Electronic Supplementary Information

Controllable synthesis of Cu_2O Hierarchical Nanoclusters with High Photocatalytic Activity

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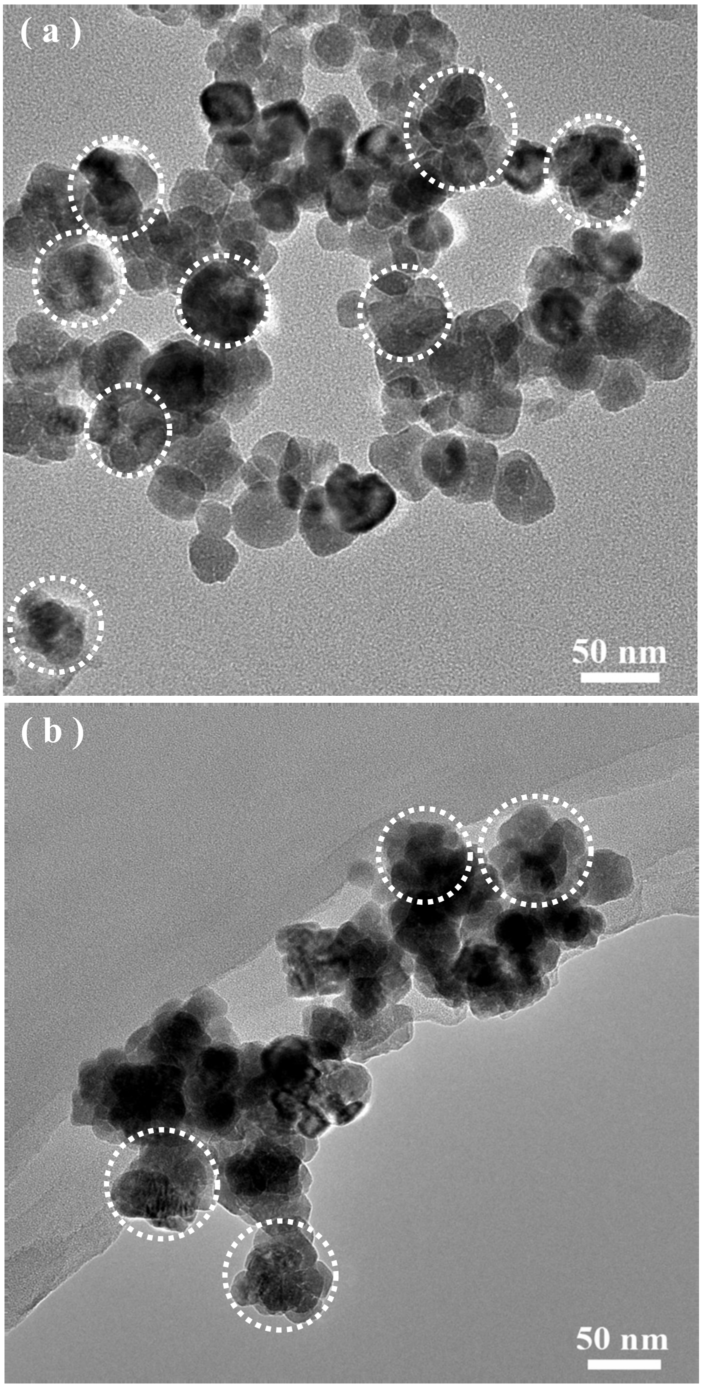

Fig. S1 (a and b) Typical TEM images of Cu_2O nanocrystals (S1) under high magnification

Note: It can be seen clearly that there are many “aggregation units” marked with white circles shown in Fig.S1. And sizes of the “units” are different ranging from 40 to 65 nm.

