Light-Driven Ethanol Dehydrogenation for Hydrogen Production over CuPt Bimetallic Catalysts

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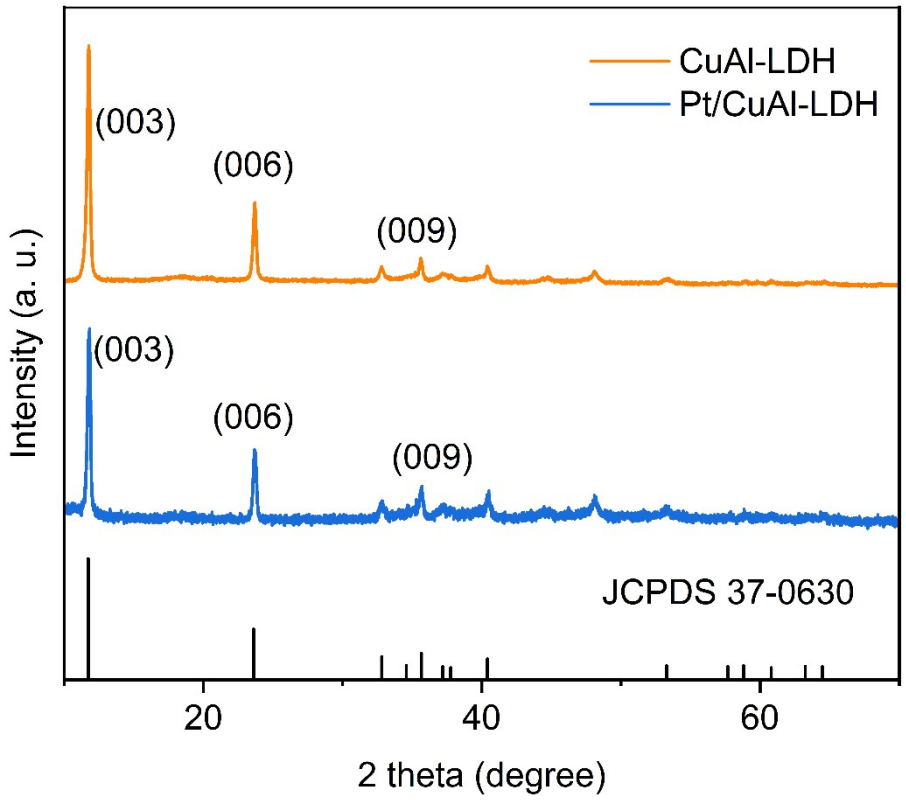

Fig. S1 XRD patterns for CuAl-LDH and Pt/CuAl-LDH.

