Supporting Information

Highly luminescent gradient alloy $CdSe_{1-x}S_x$ nanoplatelets with reduced reabsorption for white-light generation

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TEM images and SAED patterns of CdSe, CdS and $CdSe_{1-x}S_x$ alloy NPLs

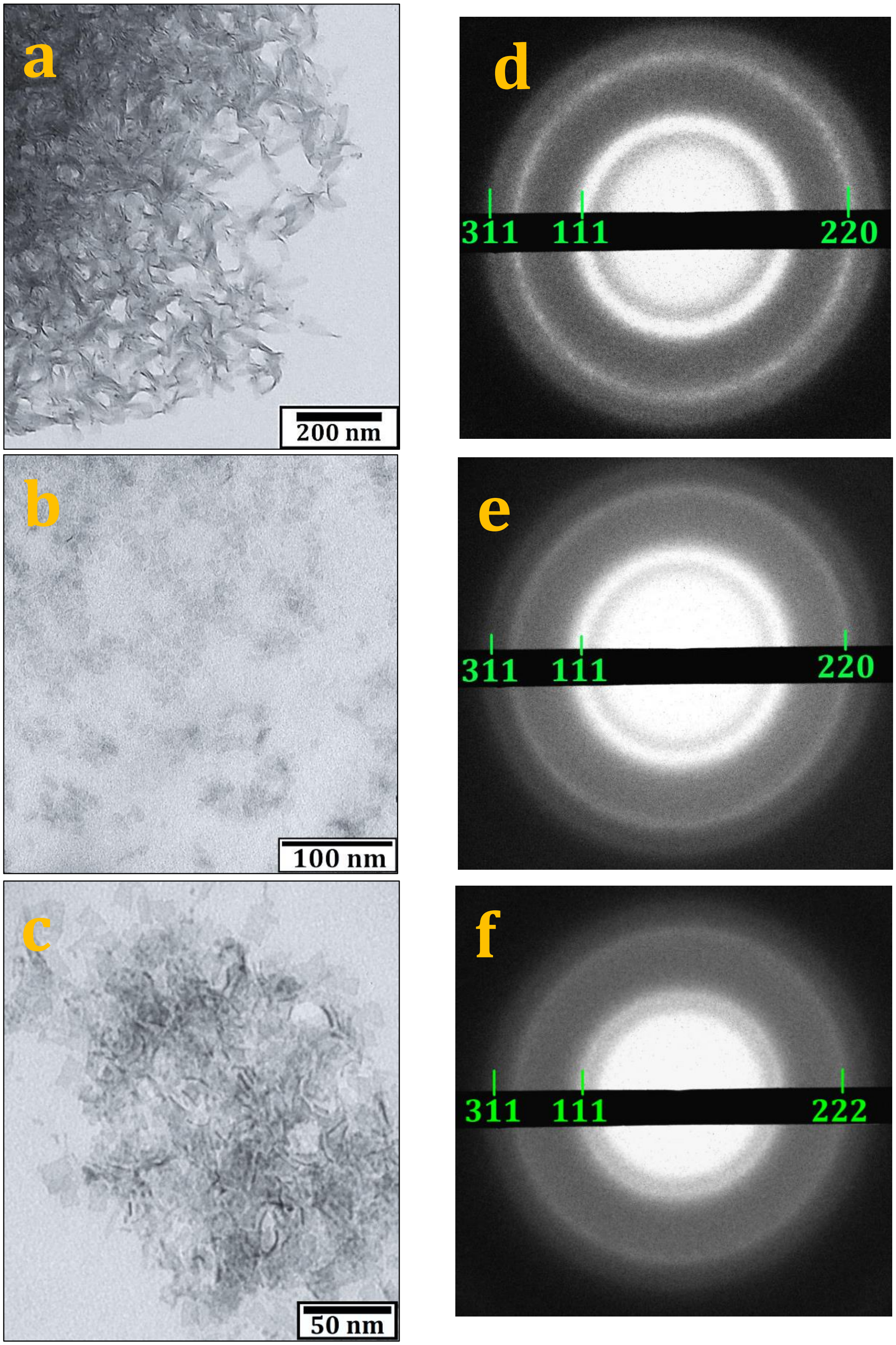

Figure S1. (a), (b), (c) TEM images and (d), (e), (f) corresponding selected area electron diffraction patterns of CdSe, CdS and $CdSe_{0.37}S_{0.63}$ NPLs, respectively. The indexed reflections in the SAED patterns show that the as-grown CdSe, CdS and $CdSe_{0.37}S_{0.63}$ NPLs have a zinc-bland crystal structure.

