Electronic Supplementary Information

Synthesis of $Cu_{2-x}S$ Nanocrystals Induced by Foreign Metal Ions: Phase and Morphology Transformation and Localized Surface Plasmon Resonance

Haihang Ye, [a] Aiwei Tang,[*, a, b] Chunhe Yang, [a] Kai Li,[c] Yanbing Hou[b] and Feng Teng[*,b]

[a]*Department of Chemistry, Ministry of Education, Beijing JiaoTong University, Beijing 100044, P.R. China.*

[b]*Key Laboratory of Luminescence and Optical Information, Ministry of Education, Beijing JiaoTong University, Beijing 100044, P.R. China.*

[c]*Department of Chemistry, Capital Normal University, Beijing 100048, P. R. China.*

*Aiwei Tang, E-mail: awtang@bjtu.edu.cn; Tel +86 10 51683627.

Feng Teng, E-mail: fteng@bjtu.edu.cn (F. T.).

Table.S1 Important parameters of sample B for different reaction time for the theoretical calculations, which includes LSPRs frequency (ω_{sp}), the bulk plasmon frequency (ω_p) and the carrier density (N_h) of sample.

Reaction time (min)	0	10	30	60	120
ω_{sp} (eV)	0.85	0.80	0.77	0.76	0.75
ω_p (eV)	2.82	2.73	2.66	2.65	2.61
N_h (10^{21} cm^{-3})	4.68	4.38	4.16	4.13	4.00

Figure S1

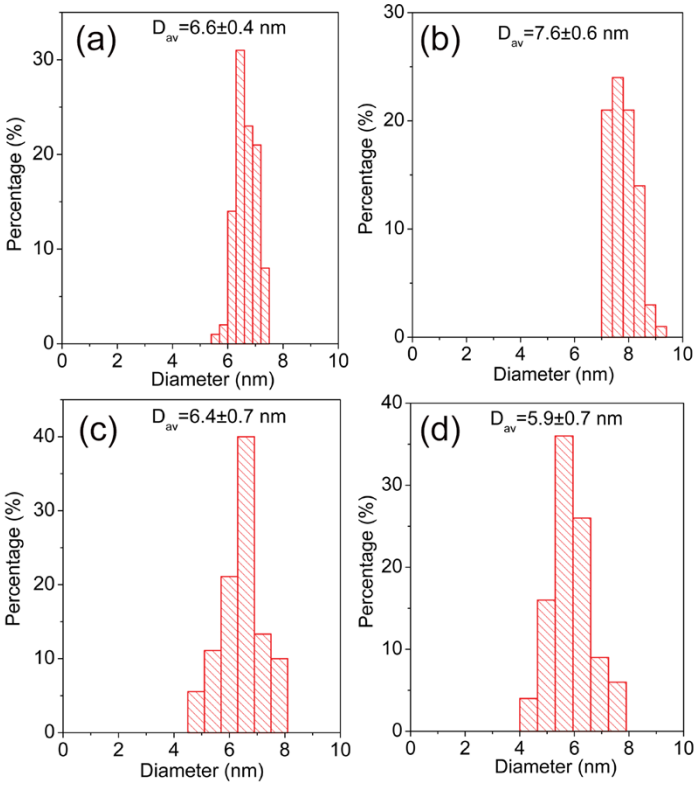


Fig.S1. Size distribution histograms of sample B obtained at different reaction time: (a) 0 min, (b) 10 min, (c) 60 min and (d) 120 min

