## Electronic Supplementary Information

## Heterogeneity Induced Dual Luminescent Properties of AgInS<sub>2</sub> and AgInS<sub>2</sub>-ZnS Alloyed Nanocrystals

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**Fig. S1.** HR-TEM image (a), energy-dispersive spectrum (b) and X-ray powder diffractogram (c) of Ag<sub>1.0</sub>In<sub>3.1</sub>Zn<sub>1.0</sub>S<sub>4.0</sub> alloyed nanocrystals (reference sample).



Fig. S2. Photoluminescence excitation (orange line) and emission (red line) spectra of  $Ag_{1,0}In_{3,1}Zn_{1,0}S_{4,0}$  nanocrystals dispersion in toluene (reference sample).



Fig. S3. Energy-dispersive spectrum of Zn<sub>1.0</sub>In<sub>3.4</sub>S<sub>4.9</sub> (Ag-0) nanocrystals.



Fig. S4. Energy-dispersive spectra of  $Ag_{1.0}In_{1.6}S_{2.8}$  (Ag-1) (a) and  $Ag_{1.0}In_{1.3}S_{2.4}$  (Ag-2) (b) nanocrystals.



Fig. S5. TEM and HR-TEM images and corresponding histogram of  $Ag_{1.0}In_{1.6}S_{2.8}$  (Ag-1) nanocrystals.



Fig. S6. HR-TEM image of Ag<sub>1.0</sub>In<sub>1.3</sub>S<sub>2.4</sub> (Ag-2) nanocrystals.



Fig. S7. Energy-dispersive spectra of  $Ag_{1.0}In_{2.3}Zn_{1.6}S_{3.6}$  (Ag-3) (a) and  $Ag_{1.0}In_{2.1}Zn_{4.4}S_{8.9}$  (Ag-4) (b) nanocrystals.



Fig. S8. TEM image and corresponding histogram of Ag<sub>1.0</sub>In<sub>2.3</sub>Zn<sub>1.6</sub>S<sub>3.6</sub> (Ag-3) nanocrystals.



Fig. S9. HR-TEM image of  $Ag_{1.0}In_{2.1}Zn_{4.4}S_{8.9}$  (Ag-4) nanocrystals.



Fig. S10. Room temperature UV-vis-NIR spectrum of toluene dispersion of  $Ag_{1.0}In_{1.6}S_{2.8}$  (Ag-1) and  $Ag_{1.0}In_{1.3}S_{2.4}$  (Ag-2) nanocrystals and the corresponding  $(Ahv)^2 vs hv$  curve (where A = absorbance, h = Planck's constant and v = frequency).



**Fig. S11.** Room temperature UV-vis-NIR spectrum of toluene dispersion of  $Ag_{1.0}In_{2.3}Zn_{1.6}S_{3.6}$ (Ag-3) and  $Ag_{1.0}In_{2.1}Zn_{4.4}S_{8.9}$  (Ag-4) nanocrystals and the corresponding  $(Ahv)^2 vs hv$  curve (where A = absorbance, h = Planck's constant and v = frequency).



**Fig. S12.** The experimental setups for the determination of absolute PLQY values (a) and time-resolved spectroscopic measurements (b).