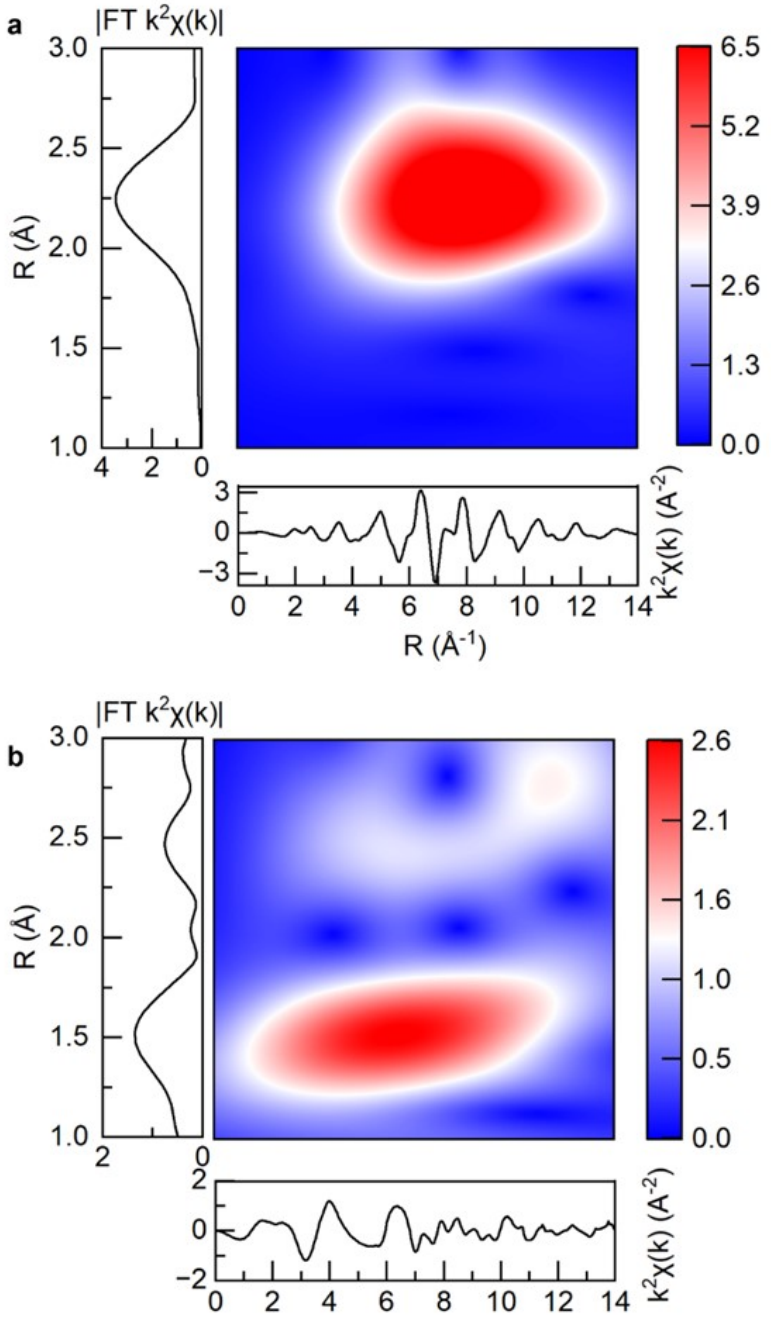

Fig. S2 (a) Wavelet transform for the k^2-weighted EXAFS signal of Cu foil; (b) Wavelet transform for the k^2-weighted EXAFS signal of CuO.

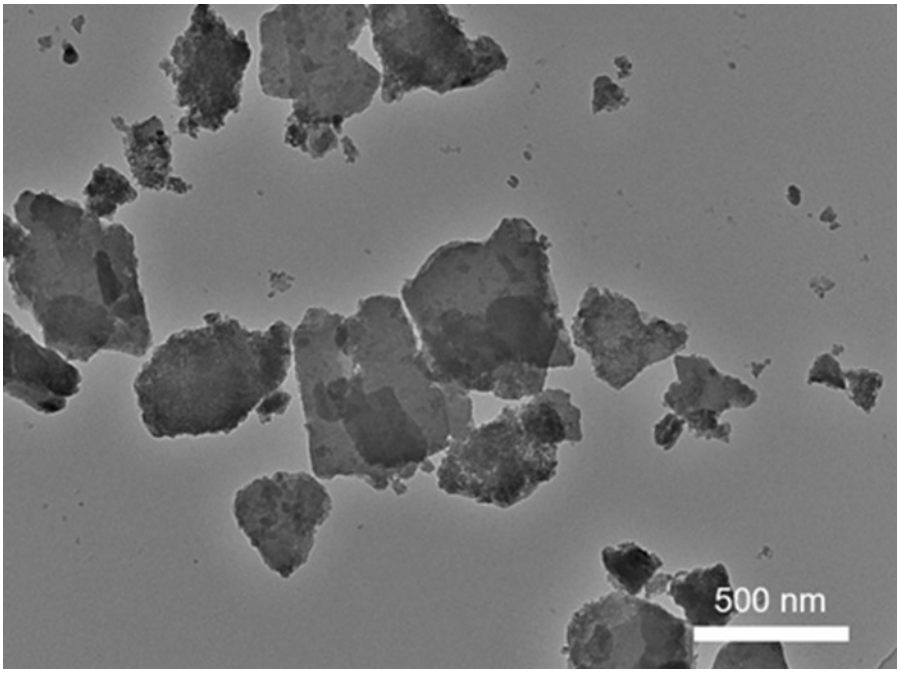

Fig. S3 TEM image for CuAl-LDH.

