Ca 2p, (b) Al 2p (c) Si 2p, (d) O 1s in CASO: Pr³⁺ and Ag/CASO: Pr³⁺ long afterglow phosphor.

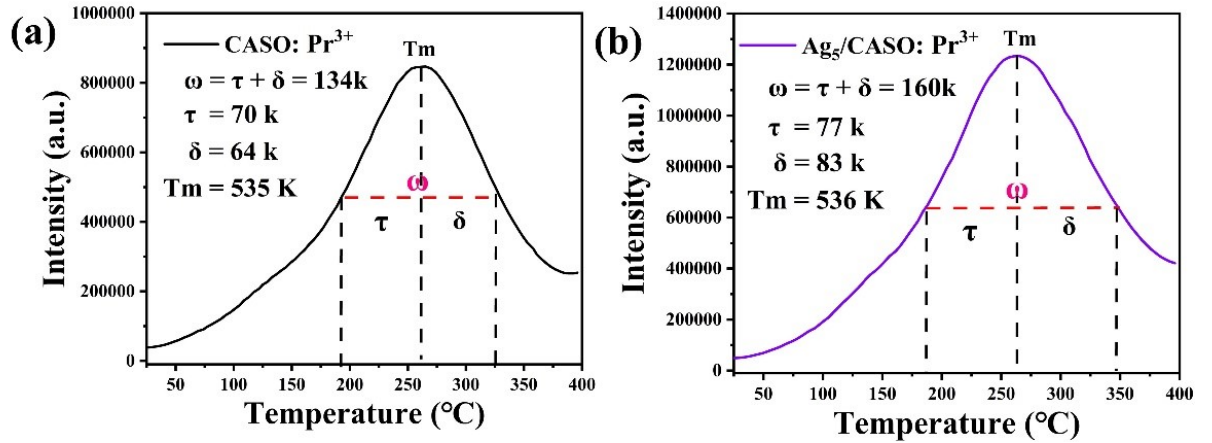


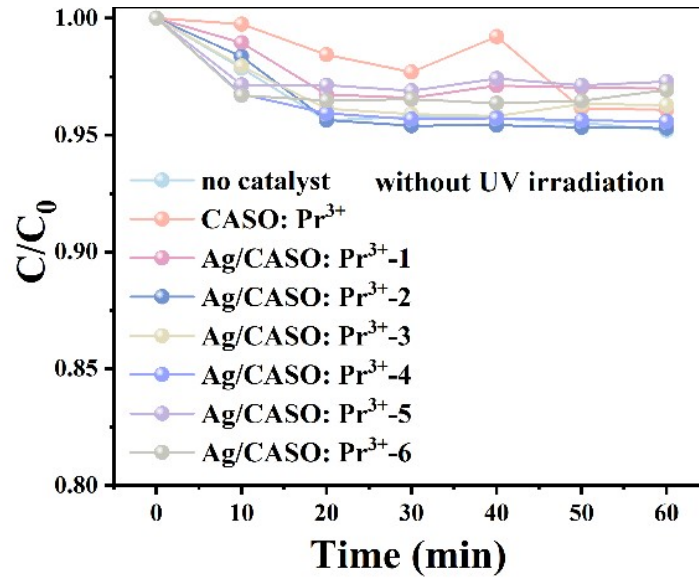
Fig. S5 The long afterglow parameters of CASO: Pr³⁺ and Ag/CASO: Pr³⁺.

Table S1 The trap depth and trap charge concentration of CASO: Pr³⁺ and Ag/CASO: Pr³⁺ phosphors

Samples	T_m (K)	ω (K)	δ (K)	μ_g	n_0 (cm ³) ⁻¹	E (eV)
CASO: Pr ³⁺	535	134	64	0.48	9.06×10^5	0.48
Ag/CASO: Pr ³⁺	536	160	83	0.52	1.39×10^7	0.45

