Electronic Supplementary Information

Synthesis of efficient near-infrared-emitting $CuInS_2/ZnS$ quantum dots by inhibiting cation-exchange for bio application

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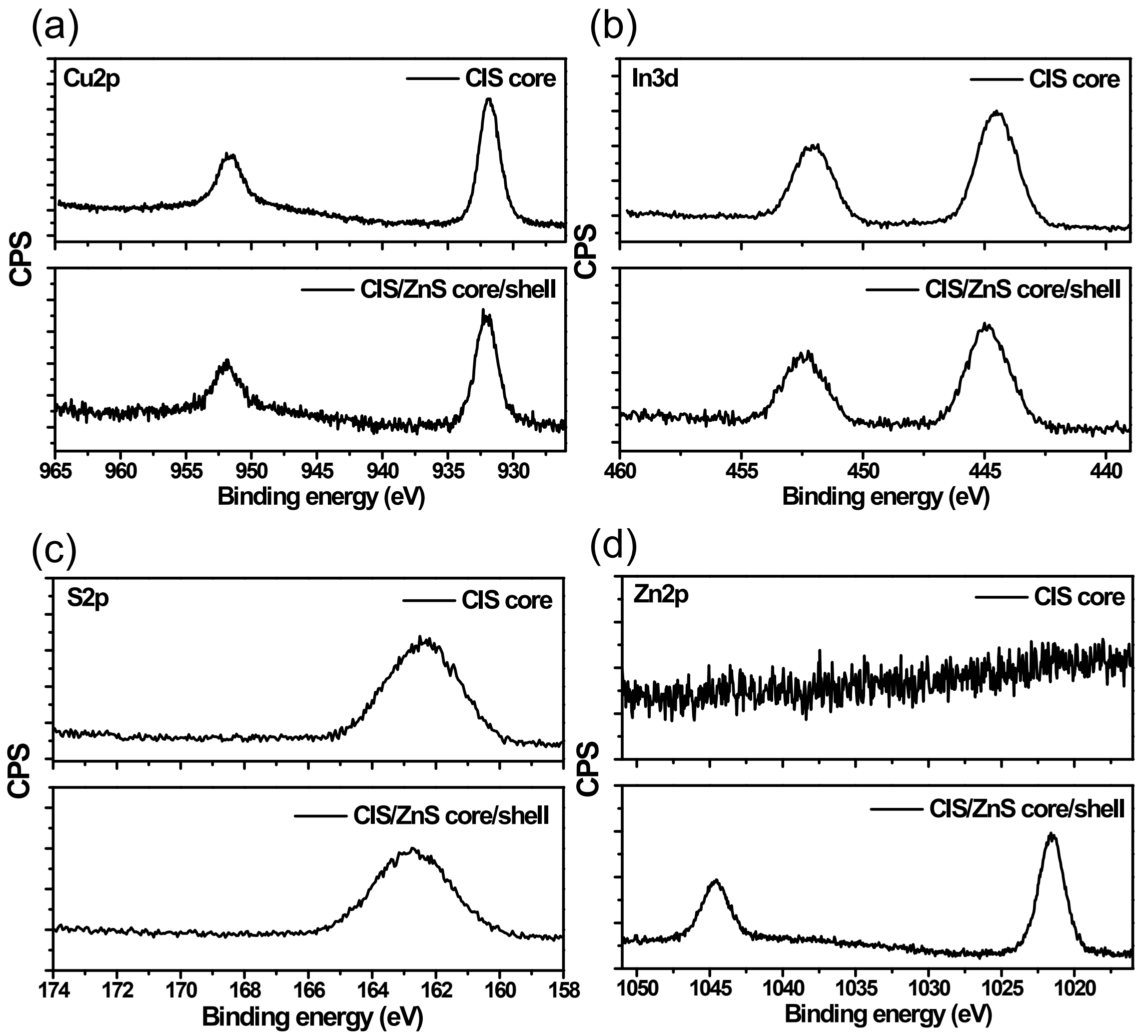

Fig S1. XPS elemental analysis of Cu, In, S, and Zn for CIS core and CIS/ZnS core/shell QDs.