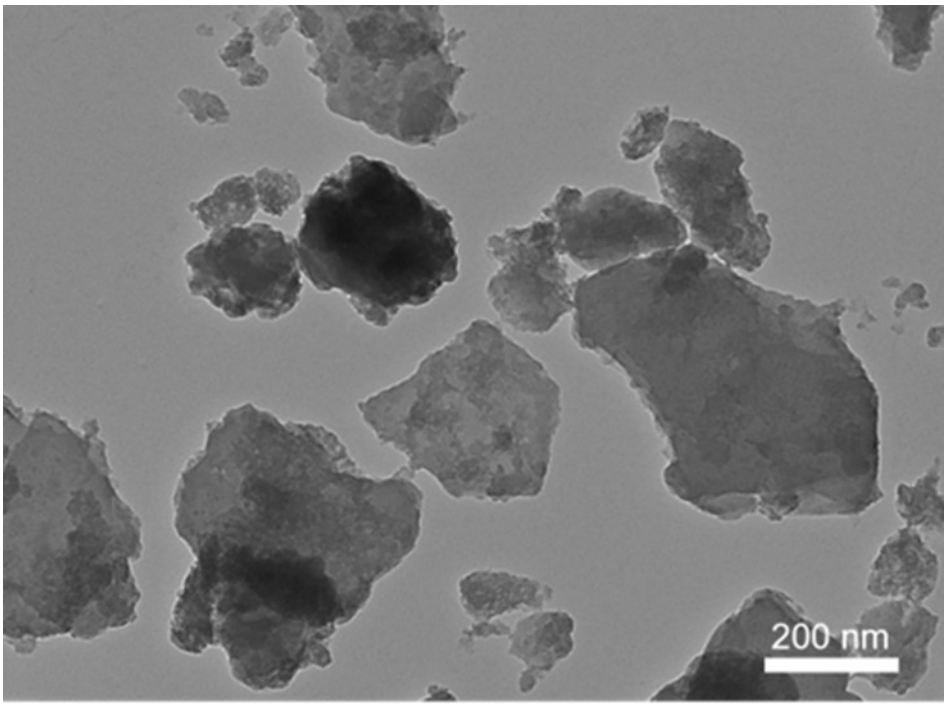

Fig. S4 TEM image for Pt/CuAl-LDH.

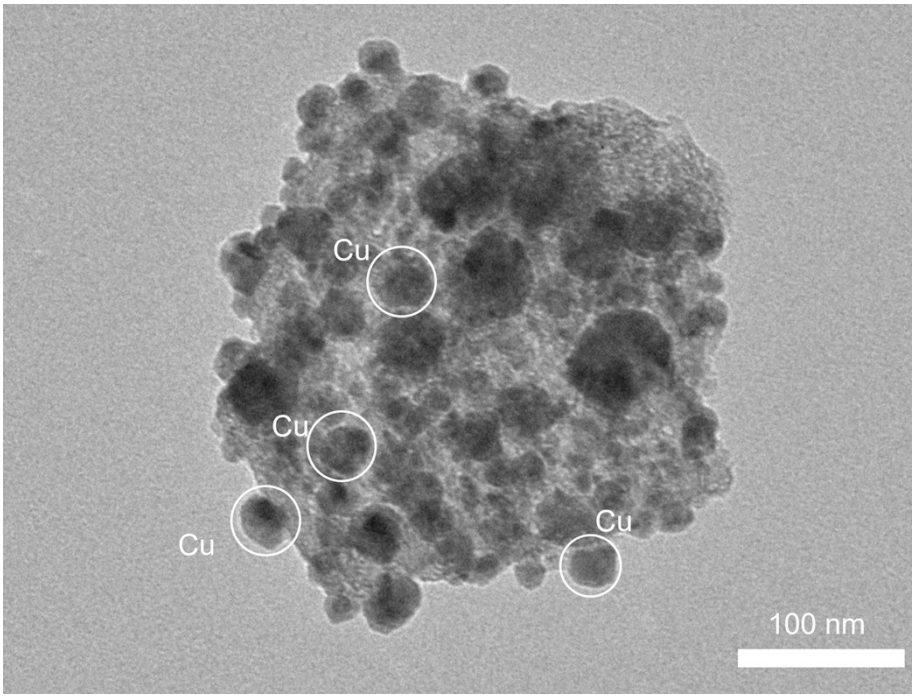

Fig. S5 TEM image for LD-Cu.