Crystal structure

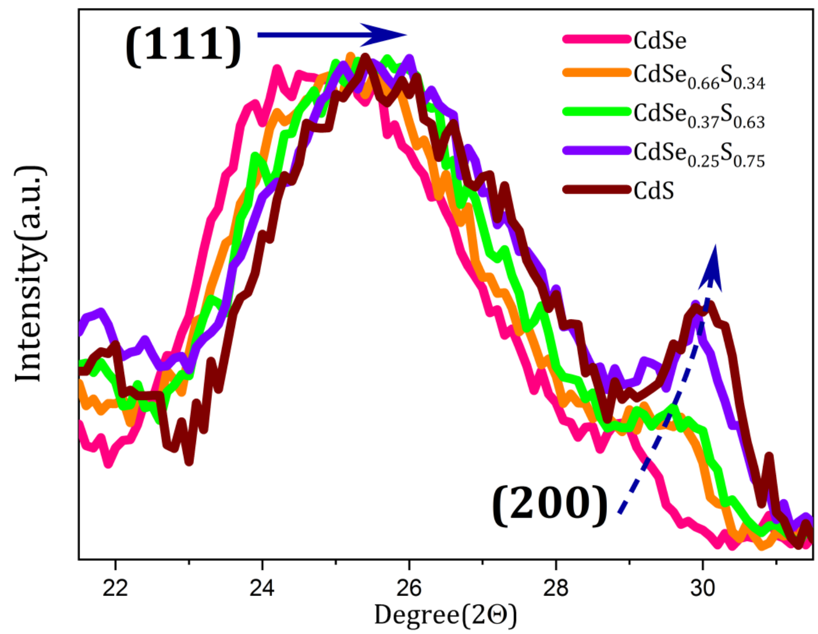

Figure S2. Evolution of (111) and (200) reflections of $CdSe_{1-x}S_x$ NPLs with increasing S content. The navy arrow shows the shift of (111) reflection towards high angles indicating the lattice contraction induced by the alloying. The dashed arrow indicates a continuous shift of the (200) reflection and an increase in its intensity that supports the increase in the S concentration in $CdSe_{1-x}S_x$ NPLs.

To gain more insights on real spatial distribution of the elements in $CdSe_{1-x}S_x$ NPLs, the lattice parameters of homogeneously alloyed $CdSe_{1-x}S_x$ NPLs were calculated according to Vegard's Law by the following expression:

$$a(\text{Å})=(1-x)\cdot a(\text{Å})(\text{CdSe NPLs})+x\cdot a(\text{Å})(\text{CdS NPLs})$$

where a*(Å)(CdSe NPLs)* and a*(Å)(CdS NPLs)* are the obtained values of the lattice parameter for pure CdSe and CdS NPLs.

To show the presence of lattice dilation in $CdSe_{1-x}S_x$ NPLs, we also calculated the lattice parameters of bulk $CdSe_{1-x}S_x$ alloys using Vegard's Law by the following expression:

$$a(\text{Å})=(1-x)\cdot a(\text{Å})(\text{CdSe bulk})+x\cdot a(\text{Å})(\text{CdS bulk})$$

where a*(Å)(CdSe bulk)* and a*(Å)(CdS bulk)* are the lattice parameters of bulk zinc blende CdSe and CdS, respectively.