Table S2 Long afterglow lifetime parameters of CASO: Pr³⁺ and Ag/CASO: Pr³⁺

Samples	τ_1 (s)	τ_2 (s)	A ₁	A ₂	A ₁ /A ₂	R ²
CASO: Pr ³⁺	9.94	157.75	113440	65872	1.72	0.9989
Ag/CASO: Pr ³⁺ -1	10.08	170.05	121642	69917	1.73	0.9996
Ag/CASO: Pr ³⁺ -2	11.71	183.45	132453	76345	1.73	0.9993
Ag/CASO: Pr ³⁺ -3	11.96	205.06	155210	81078	1.91	0.9997
Ag/CASO: Pr ³⁺ -4	17.22	224.29	155318	82920	1.87	0.9996
Ag/CASO: Pr ³⁺ -5	20.20	253.68	162117	91242	1.77	0.9989
Ag/CASO: Pr ³⁺ -6	12.09	187.06	142539	94811	1.50	0.9995

**Fig. S6** The degradation efficiency of RhB without photocatalyst, CASO: Pr³⁺ and Ag/CASO: Pr³⁺ without UV irradiation.

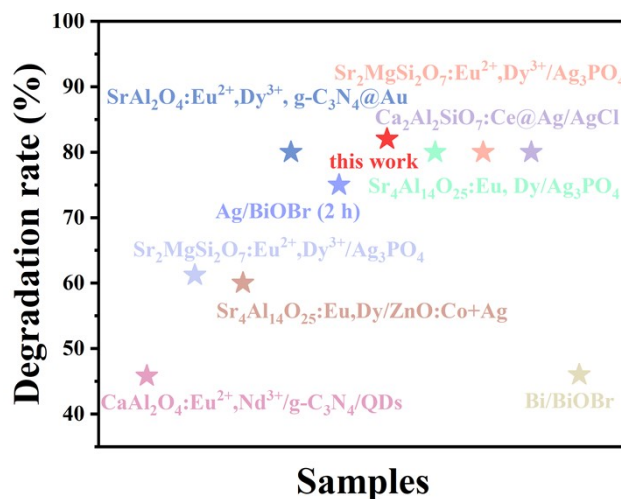


Fig. S7 The comparison of degradation efficiency of $\text{Ag}/\text{CASO}:\text{Pr}^{3+}$ with other photocatalysts.