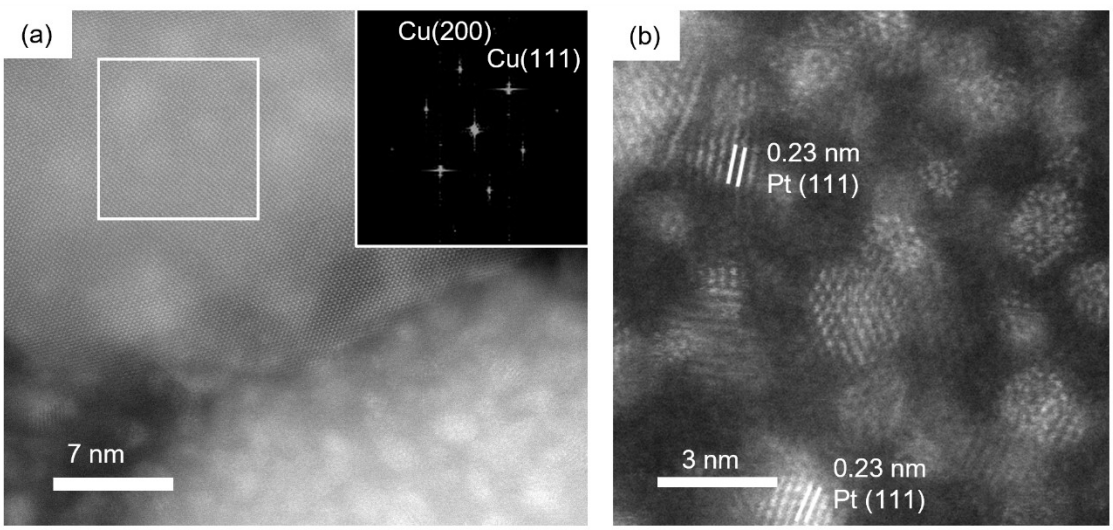

Fig. S6 (a) HRTEM image and corresponding fast Fourier transform for LD-CuPt. (b) Enlarged view of the Pt NPs in LD-CuPt.

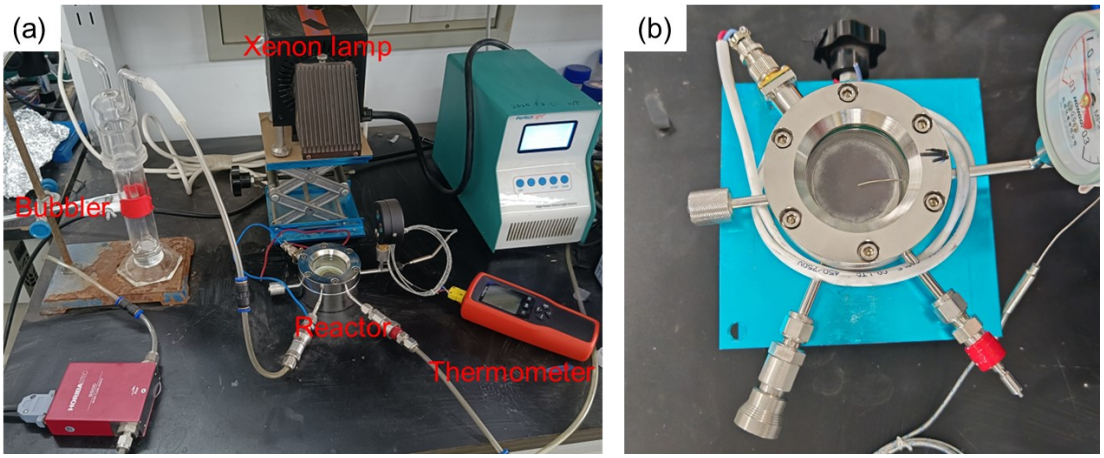

Fig. S7 Photograph of (a) front view and (b) top view of the photoreactor used for the light-driven ED reaction tests.