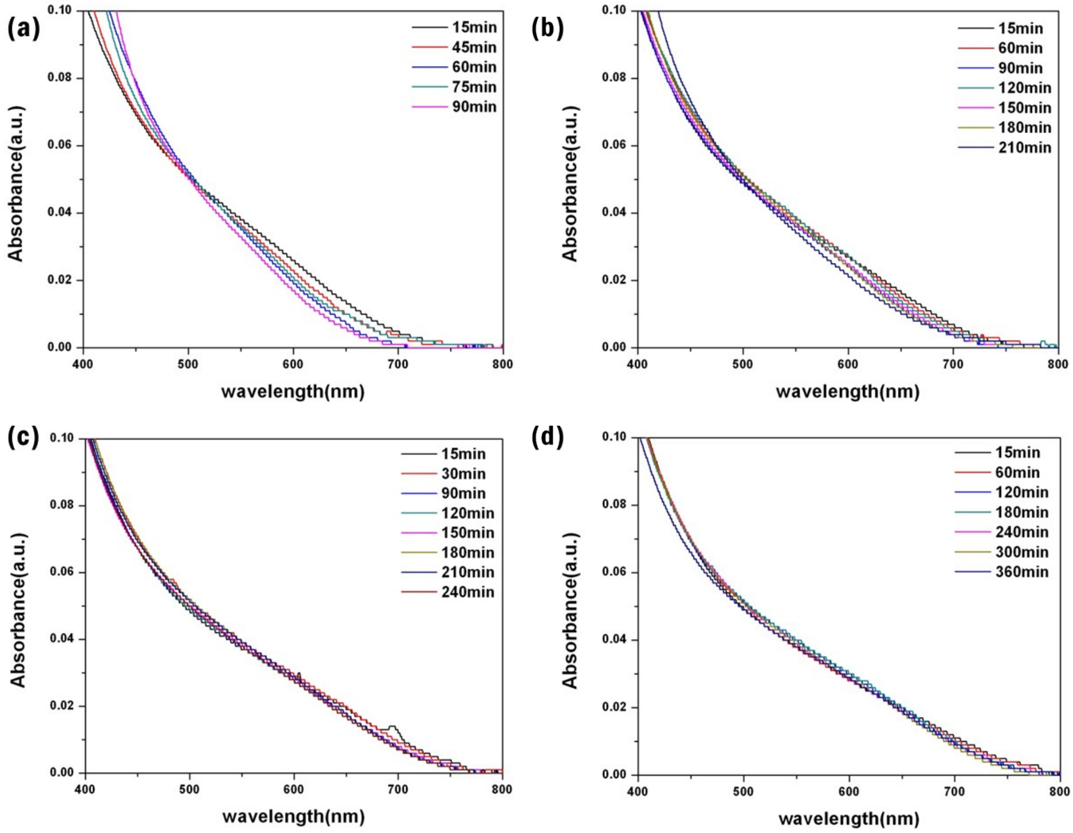

Fig. S2. The temporal evolution of absorption spectra of CIS/ZnS QDs synthesized at (a) 250℃, (b)230℃, (c) 210℃, and (d) 180℃, respectively. More blue-shift was observed at 250℃, which is the highest temperature.