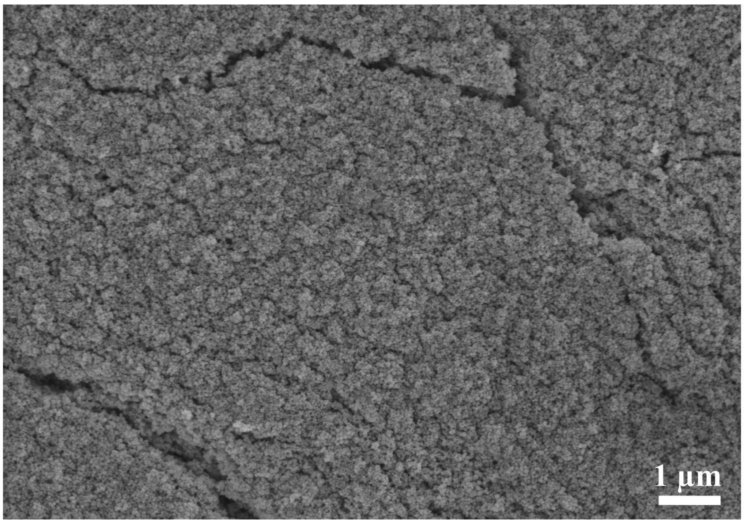

Fig. S2 Typical SEM images of the Cu_2O NCs (S2) under low magnification

Note: It can be seen obviously that S2 has uniform size distribution even under the large scanning scale.

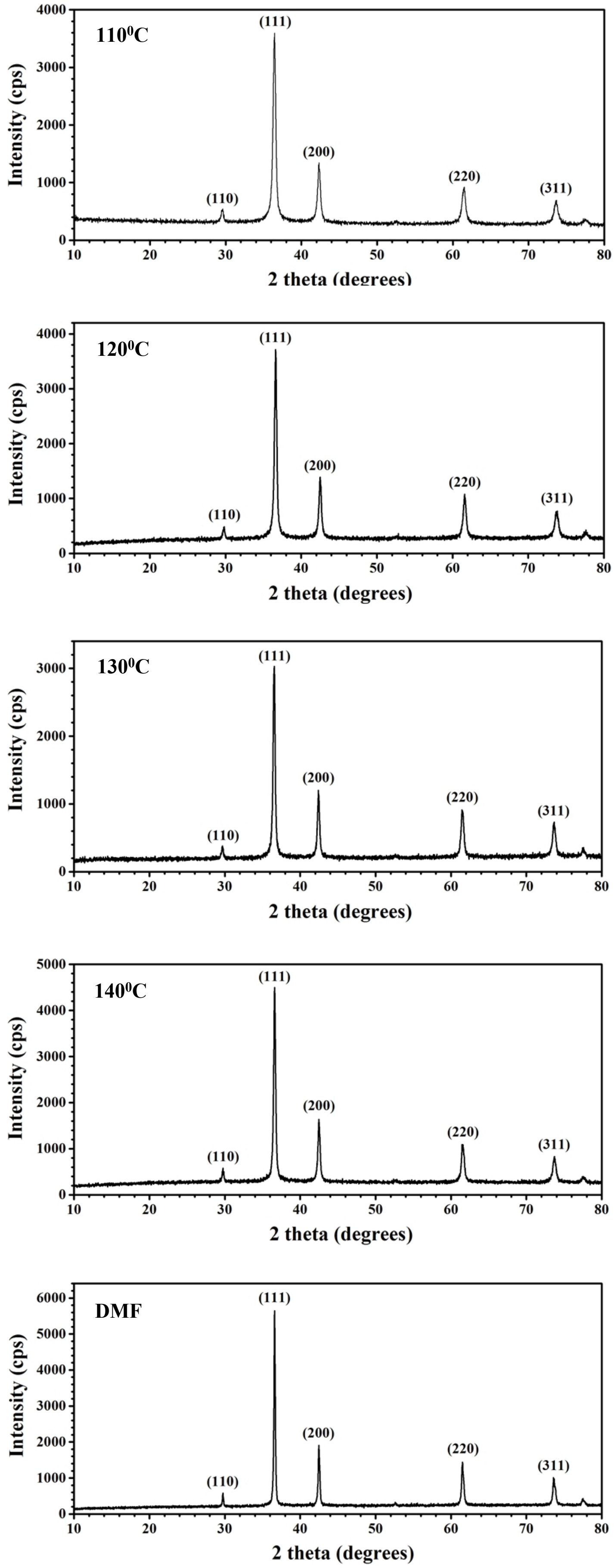

Fig. S3 XRD patterns of different shaped Cu_2O nanocrystals.

“cps” is the abbreviation of the phrase of “counts per second”.

