Supporting Information

Triangular-Shaped Cu-Zn-In-Se-based Nanocrystals with Narrow Near Infrared Photoluminescence

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Synthesis of zinc oleate

A mixture of 0.99 g of $Zn(OAc)_2 \cdot 2H_2O$, 7.2 mL of OlAc, and 18 mL of ODE in a 50-mL round-bottom flask connected to a Schlenk line was degassed at 50 °C for 30 min under vigorous stirring. The temperature was then increased to 160 °C under an argon atmosphere and subsequently lowered to 100 °C once a clear solution formed, indicating the formation of zinc oleate. Finally, while maintaining the temperature at 100 °C, 0.5 mL of OlAm were added and the product was transferred into a degassed vial for future use. Since zinc oleate solidifies at room temperature, it was reheated to approx. 80–100 °C using a heat gun before use.

Synthesis of sulfur precursor

0.2-molar sulfur stock solution was prepared by dissolving 64.1 mg (2 mmol) of S powder in 10 mL of dried ODE and stored in a degassed vial.

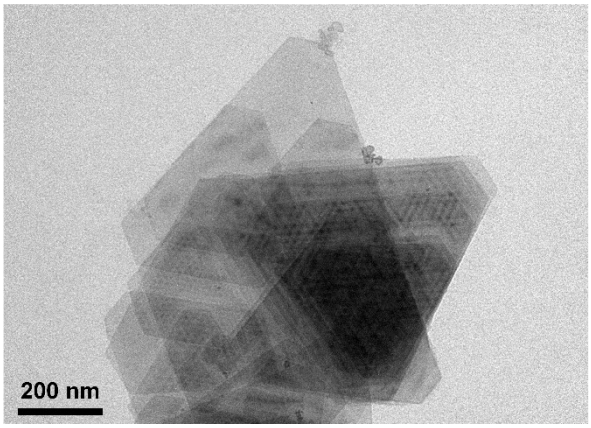

Figure S1. TEM image of In_2Se_3 nanosheets.

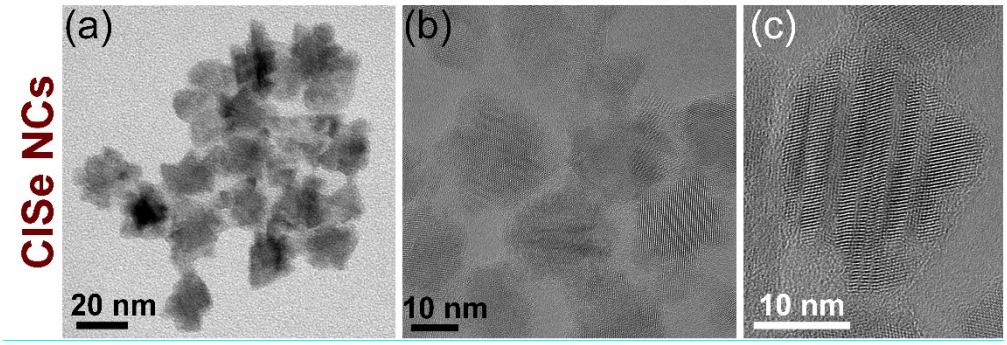

Figure S2. Conventional TEM (a) and HRTEM (b, c) images of CISe NCs, which reveal the stacking of triangular NPLs.