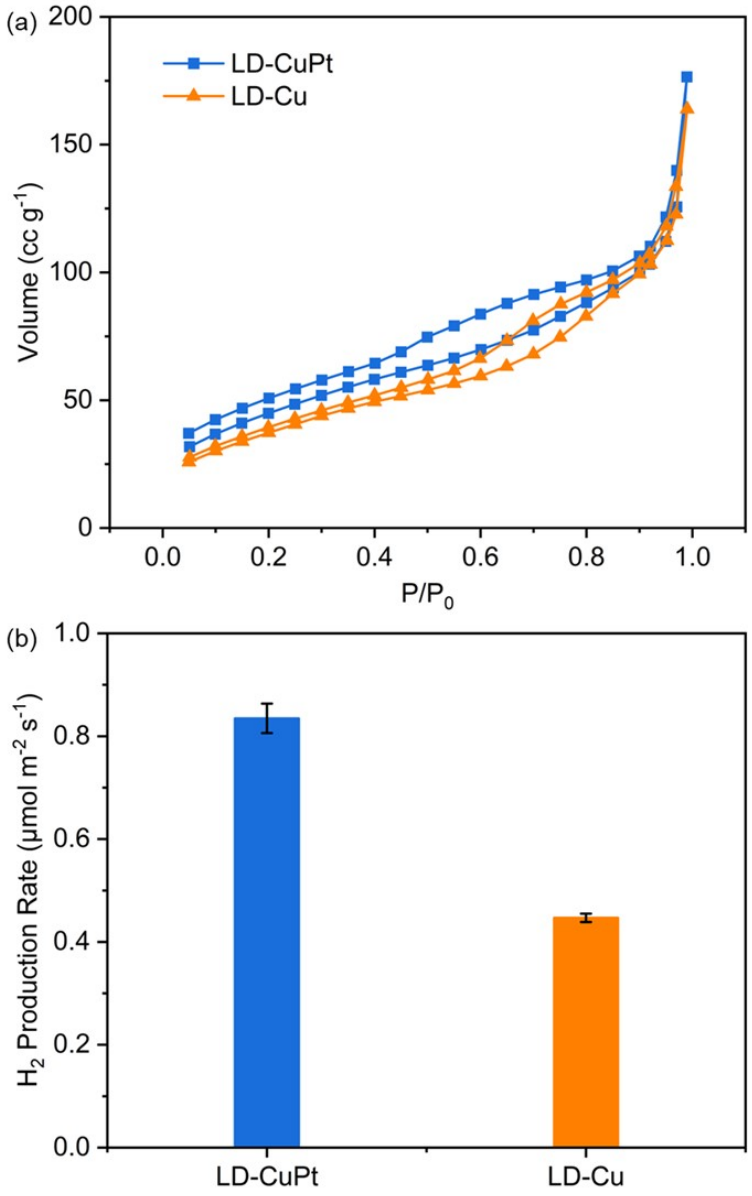

Fig. S8 (a) N_2 adsorption/desorption isotherms for LD-CuPt and LD-Cu. The specific surface areas of LD-CuPt and LD-Cu are 164.0 m^2 g^{-1} and 139.2 m^2 g^{-1}, respectively. (b) H_2 production rates of LD-Cu and LD-CuPt normalized by specific surface area.

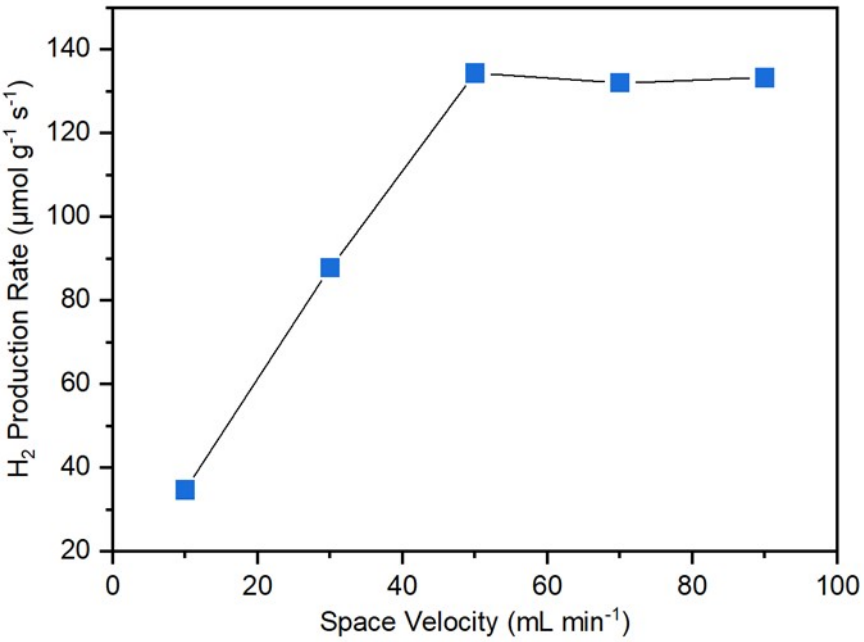

Fig. S9 Space velocity-dependent H_2 production rate of LD-CuPt under the light intensity of 1.1 W cm^{-2}.