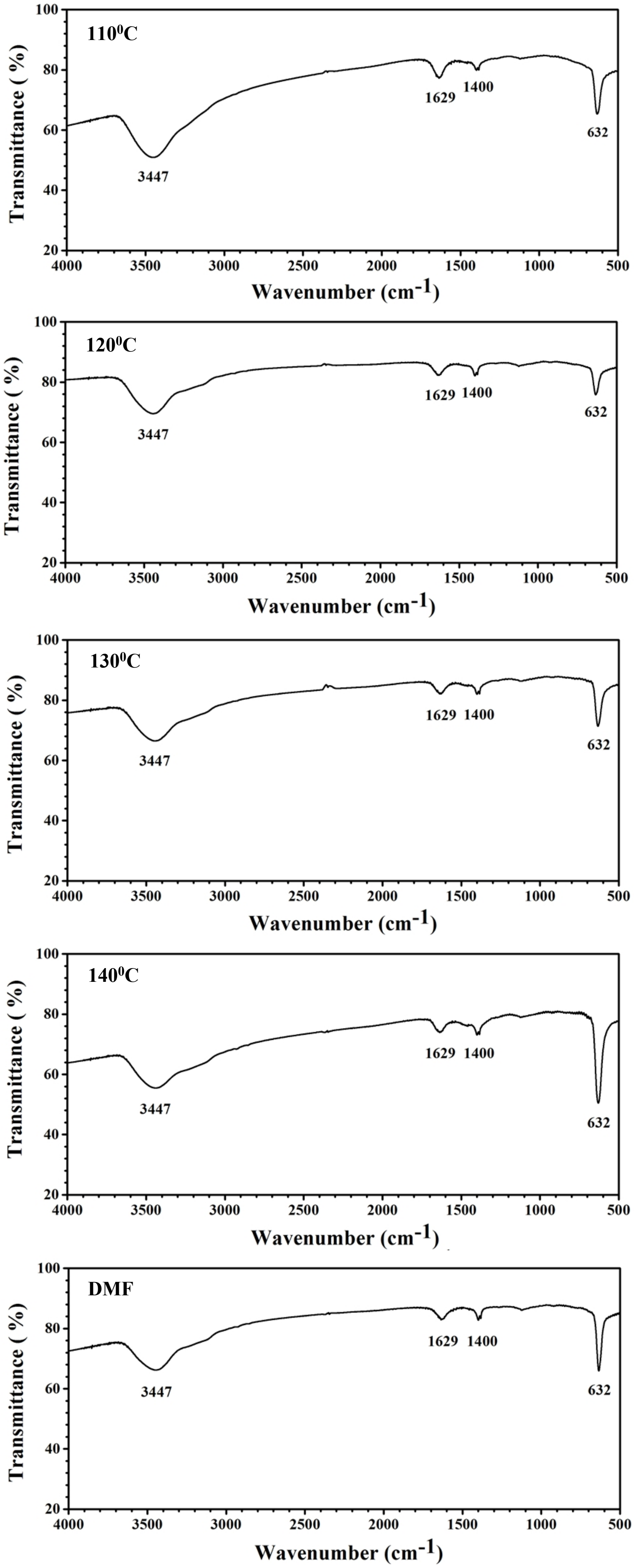

Fig. S4 FT-IR spectra of various shaped Cu_2O nanocrystals

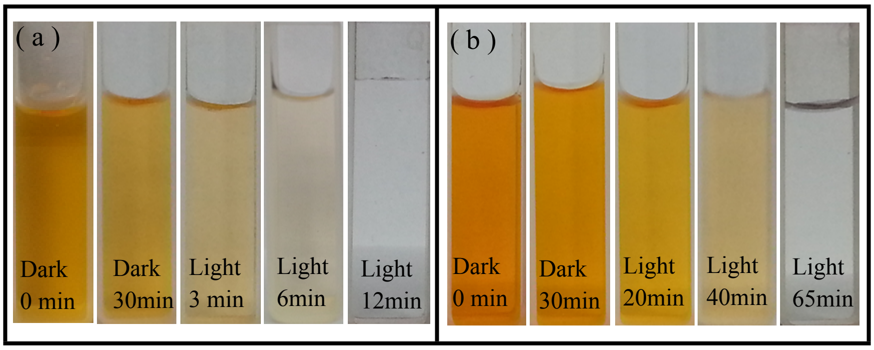

Fig. S5 Digital pictures of the color changes with the irradiation time of Cu_2O NCs (S2) by using different initial concentrations of MO solution: (a) 10 mg/L (b) 40 mg/L

Further work has been done to prove that the effect observed is indeed photocatalysis, and not just continued adsorption. The experimental results are listed in Tab. S1 as following. For convenient discussion, the decoloration rate of MO is determined by the formula η % = $(C_0 - C_t)/C_0 \times 100$ %. Where, C_0 and C_t represent the initial absorbance and the real time absorbance of MO solution in dark or under irradiation, respectively.