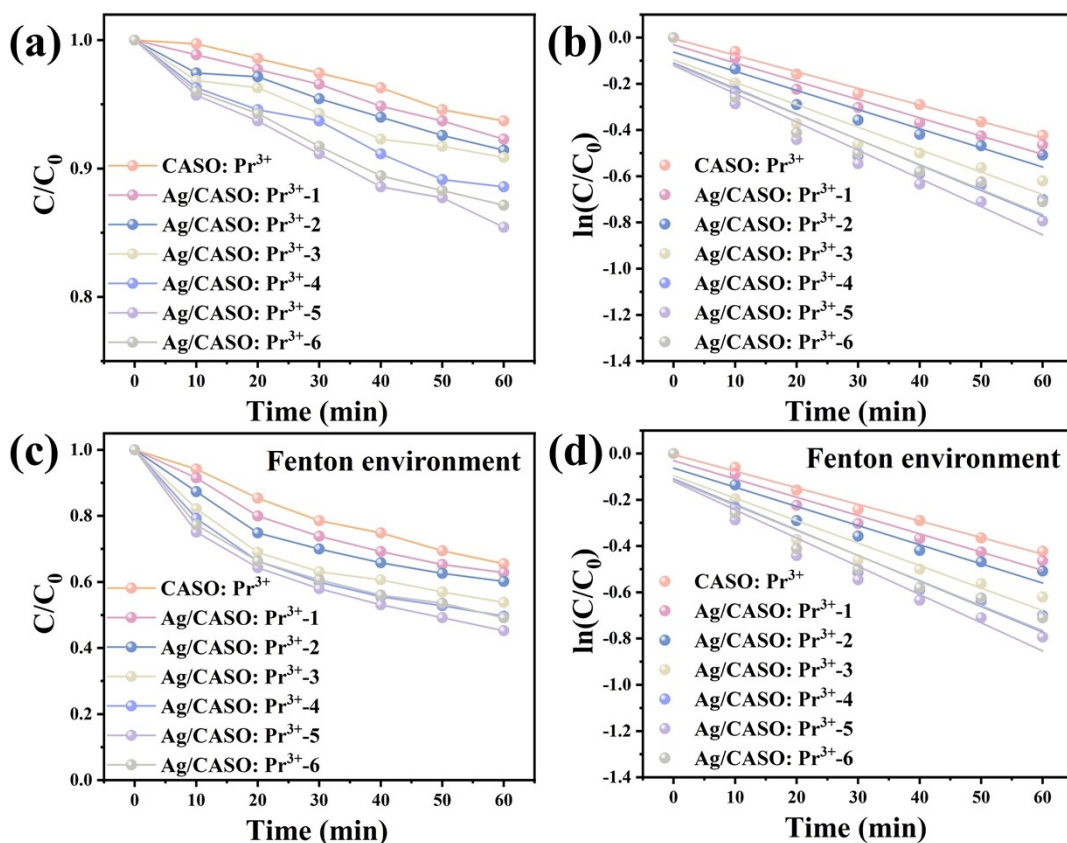


Fig. S8 Photocatalytic performance of TC degradation of $\text{CASO}:\text{Pr}^{3+}$ and $\text{Ag}/\text{CASO}:\text{Pr}^{3+}$ phosphors irradiation with a 254 nm UV lamp. (b) The corresponding pseudo-first-order kinetics of $\text{CASO}:\text{Pr}^{3+}$ and $\text{Ag}/\text{CASO}:\text{Pr}^{3+}$ phosphors. (c) The photo-Fenton degradation performance for TC degradation of $\text{CASO}:\text{Pr}^{3+}$ and $\text{Ag}/\text{CASO}:\text{Pr}^{3+}$ phosphors. (d) The corresponding pseudo-first-order kinetics of $\text{CASO}:\text{Pr}^{3+}$ and $\text{Ag}/\text{CASO}:\text{Pr}^{3+}$ phosphors in photo-Fenton system.