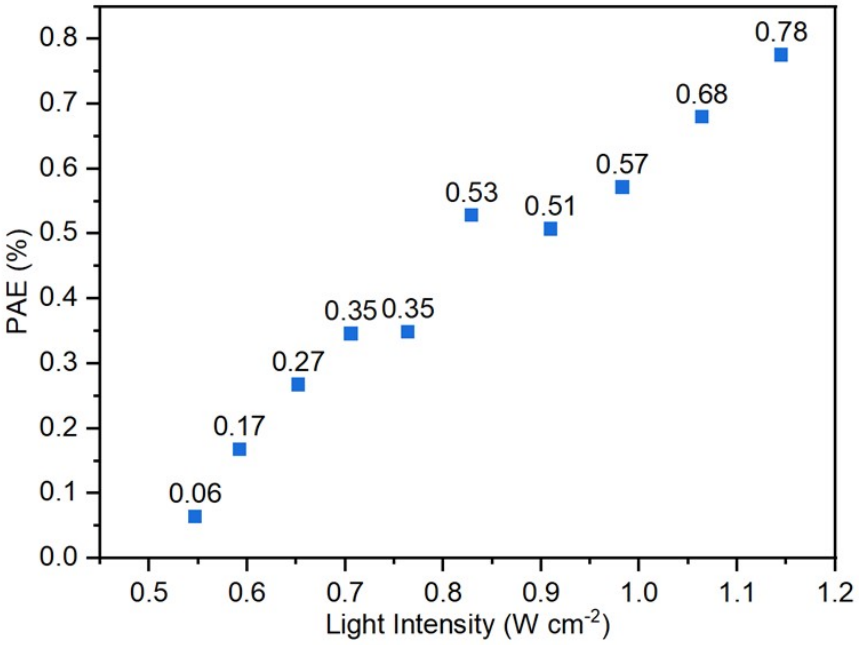

Fig. S10 Apparent PAE of LD-CuPt at different light intensities.

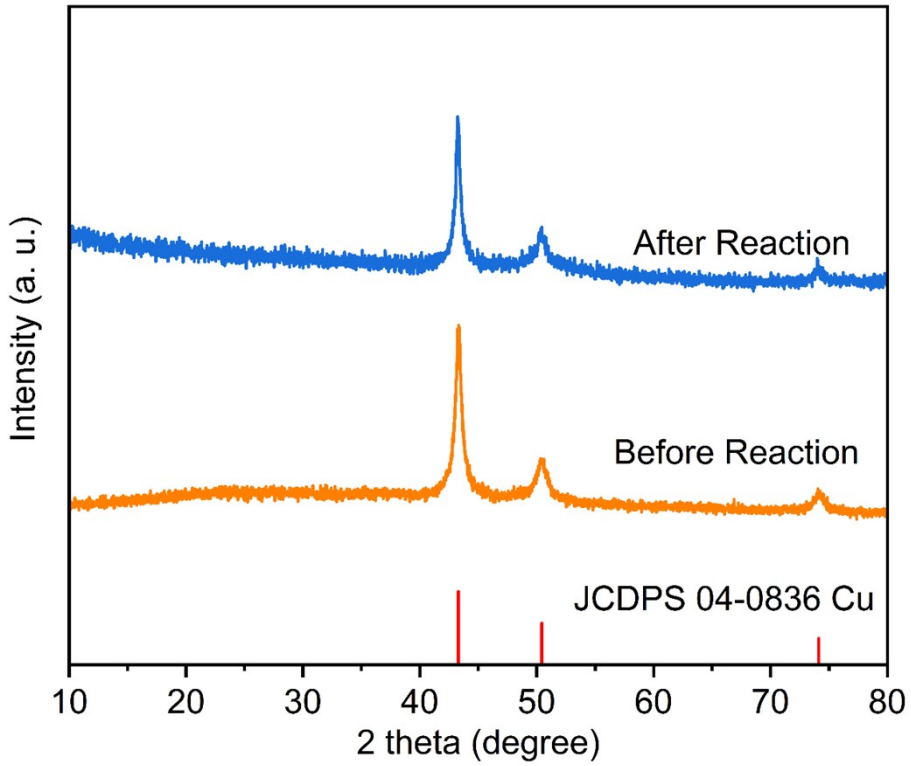

Fig. S11 XRD patterns of LD-CuPt before and after reaction.

