Electronic Supplementary Information (ESI)

$Cu_{2-x}Se$ nanooctahedra: controllable synthesis and optoelectronic properties

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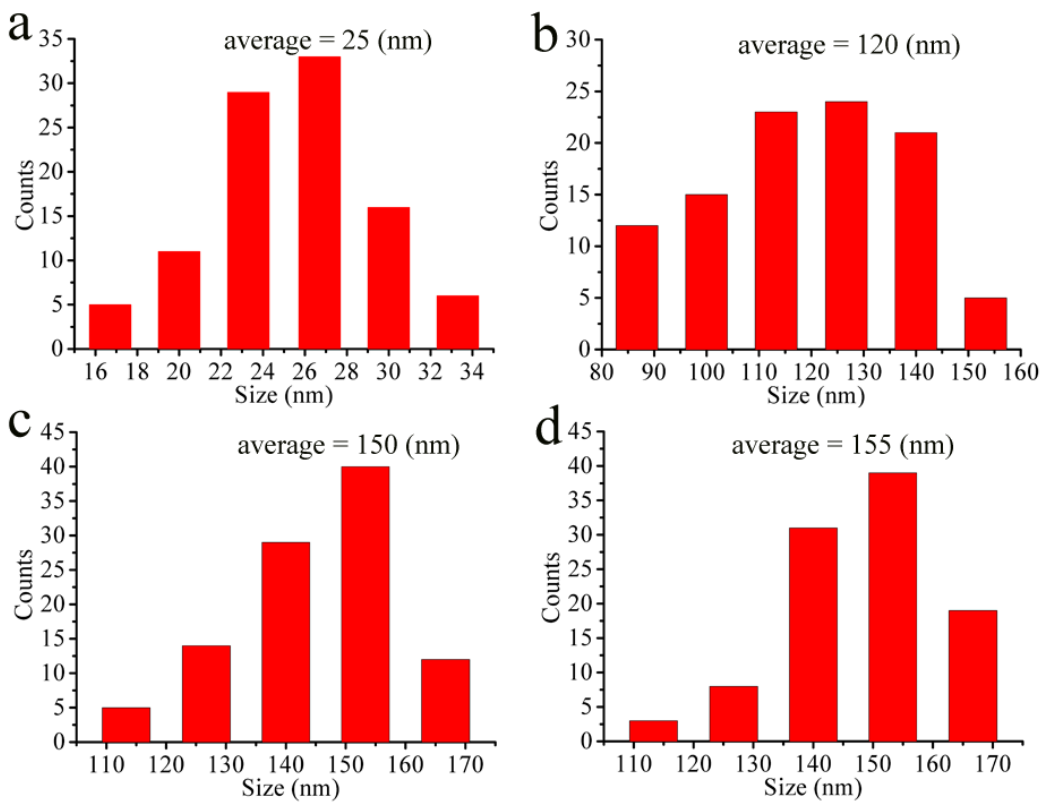

Fig. S1. Size distribution of the $Cu_{2-x}Se$ NCs synthesized by injection of 1.0 mL ODE containing 0.1 mmol Ph_2Se_2 into 6 mL ODE and 0.5 mL OAm with 0.2 mmol CuCl at 270 °C with different reaction time: (a) 30 sec, (b) 5 min, (c) 45 min, and (d) 60min.

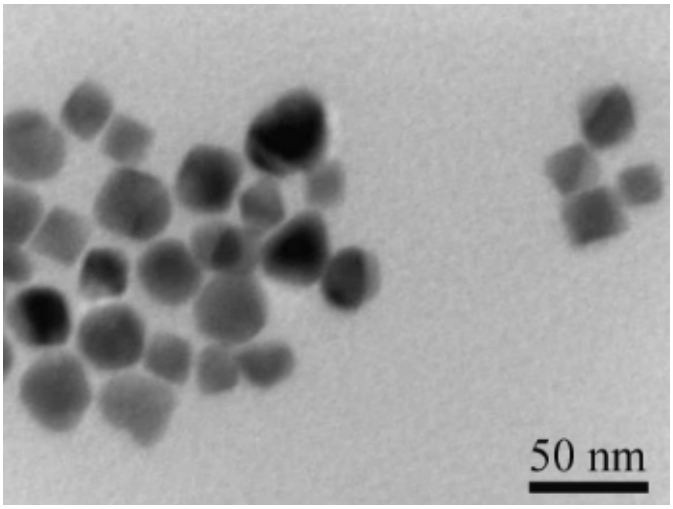

Fig. S2. TEM image of the products prepared at 270 °C in ODE (7.0 mL) and OAm (0.5 mL) for 30 sec.