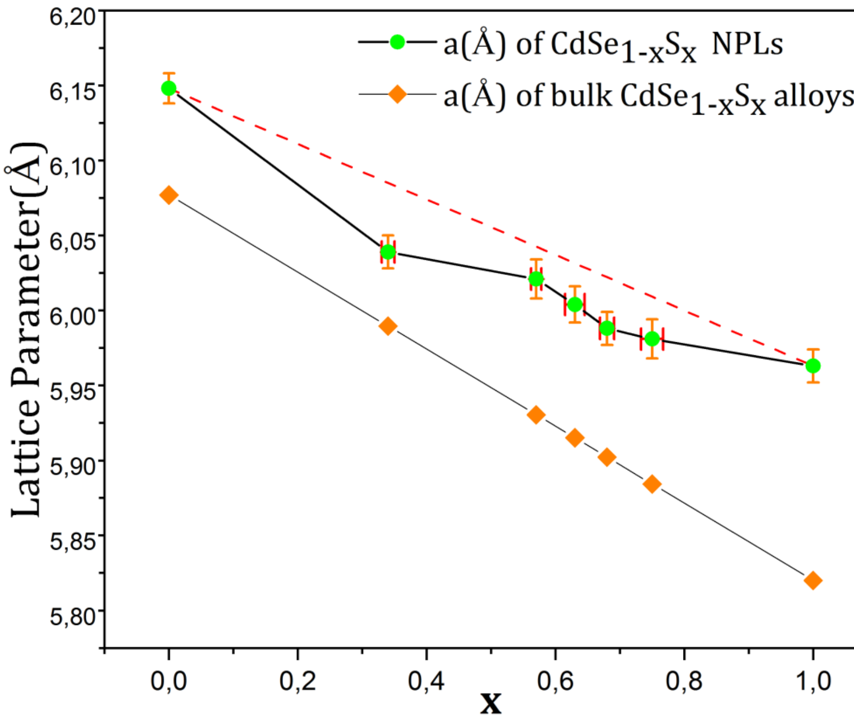

Figure S3. Comparison of lattice parameters of bulk and NPL $CdSe_{1-x}S_x$ alloys. The green dots depict the lattice parameter of the as-obtained $CdSe_{1-x}S_x$ NPLs. The dashed red line represents the Vegard's Law. The orange dots show lattice parameter of bulk $CdSe_{1-x}S_x$ according to the Vegard's Law.