Tab. S1 Adsorption property and photocatalytic activity of S2

Initial concentration of MO aqueous solution	Experimental procedure	Decoloration rate of MO
40 mg/L	30 mins (dark) plus 65 mins (dark)	51 %
	30 mins (dark) plus 65 mins (irradiation)	100 %
10 mg/L	30 mins (dark) plus 12 mins (dark)	55 %
	30 mins (dark) plus 12 mins (irradiation)	100 %
40 mg/L	**16 hours** in the **dark**	100 %
10 mg/L	**15 hours** in the **dark**	100 %

Note: The amount of S2 keeps the same (0.01g) in all the experiments with MO aqueous solution of 100 ml.

According to Tab.S1, it is obviously that photocatalysis really exists by using the most active Cu_2O sample (S2). Moreover, the adsorption rate of S2 becomes very very slow after 30 mins in the dark. Further experimental results indicate that MO can be completely adsorbed after 16 hours (40 mg/L) and 15 hours (10 mg/L) in the dark, respectively. Therefore, the effect observed is indeed photocatalysis.

Tab. S2 Constants (*k*) of each sample under different conditions

Initial concentration of MO aqueous solution	S1	S2	S3	S4	S5
40 mg/L	0.0404	0.0533	0.0362	0.0293	0.0017
10 mg/L	0.0859	0.2033	0.0829	0.0818	0.0053

Tab. S3 Photocatalytic activities of Cu_2O with different morphologies and composites

Morphologies of Cu_2O	Average particle size of Cu_2O	Composites	The quality ratio between Cu_2O and MO	Irradiation time	Degradation ratio of MO	Ref.
Porous sphere	~300 nm	Pure Cu_2O	10 mg:1.5 mg=20:3	3 h	~3%	1
26(18)-facet Polyhedral	2 μm	Pure Cu_2O	50 mg:1.5 mg=100:3	3 h	73%	2
Sphere	200 nm	rGO-Cu_2O	20 mg:1 mg=20:1	60 mins	96.6%	3
Sphere	1-2 μm	Cu-Cu_2O	50 mg:2.5 mg=20:1	20 mins	99.77%	4
Hollow sphere	200 nm	Au-Cu_2O	20 mg:16 mg=5:4	4 h	~70%	5
Irregular sphere	20-40 nm	TiO_2-Cu_2O	25 mg:1.5 mg=50:3	60 mins	90%	6
Quasi- sphere	100-300 nm	Fe_3O_4-Cu_2O	100 mg:3 mg=100:3	60 mins	90%	7
Octahedral	60 nm	Ag-Cu_2O	25 mg:2.5 mg=10:1	60 mins	~98%	8
NCs	25nm	Pure Cu_2O	10 mg:1 mg=10:1	12 mins	100%	This work
NCs	25 nm	Pure Cu_2O	10 mg:4 mg=5:2	65 mins	100%	This work

Notes: (1) The definition of the degradation ratio is the same with the decoloration rate discussed before. (2) Porous sphere Cu_2O. The degradation ratio of MO was not provided with accurate value but with curve at different time.[1] (3) rGO-Cu_2O composites with weight ratio 2:5.[3] (4) Cu-Cu_2O composites with weight ratio 6:125.[4] (5) Au-Cu_2O composites with molar ratio 1:20. The degradation ratio of MO was not provided with accurate value but with curve at different time.[5] (6) TiO_2-Cu_2O composites with molar ratio 1:9.[6] (7) Fe_3O_4-Cu_2O composites with weight ratio 4:6.[7] The degradation ratio of MO was not provided with accurate value but with curve at different time. (8) Ag-Cu_2O composites with molar ratio 3:10.[8]

References

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