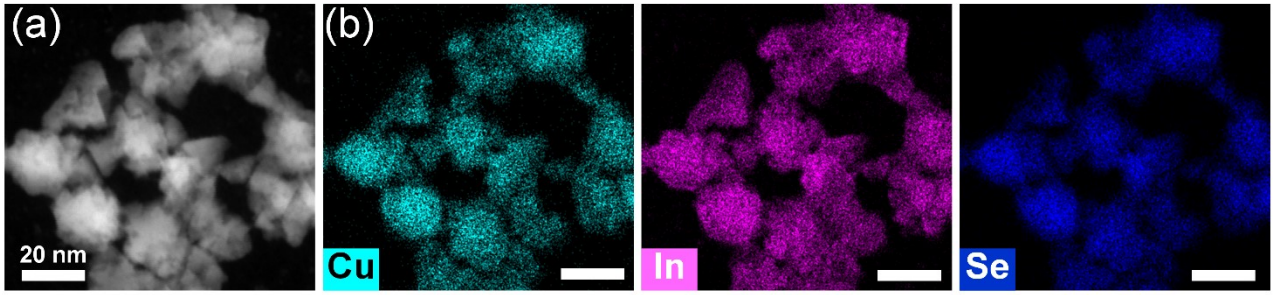

Figure S3. HAADF-STEM image of CISe NCs synthesized at 240 °C (a) and corresponding EDXS-based element maps (b) of Cu, In, and Se.

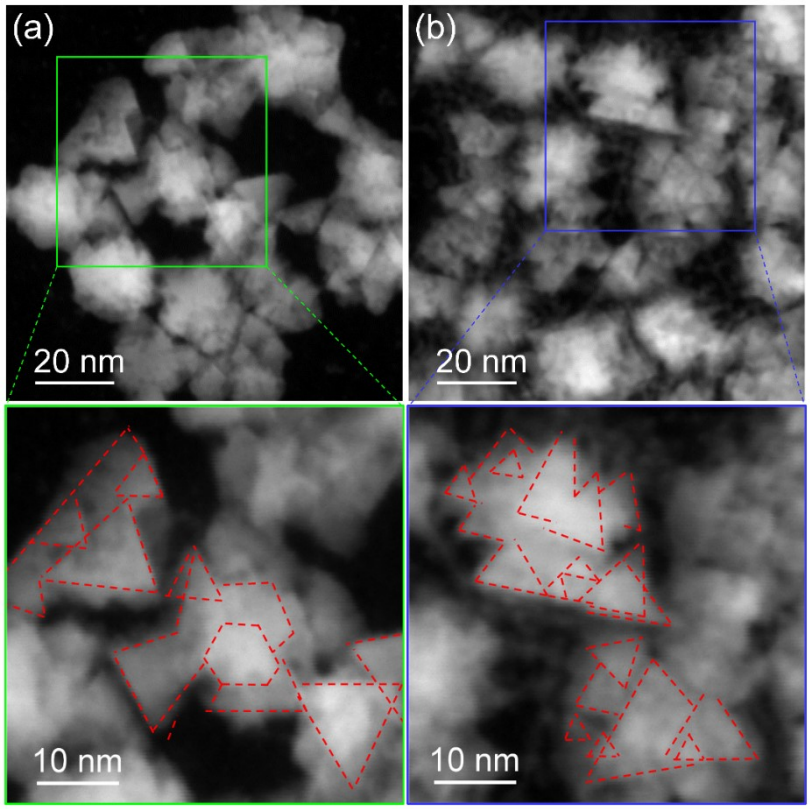

Figure S4. HAADF-STEM images of (a) CISe NCs (cf. Figure S3a) and (b) CZISe NCs (cf. Figure 3g) showing their triangular building blocks.