Figure S2

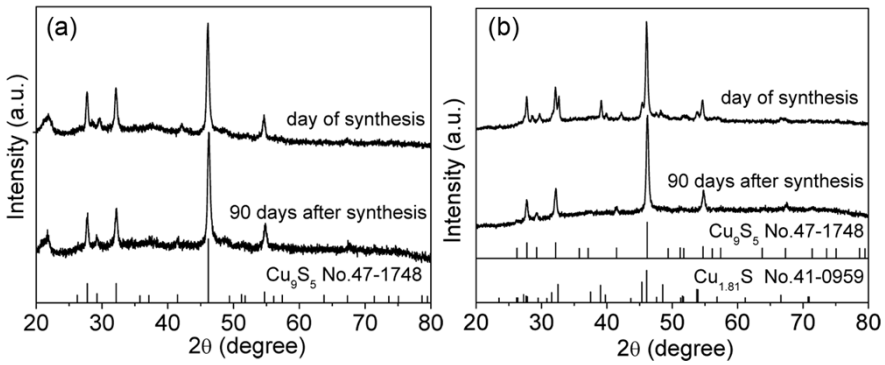
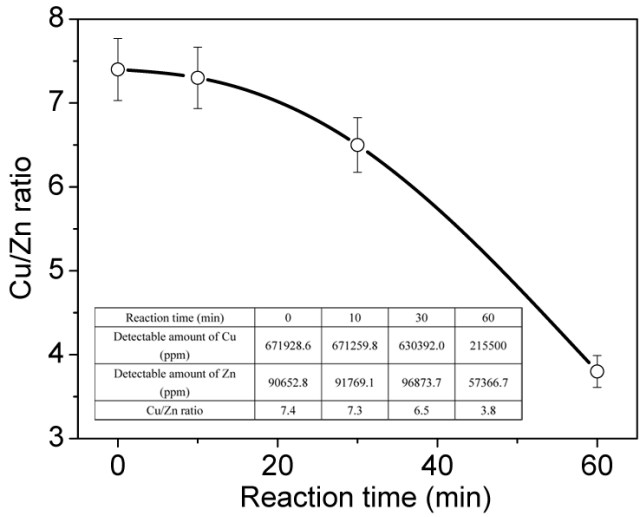


Fig.S2 XRD patterns of sample B collected on the day of synthesis and after 90 days for different reaction time: (a) 60 min and (b) 120 min.

Figure S3



Reaction time (min)	0	10	30	60
Detectable amount of Cu (ppm)	671928.6	671259.8	630392.0	215500
Detectable amount of Zn (ppm)	90652.8	91769.1	96873.7	57366.7
Cu/Zn ratio	7.4	7.3	6.5	3.8

Fig.S3 The relationship between the Cu:Zn atomic ratio measured by ICP and the reaction time of the sample B, and the inset is the table of the ICP results.

Figure S4

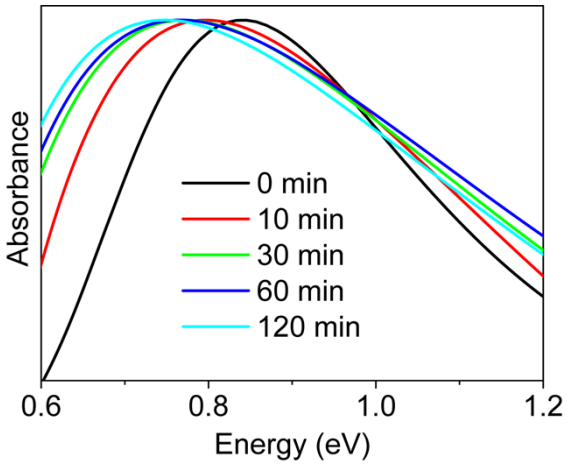


Fig.S4 The fitting NIR absorption spectra on the energy scale of sample B for different reaction time based on the Gaussian function.