PLE spectroscopy of $CdSe_{1-x}S_x$ NPLs

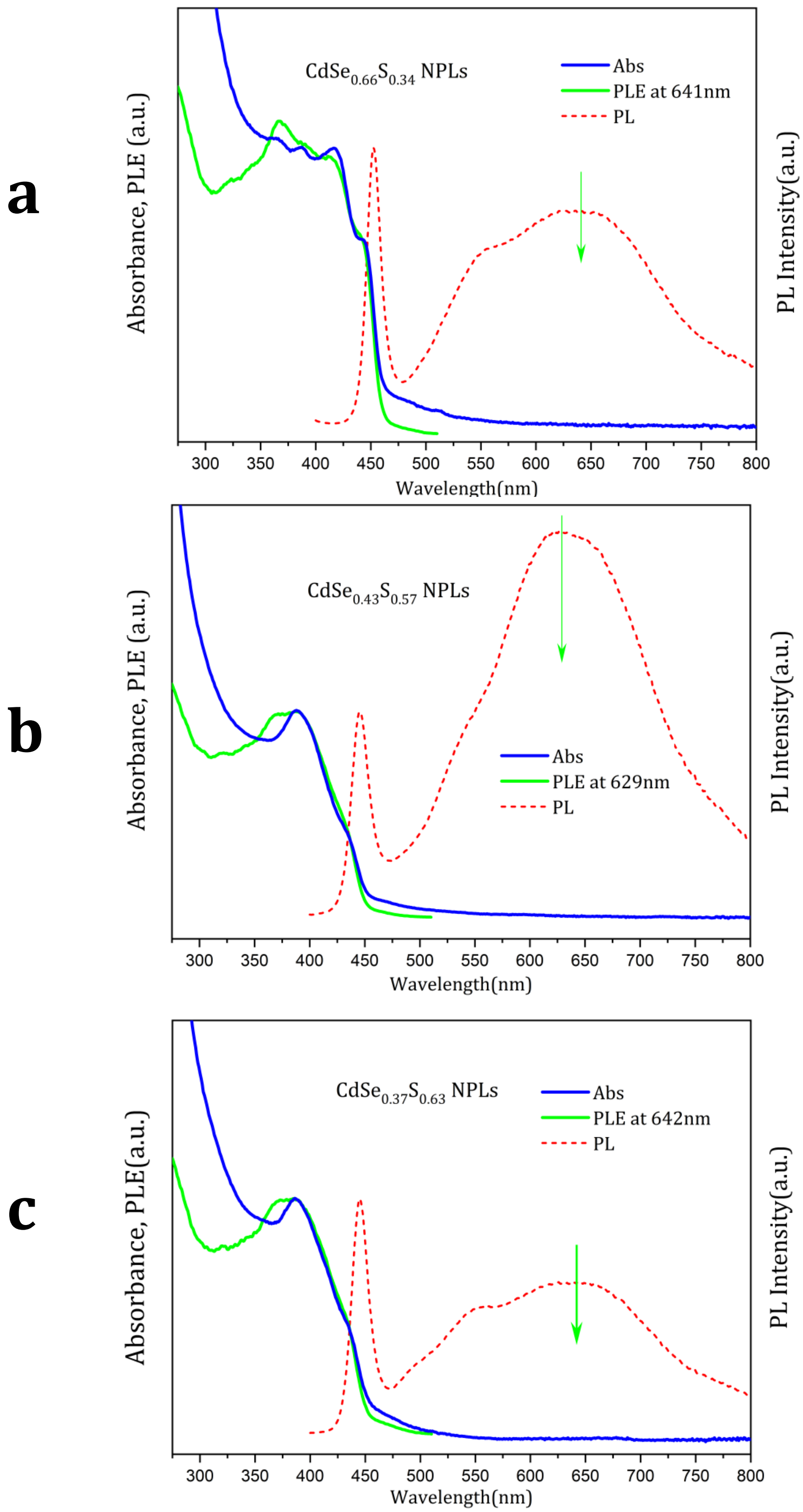

Figure S4. Absorption, PLE and PL spectra of (a) $CdSe_{0.66}S_{0.34}$, (b) $CdSe_{0.43}S_{0.57}$ and (c) $CdSe_{0.37}S_{0.63}$ NPLs. The green arrows show the emission wavelength at which the PLE spectra were recorded. The presented PLE spectra reproduce well all the features of the corresponding absorption spectra, which indicates that the $CdSe_{1-x}S_x$ NPLs have gradient composition and there are no composition/thickness variation in the ensemble these nanoparticles.