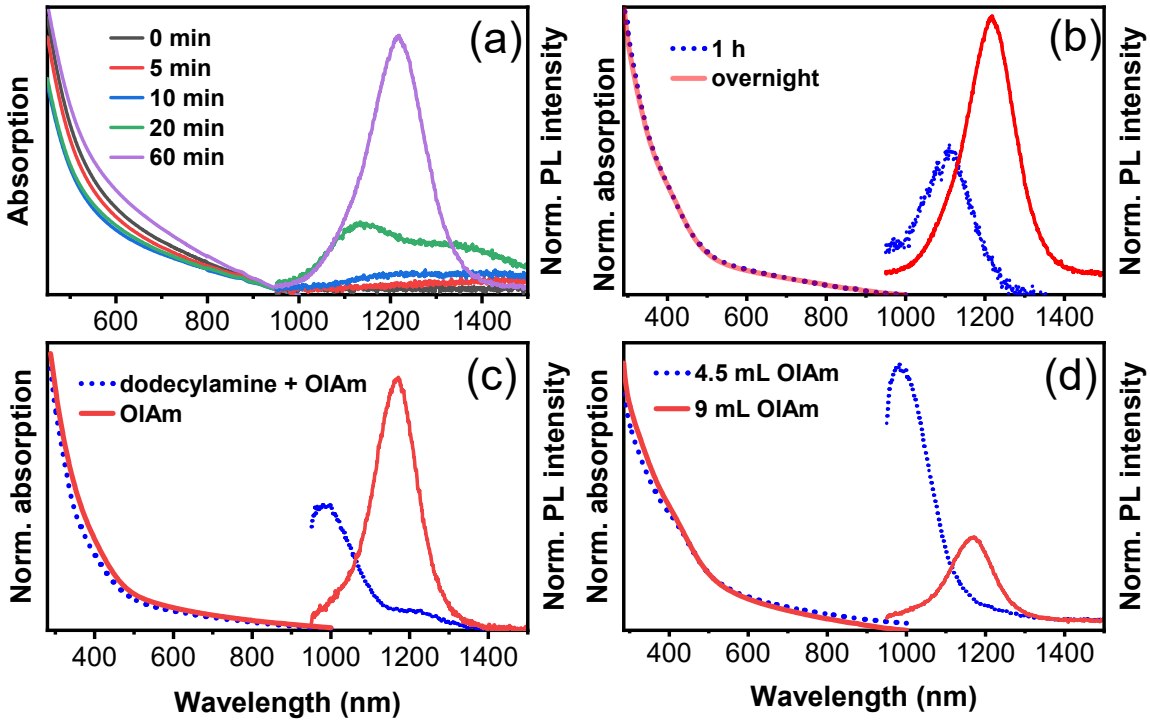

Figure S5. Absorption and PL spectra of: CISe NC samples taken at 0, 5, 10, 20, and 60 min of the synthesis (a); CISe NCs synthesized by Cu incorporation for 1 h and overnight (b), CISe NCs synthesized with a mixture of ligands and a single ligand (c), CISe NCs synthesized with 4.5 mL of OlAm and 9 mL of OlAm (d).

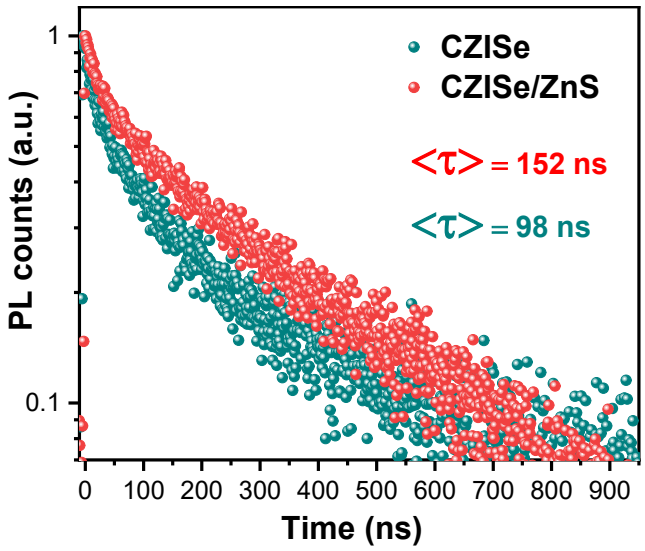

Figure S6. PL lifetime traces of CZISe and core/shell CZISe/ZnS NCs emitting at 1218 nm. The average PL lifetime was determined as the time when the initial signal intensity decreased to the maximum number of counts divided by e.