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Supplementary Information

Solution synthesis of copper selenide nanocrystals and their electrical transport properties

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Photoluminescence quantum yield (PL QY)

Quinine sulfate was used as standard in the measurement and the standard quantum yield for Quinine sulfate was considered to be 58%. The optical density (OD) at the excitation wavelength of Quinine sulfate and the nanocrystal sample was set to a similar value. Besides, the OD at either the first excitation absorption peak of the nanocrystals or the main absorption peak of Quinine sulfate was below 0.1 in order to avoid any significant reabsorption. In this way, excitation wavelength was used to excite the photoluminescence spectra of the nanocrystals and Quinine sulfate. When photoluminescence spectra of samples and Quinine sulfate were obtained, photoluminescence quantum yield value (PL QY) was measured for $Cu_{2-x}Se$ system relative to Quinine sulfate and was calculated by using equation 1.[1]

$$Q = Q' \cdot (I/I') \cdot (A/A') \cdot (n/n') \qquad (1)$$

In equation 1, I (sample) and I' (standard) are the integrated emission peak areas, A (sample) and A' (standard) are the absorbances at the excitation wavelength, and n (sample) and n' (standard) are the refractive indices of the solvents, generally, we assume n (sample) and n' (standard) are approximately equal. Therefore, the PL QY of the $Cu_{2-x}Se$ NCs calculated by comparing the integrated PL intensities of the nanocrystals and Quinine sulfate is about 6%. However, $Cu_{2-x}Se$ nanocrystals, obtained in this synthetic protocol, can be coated as an inorganic shell (e.g., ZnS, ZnSe, using standard protocols), which increases their quantum yield.

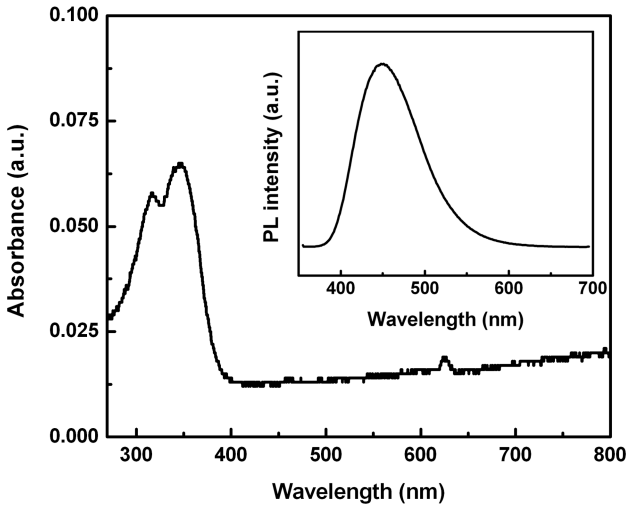

Fig. S1 The UV-vis and PL spectra of Quinine sulfate in 0.1 M H_2SO_4 aqueous solution.

References

1 G. A. Crosby and J. N. Demas, *J. Phys. Chem*, 1971, **75**, 991-1024.