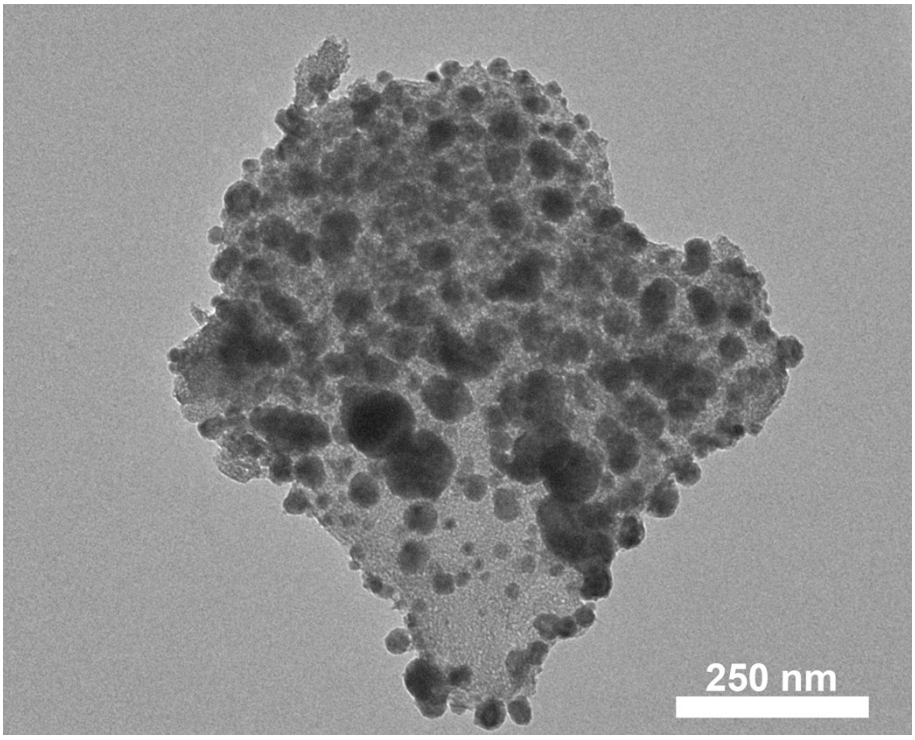

Fig. S12 TEM image of LD-CuPt after reaction.

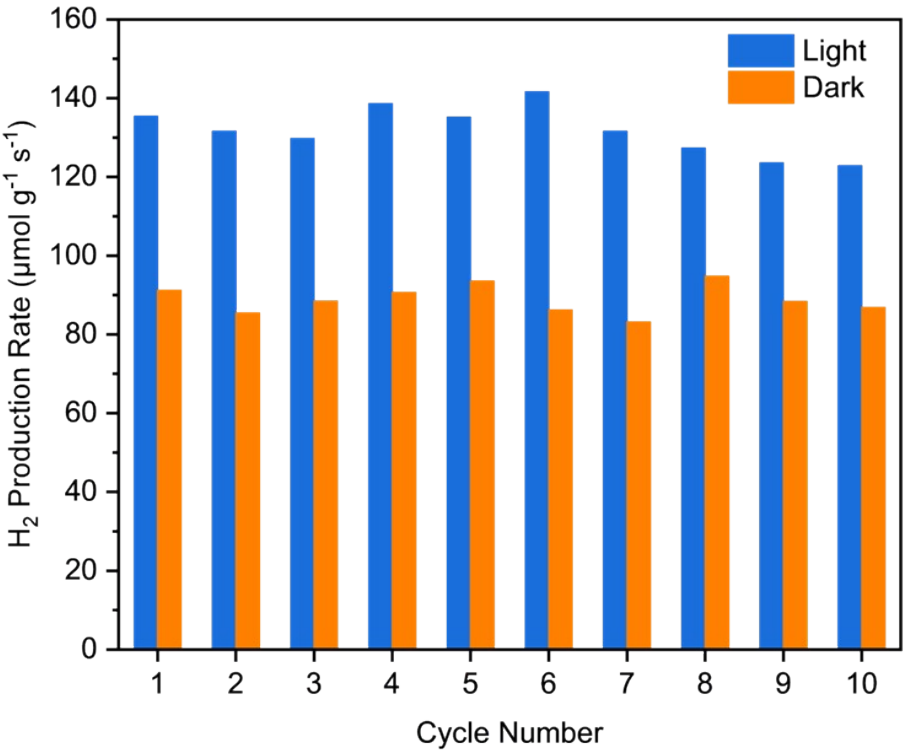

Fig. S13 Cycling experiment for the ED reaction using LD-CuPt as catalyst under light and dark conditions at 280 °C.