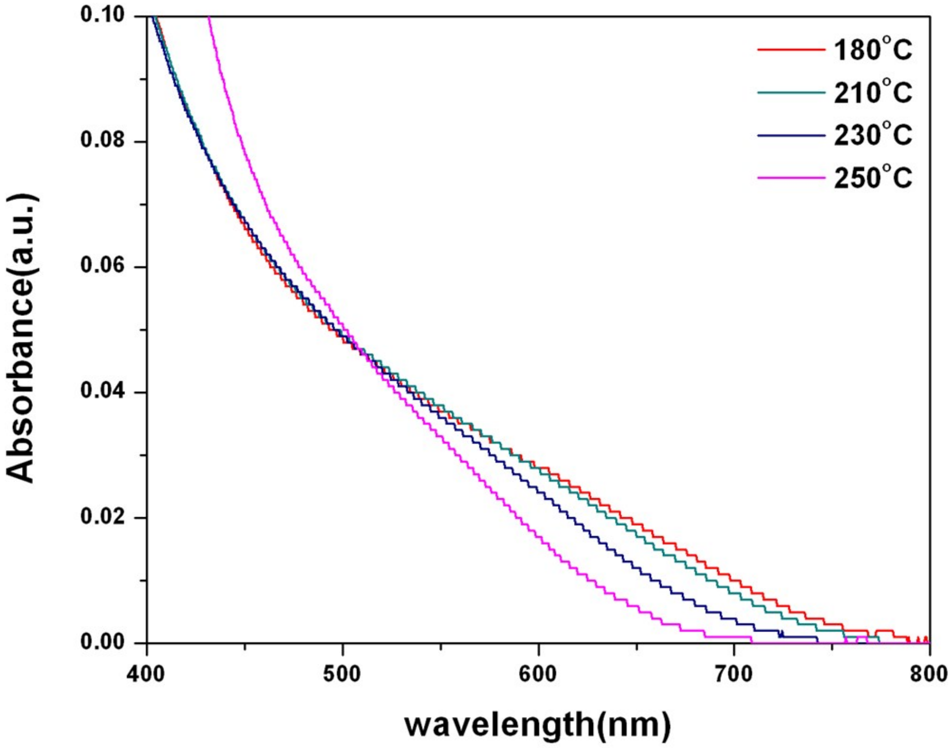

Fig. S3. Comparison of the absorption spectra between four samples prepared for with the same duration of ZnS shell synthesis. More blue-shift was observed at 250℃, which is the highest temperature.

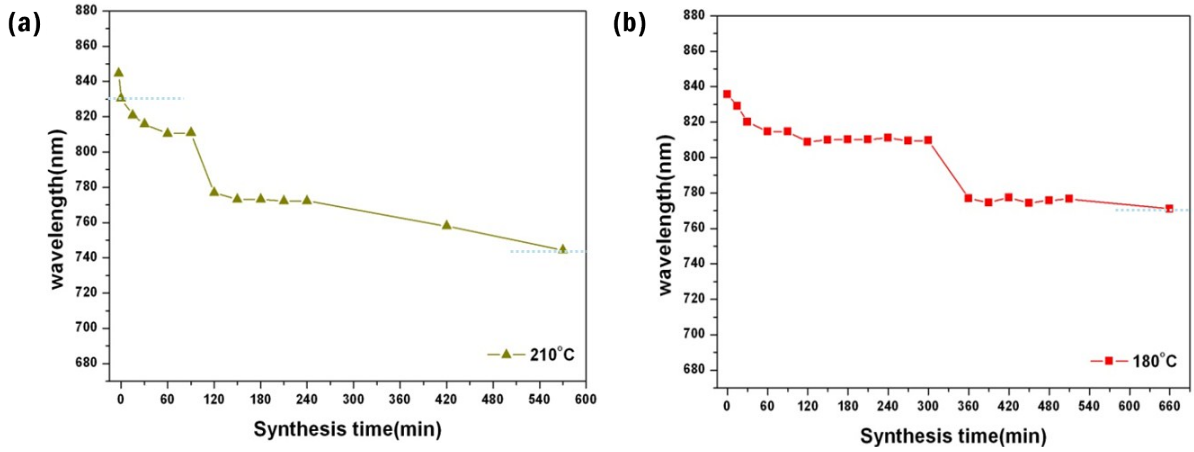

Fig. S4 The blue-shifted emission wavelength as a function of synthesis time at relatively low temperature. (a) 210℃ and (b)180℃. Even with long duration time, there is no PL spectra degradation.

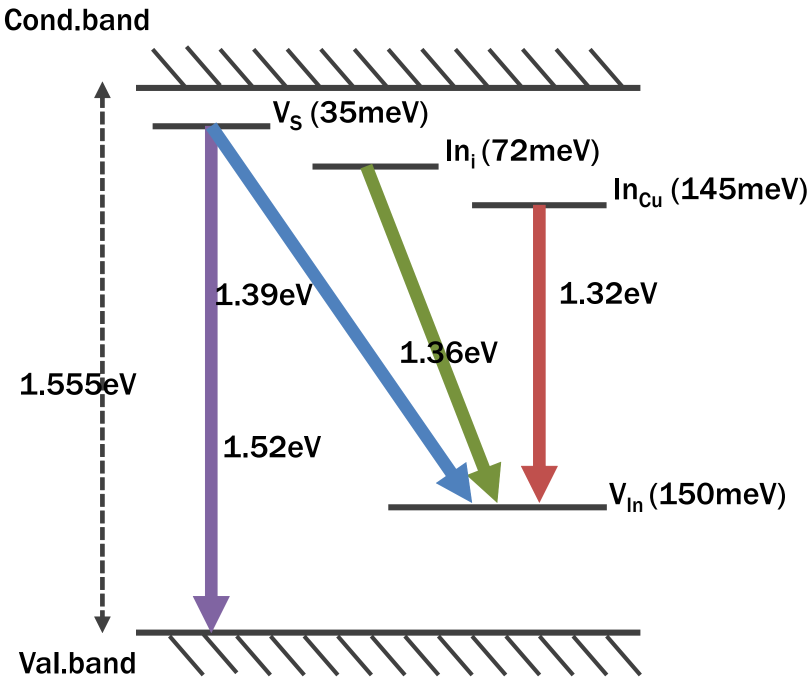

Fig. S5 The proposed energy level diagram of Cu-rich CIS-based QDs.