Figure S5

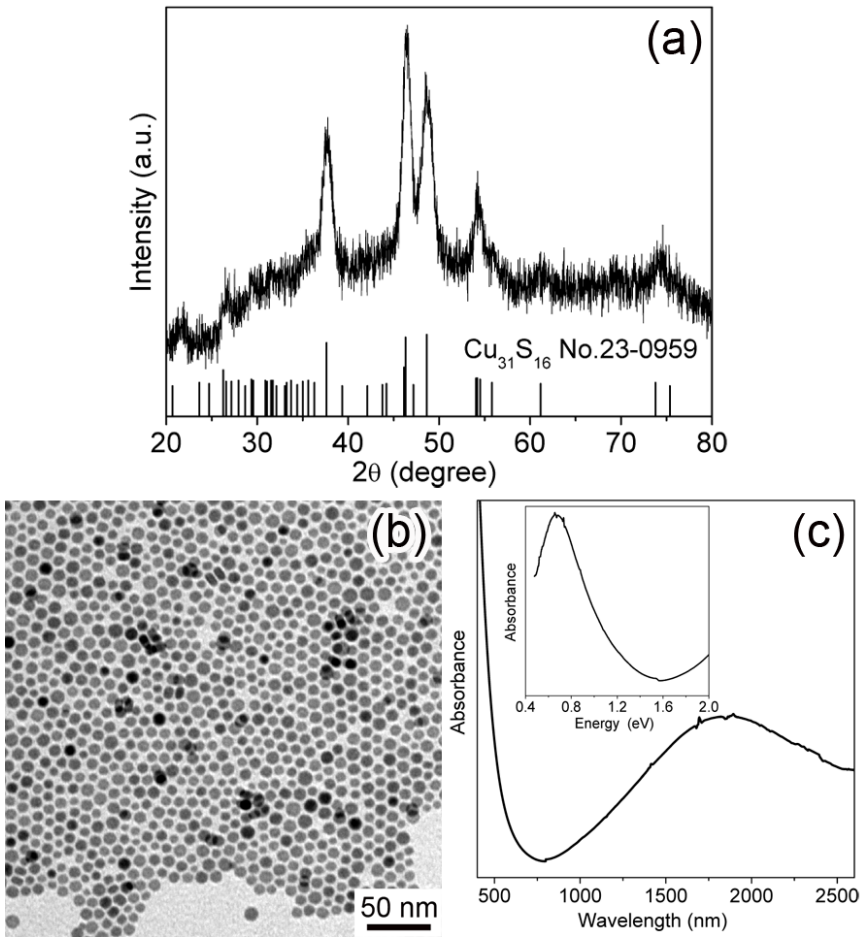


Fig. S5 (a) XRD pattern of the as-synthesized $Cu_{1.94}S$ nanocrystals and the bottom lines are the standard file of monoclinic $Cu_{31}S_{16}$ (JCPDS card 23-0959); (b) a typical TEM image of $Cu_{1.94}S$ obtained at 60 min and (c) the corresponding LSPR absorption spectrum on the wavelength scale, and the inset shows the LSPR absorption spectrum on the energy scale.

Figure S6

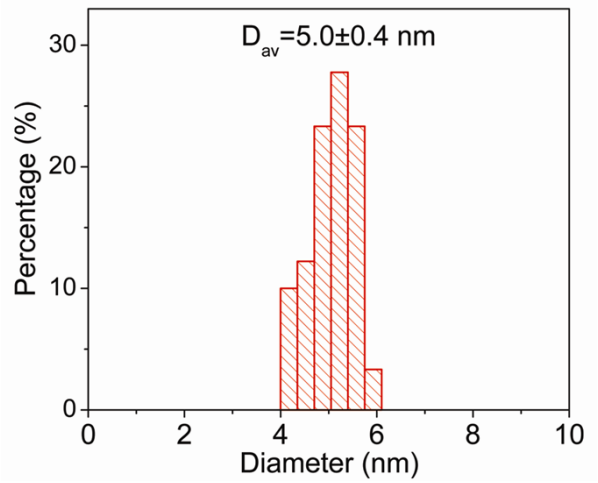


Fig.S6 Size distribution histogram of sample E obtained at 180 min.

Figure S7

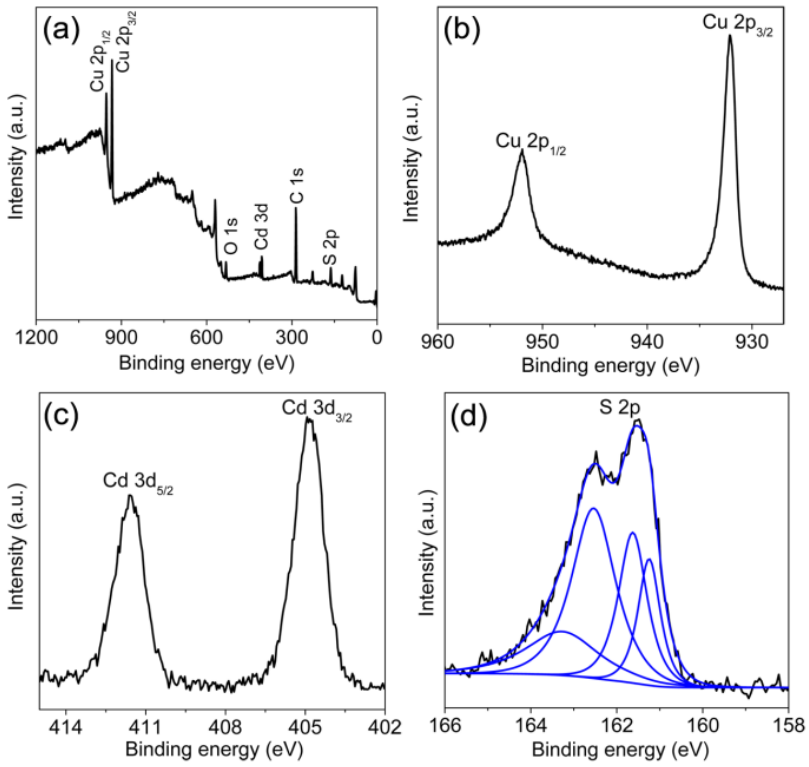


Fig.S7 XPS spectra of sample E obtained at 120 min: (a) survey spectrum; (b) Cu 2p, (c) Cd 3d, and (d) S 2p.