The overlap of absorption and PL spectra of $CdSe_{1-x}S_x$ NPLs

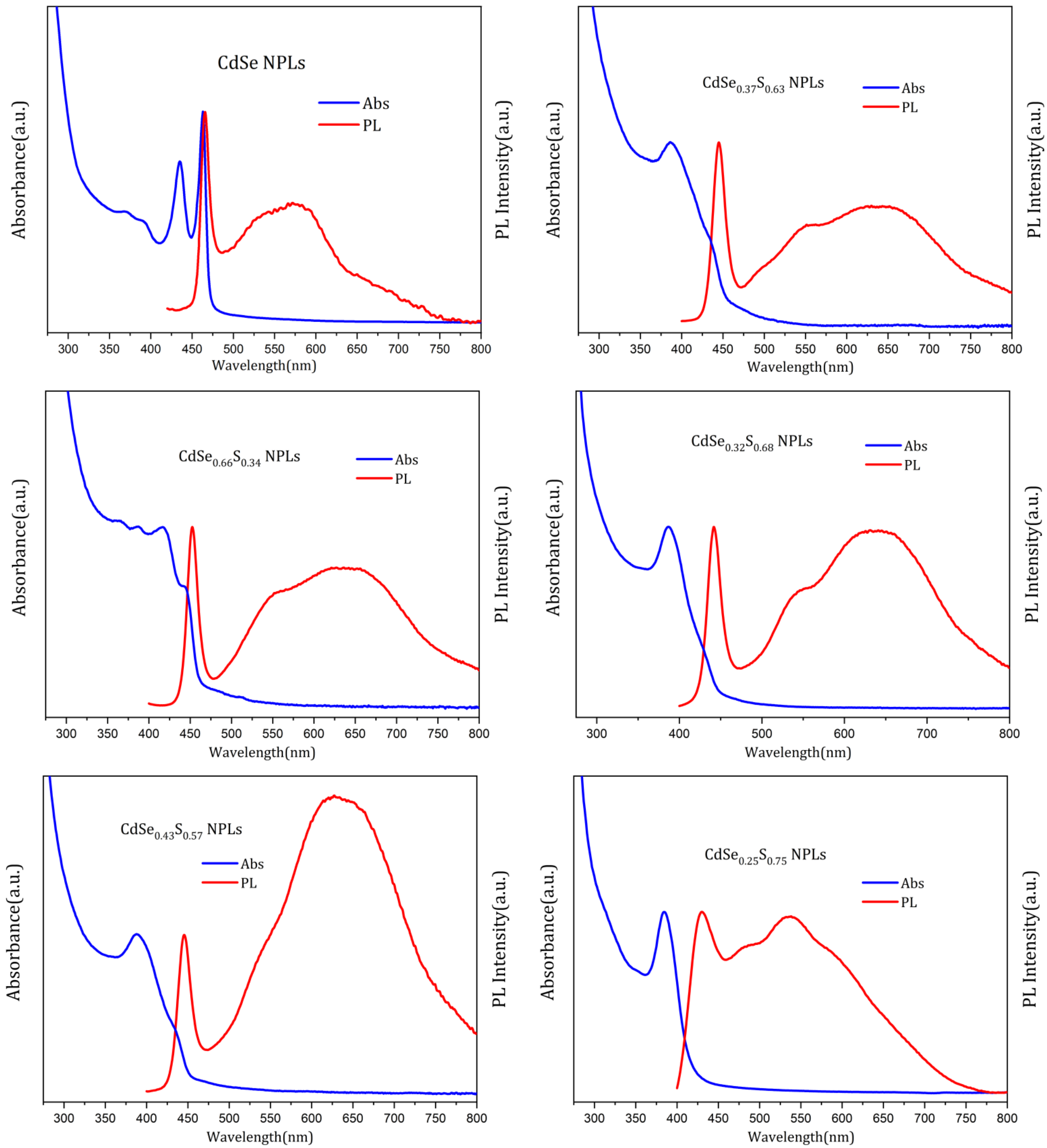

Figure S5. Absorption and PL spectra of the as-obtained gradient alloy $CdSe_{1-x}S_x$ NPLs. The overlap between the absorption and PL spectrum of $CdSe_{1-x}S_x$ NPLs decreases significantly with increasing S concentration, which indicates the impact of the gradient composition on the emission properties. Due to the gradient structure, the S-rich domains of $CdSe_{1-x}S_x$ NPLs act as an efficient photon antenna, adsorbing light and transferring the generated carriers into the Se-rich domains where they recombine. Thereby, by varying the composition of gradient alloy $CdSe_{1-x}S_x$ NPLs, the overlap of the absorption and emission spectra can be conveniently controlled.

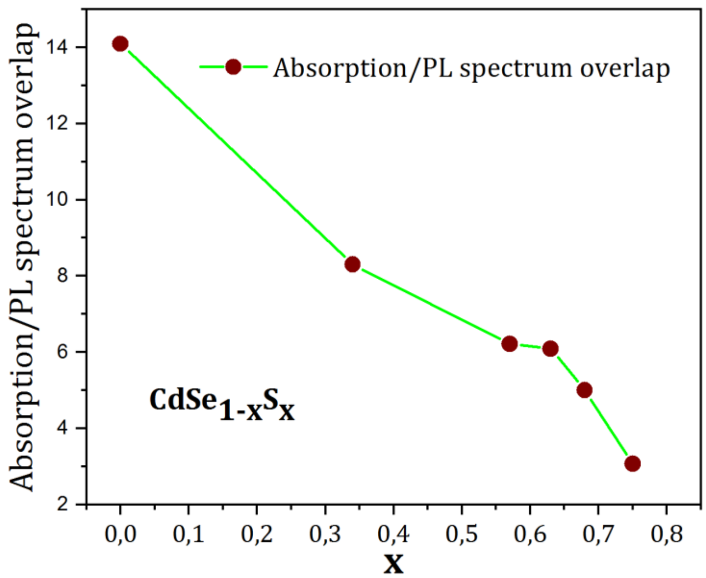

Figure S6. The dependence of the overlap of absorption and PL spectrum of gradient alloy $CdSe_{1-x}S_x$ NPLs on their composition. The dots depict area of intersection of the first absorption maximum and band-edge emission of the normalized absorption and PL spectra.