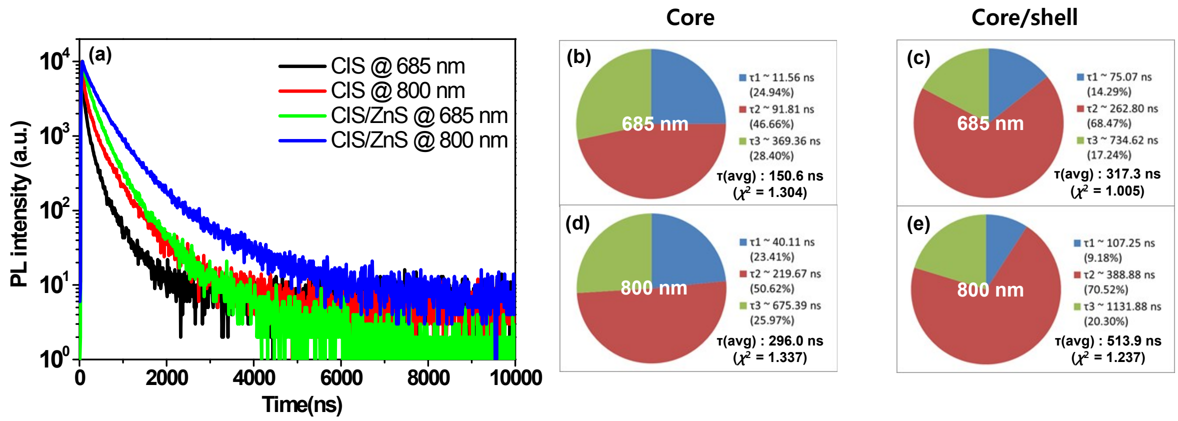

Fig. S6 (a) PL decay curves of CIS and CIS/ZnS QDs measured at 685 and 800 nm. The exponential PL decay components of (b) CIS QDs and (c) CIS/ZnS QDs measured at 685 nm, (d) CIS QDs, (e) CIS/ZnS QDs measured at 800 nm.

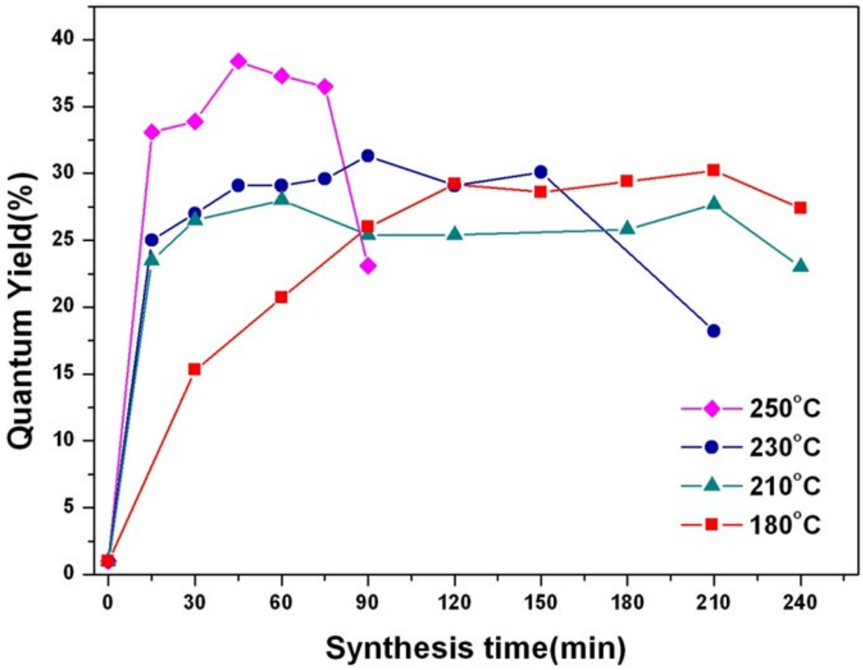

Fig. S7 The enhancement of QY as a function of duration of ZnS shell synthesis. The saturated QY of each case is as follows: 180℃: 28%, 210℃: 26%, 230℃: 30%, and 250℃: 36%

Atomic %	**Cu**	**In**	**S**	**Zn**
CIS core	**26.7**	**21.9**	**51.4**	**0**
CIS/ZnS core/shell	**7.9**	**5.2**	**78.2**	**8.7**

Tab. S1 XPS composition analysis of CIS core and CIS/ZnS core/shell QDs.