Electronic Supplementary Material (ESI) for Nanoscale.

Supplementary information

Toward temperature-insensitive near-infrared optical gain using low-toxicity Ag_2Se quantum dots

Chen Liao,[a] Luping Tang,[b,c] Yan Li,[a] Shaoling Sun,[d] Liye Wang,[a] Jie Xu,[a] Yunzhe Jia [a] and Zixuan Gu [a]*

[a.] College of Electronic and Optical Engineering & College of Microelectronics, Nanjing University of Posts and Telecommunications, Nanjing 210023, China

[b.] College of Mechanical and Electronic Engineering, Nanjing Forestry University, Nanjing 210037, China

[c.] SEU-FEI Nano-Pico Center, Key Lab of MEMS of Ministry of Education, Southeast University, Nanjing 210096, China

[d.] Joint International Research Laboratory of Information Display and Visualization, School of Electronic Science and Engineering, Southeast University, Nanjing 210096, China

Corresponding author

*E-mail: chenliao@njupt.edu.cn.

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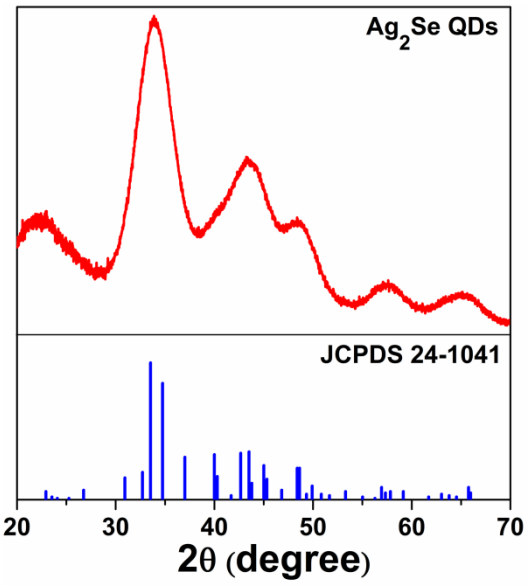

Fig. S1 XRD spectrum (top) of Ag_2Se QDs and XRD pattern (bottom) of the orthorhombic Ag_2Se bulk (JCPDS 24-1041).

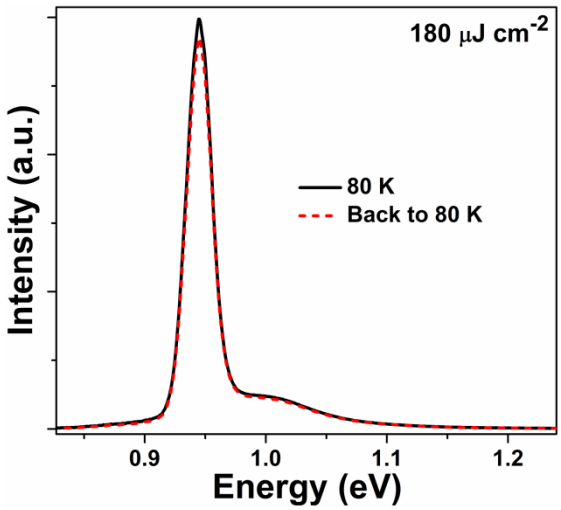

Fig. S2 The initial emission spectrum of a Ag_2Se QD film recorded at 80 K and the emission spectrum after heated to 340 K and then cooled back to 80 K.

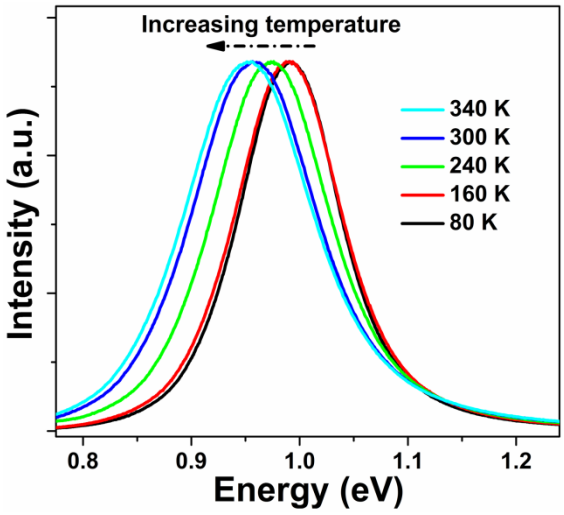

Fig. S3 Spontaneous emission (SE) spectra of a Ag_2Se QD film recorded at temperatures of 80-340 K.

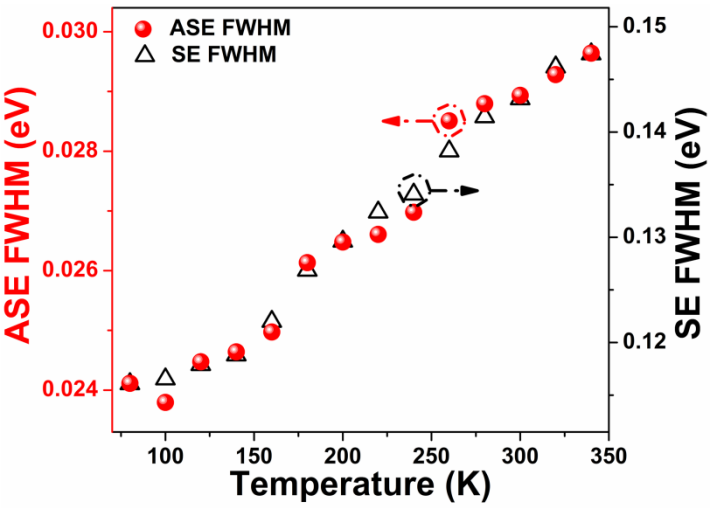

Fig. S4 ASE FWHM and SE FWHM versus temperature.

Supplementary text

S1. Bohr exciton diameter of orthorhombic Ag_2Se

The Bohr exciton diameter (D_B) of orthorhombic Ag_2Se can be calculated according to Griffiths equation:[1,2]

$$D_B = \frac{8\pi\varepsilon_0\varepsilon\hbar^2}{e^2}\left(\frac{1}{m_e^*}+\frac{1}{m_h^*}\right)$$

where ε_0 is the vacuum dielectric constant, ε is the dielectric constant of the material, $\hbar$ is the reduced Planck constant, e is the charge on the electron, and m_e^* and m_h^* are the effective masses of the electron and hole, respectively. For the orthorhombic Ag_2Se, ε is 11,[3] m_e^* equals 0.17 m_0, and m_h^* equals 0.75 m_0, respectively,[3-6] where m_0 is the free-electron mass. Therefore, the Bohr exciton diameter of orthorhombic Ag_2Se is calculated to be 8.4 nm.

References

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