Figure S8

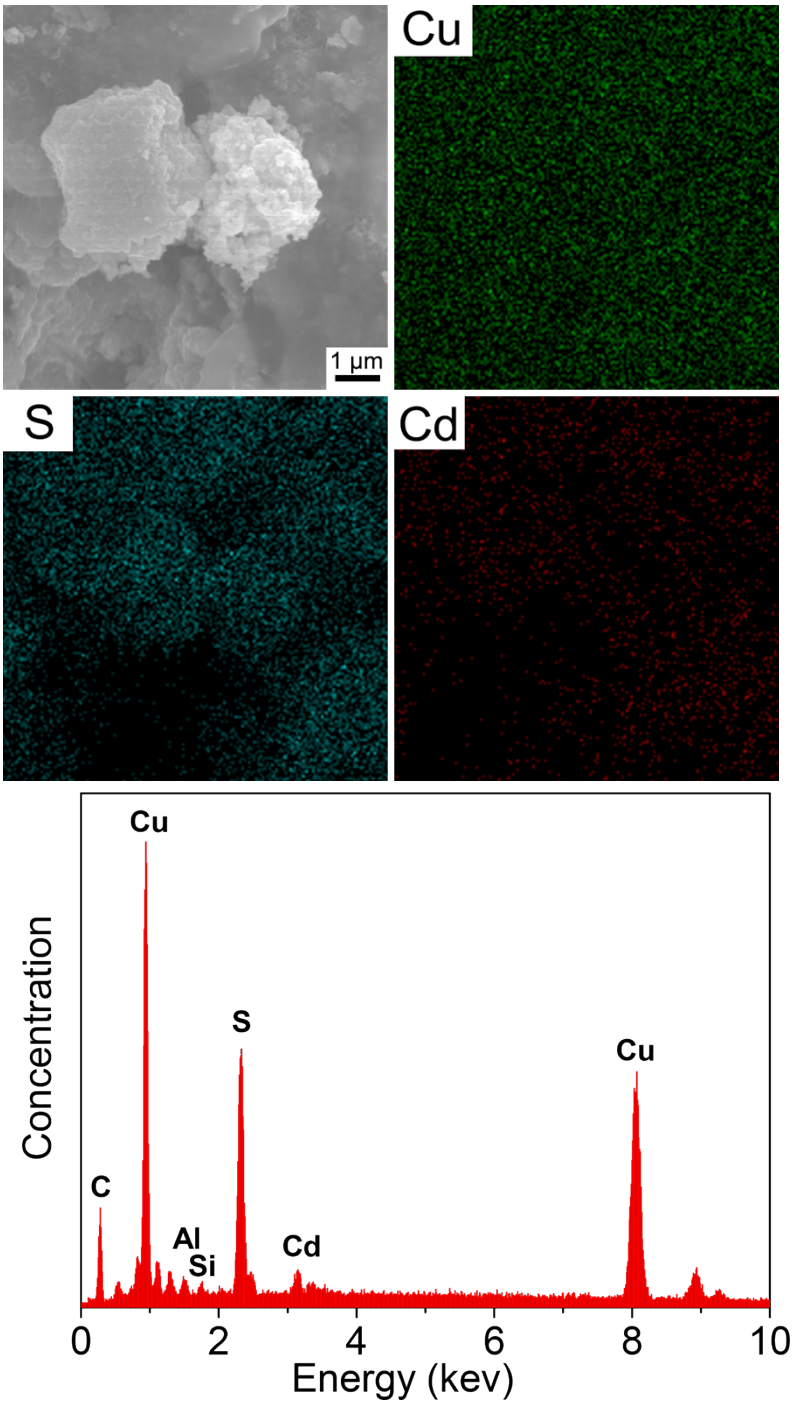


Fig.S8 Element mapping and energy dispersive X-ray (EDX) in SEM images of sample E obtained at 180 min.

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