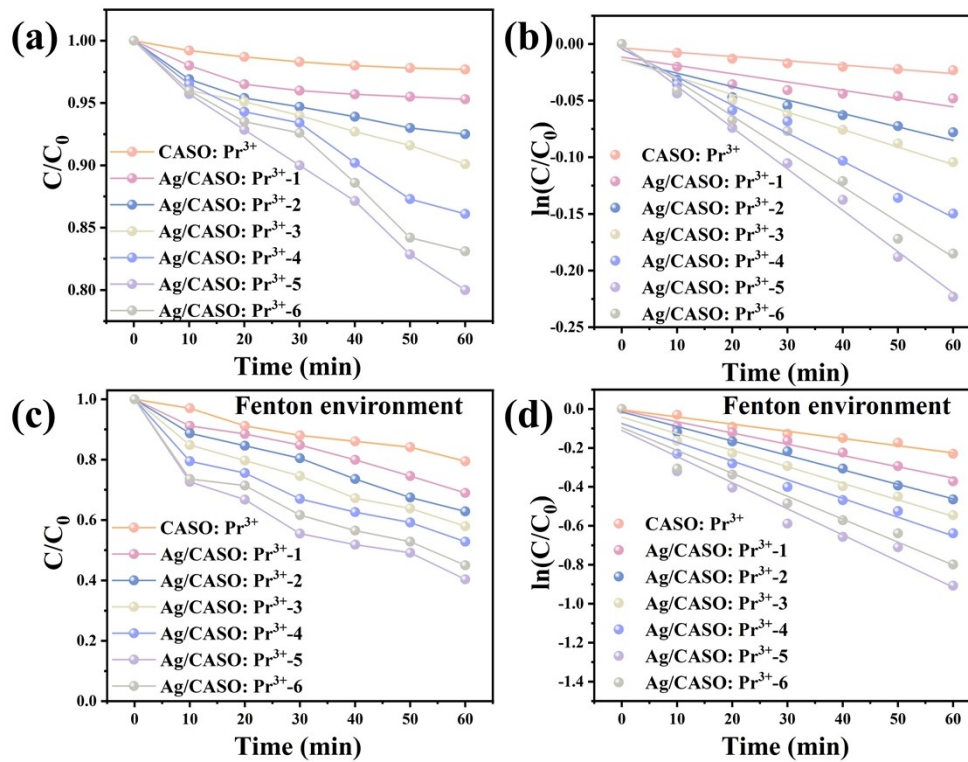


Fig. S9 Photocatalytic performance of NFX degradation of CASO: Pr³⁺ and Ag/CASO: Pr³⁺ phosphors irradiation with a 254 nm UV lamp. (b) The corresponding pseudo-first-order kinetics of CASO: Pr³⁺ and Ag/CASO: Pr³⁺ phosphors. (c) The photo-Fenton degradation performance for NFX degradation of CASO: Pr³⁺ and Ag/CASO: Pr³⁺ phosphors. (d) The corresponding pseudo-first-order kinetics of CASO: Pr³⁺ and Ag/CASO: Pr³⁺ phosphors in photo-Fenton system.

Table S3 The corresponding pseudo-first-order kinetics CASO: Pr³⁺ and Ag/CASO: Pr³⁺ phosphors

	TC	TC (Fenton)	NFX	NFX (Fenton)
CASO: Pr ³⁺	0.0011 min ⁻¹	0.0071 min ⁻¹	0.0004 min ⁻¹	0.0037 min ⁻¹
Ag/CASO: Pr ³⁺ -1	0.0013 min ⁻¹	0.0079 min ⁻¹	0.0007 min ⁻¹	0.0057 min ⁻¹
Ag/CASO: Pr ³⁺ -2	0.0014 min ⁻¹	0.0082 min ⁻¹	0.0012 min ⁻¹	0.0074 min ⁻¹
Ag/CASO: Pr ³⁺ -3	0.0016 min ⁻¹	0.0097 min ⁻¹	0.0015 min ⁻¹	0.0085 min ⁻¹
Ag/CASO: Pr ³⁺ -4	0.0019 min ⁻¹	0.0110 min ⁻¹	0.0025 min ⁻¹	0.0096 min ⁻¹
Ag/CASO: Pr ³⁺ -5	0.0025 min ⁻¹	0.0122 min ⁻¹	0.0037 min ⁻¹	0.0134 min ⁻¹
Ag/CASO: Pr ³⁺ -6	0.0022 min ⁻¹	0.0108 min ⁻¹	0.0031 min ⁻¹	0.0117 min ⁻¹

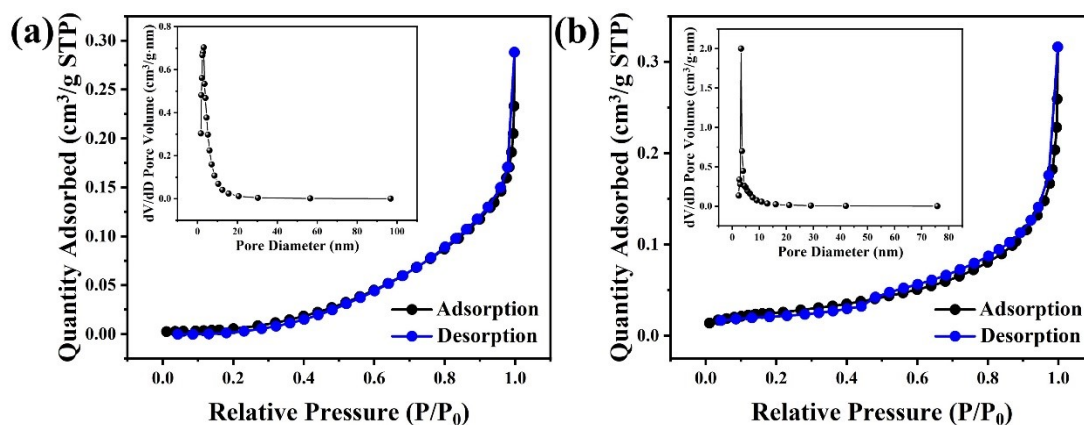


Fig. S10 (a) Nitrogen adsorption-desorption curves and (b) pore size distributions curves of CASO: Pr³⁺ and Ag/CASO: Pr³⁺ phosphors.