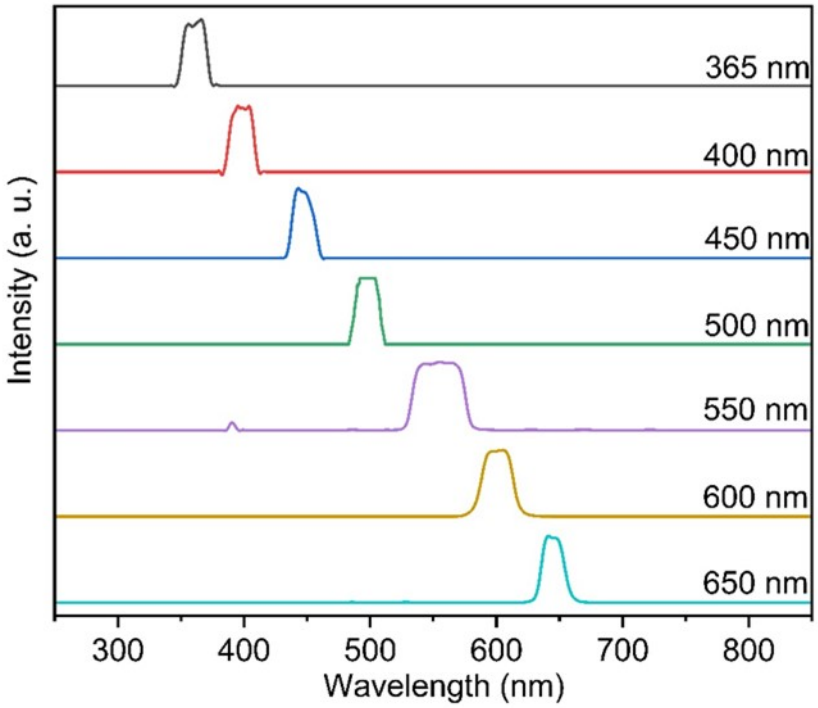

Fig. S14 Emission spectra of the different monochromatic light sources.

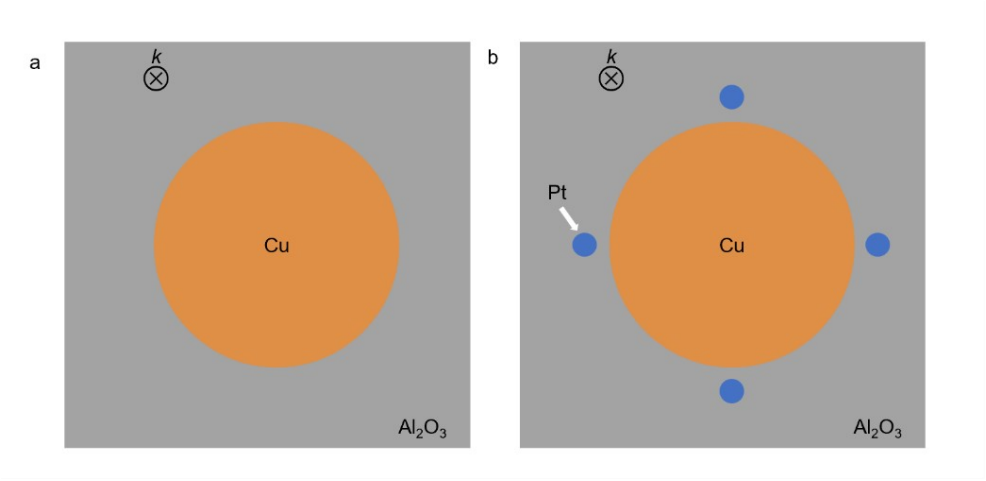

Fig. S15 Top views of models of (a) a Cu NP and (b) a Cu NP surrounded by four Pt NPs.

Supplementary Table 1. The elemental composition of different catalysts.

Sample	Cu content (wt.%)	Al_2O_3 content (wt.%)	Pt content (wt.%)
LD-Cu	52.17	44.96	0.00
1% LD-CuPt	50.69	43.35	1.66
3% LD-CuPt	51.59	44.52	4.78
5% LD-CuPt	46.81	42.49	7.82
7% LD-CuPt	48.37	42.62	8.40

Supplementary Table 2. Summary of the specific activity for ED over LD-CuPt and reported thermocatalysts and photocatalysts.

Catalyst	Reaction conditions (˚C)	H_2 production rate (μmol g_{cat}^{-1} s^{-1})	Ref.
LD-CuPt	xenon light source, 1.1 W cm^{-2}, 280 °C	136.9	This work
Cu@S-1	250 °C	3.2	[2]
Cu/PPC	180 °C	11.5	[3]
Cu20CA-C	275 °C	8.5	[4]
HT-Cu20	275 °C	9.2	[5]
Cu/$MgAlO_x$-P	300 °C	117.5	[6]
Cu/SiC	280 °C	14.1	[7]
Cu/SiO_2-AE	300 °C	9.8	[8]
$Ni_{0.04}Cu$	focused solar light, 210 °C	49.1	[9]

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