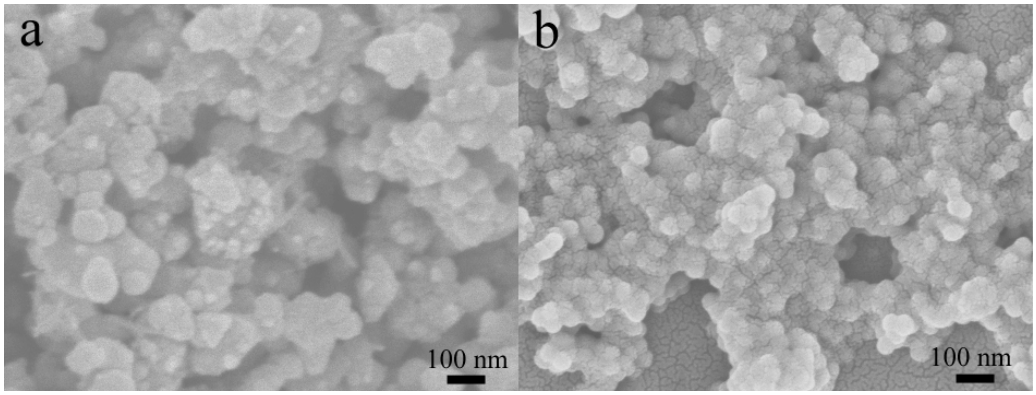

Fig. S3. SEM images of the products prepared at 270 °C for 30 min in (a) pure ODE (7.5 mL), and (b) pure OAm (7.5 mL), respectively.

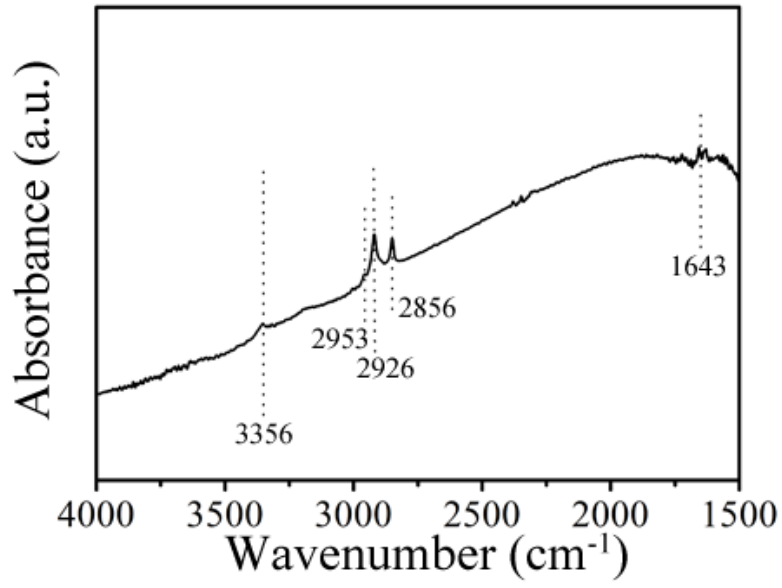

Fig. S4. ATR-FTIR spectrum for the as-synthesized octahedral $Cu_{2-x}Se$ NCs.

ATR-FTIR is demonstrated to further characterize the capping agent binding to the surface of the as-synthesized octahedral $Cu_{2-x}Se$ NCs obtained in a mixture media of ODE (7.0 mL) with OAm (0.5 mL). In Fig. S4, the absorbance bands at 2856, 2926 and 2953 cm^{-1} can be assigned to the C–H stretching modes.[1] The IR absorbance band at 3356 cm^{-1} is attributed to the stretching mode of N-H bond. Moreover, a small band peak at 1643 cm^{-1} is observed, revealing the existence of OAm on the $Cu_{2-x}Se$ NCs surface as well.[2,3] Therefore, it is suggested that the capping effect of the media, especially OAm, promotes the growth of the $Cu_{2-x}Se$ NCs with well-defined octahedral shapes.

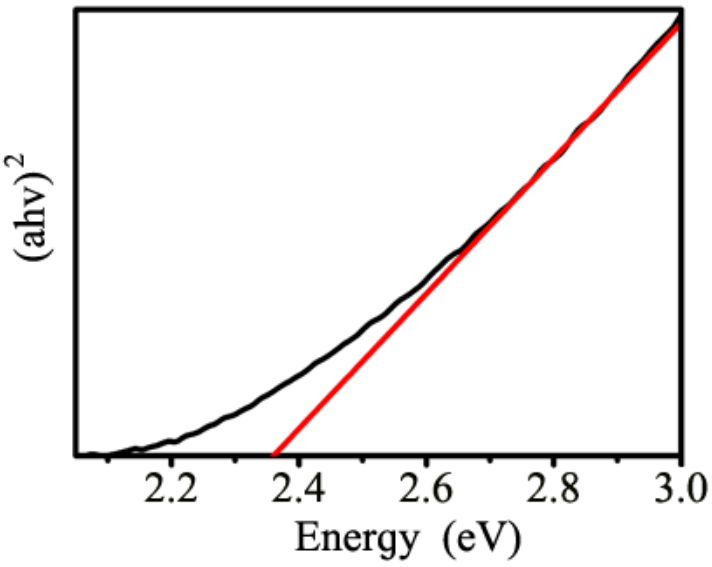

Fig. S5. Plot the direct band gap of the octahedral $Cu_{2-x}Se$ NCs derived from UV-vis-NIR absorption spectrum.

Supplementary References

1. P. J. Thistlethwaite and M. S. Hook, *Langmuir*, 2000, **16**, 4993-4998.

2. X. Lu, H.-Y. Tuan, J. Chen, Z.-Y. Li, B. A. Korgel and Y. Xia, *J. Am. Chem. Soc.*, 2007, **129**, 1733-1742.

3. G. Shao, G. Chen, W. Yang, T. Ding, J. Zuo and Q. Yang, *Langmuir*, 2014, **30**, 2863-2872.