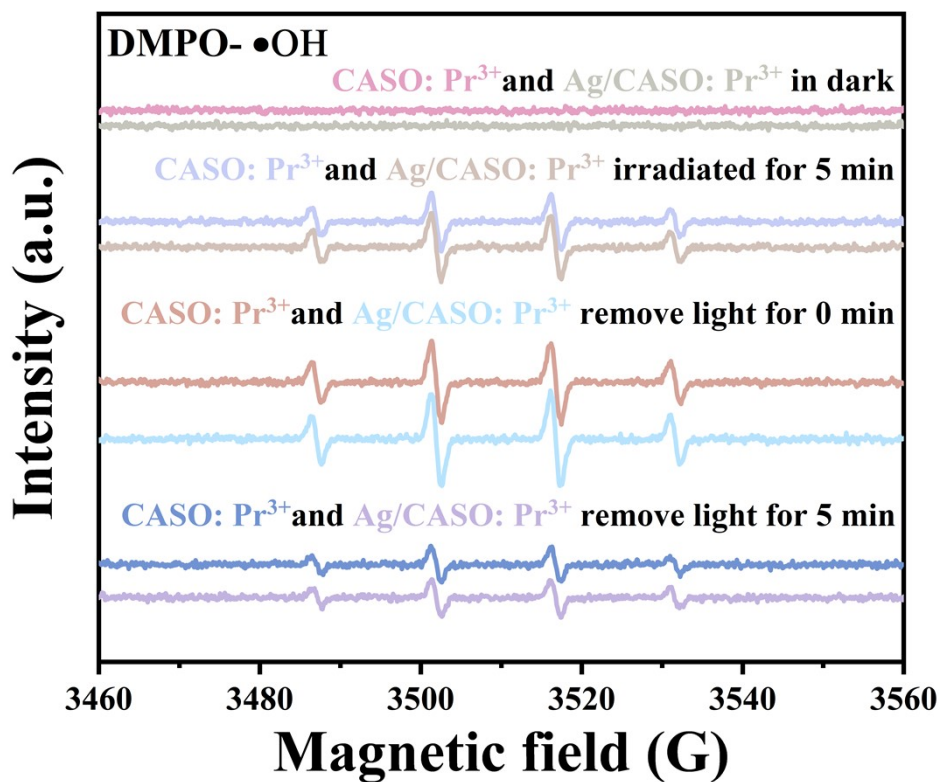


Fig. S11 The ESR spectra of DMPO-•OH in CASO: Pr³⁺ and Ag/CASO: Pr³⁺ in the dark, after 5 min of light, after 0 min of irradiation and after 5 min of irradiation.

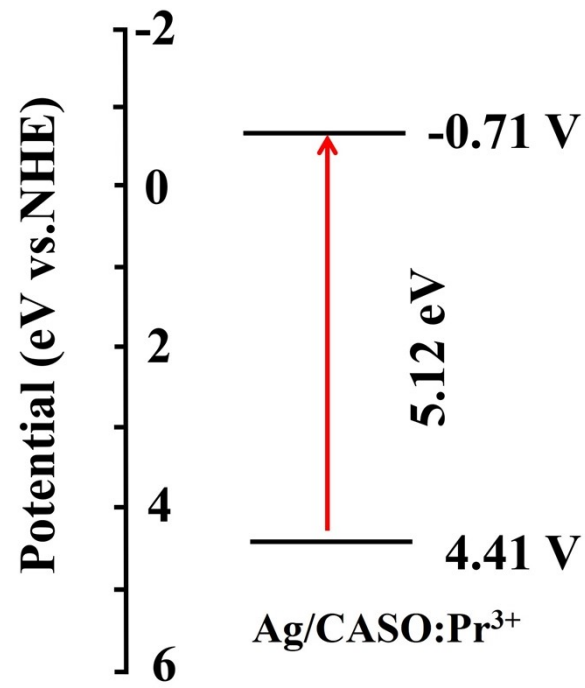


Fig. S12 The band structure diagram of Ag/CASO: Pr³⁺