

Supplementary Information

Metal acetates based synthesis of small-sized $\text{Cu}_2\text{ZnSnS}_4$ nanocrystals: Effect of injection temperature and synthesis time

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Tab. S1. Reaction conditions.

T_{inj} , °C	Solvent/ligand, ml	Cu/Sn	Zn/Sn	Growth time
190	Oleylamine, 10 ml	1.76	1.05	40
200	Oleylamine, 10 ml	1.76	1.05	40
225	Oleylamine, 10 ml	1.76	1.05	40
250	Oleylamine, 10 ml	1.76	1.05	40
275	Oleylamine, 10 ml	1.76	1.05	40
300	Oleylamine, 10 ml	1.76	1.05	40
<i>Additional experiments</i>				
T_{inj} , °C	Solvent/ligand, ml	Cu/Sn	Zn/Sn	Growth time
200	Oleylamine, 5 ml Octadecene, 5 ml	1.76	1.05	40
225	Oleylamine, 10 ml	1.76	1.2	40
250	Oleylamine, 10 ml	1.76	1.2	40

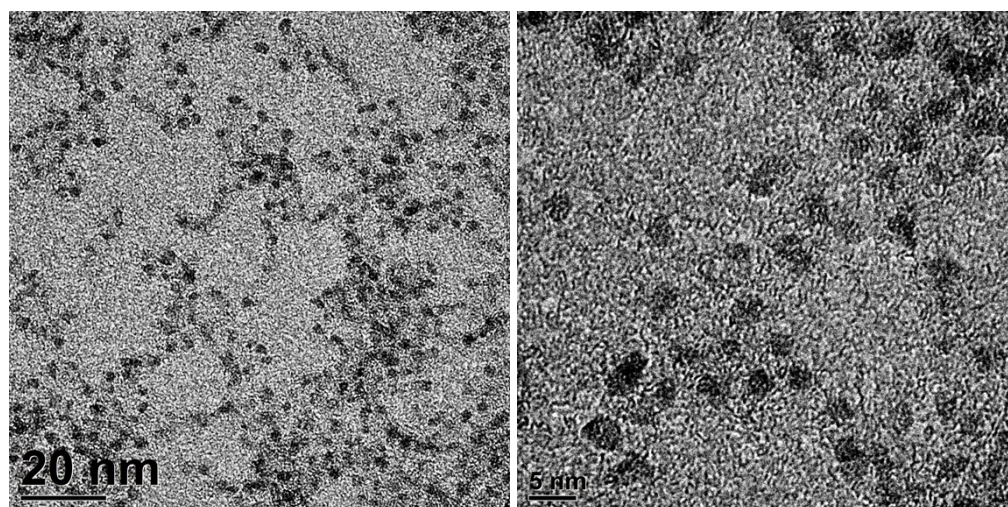


Fig. S1. TEM images of CZTS nanocrystals obtained with lower amount of oleylamine (oleylamine/octadecene mixture 1:1).

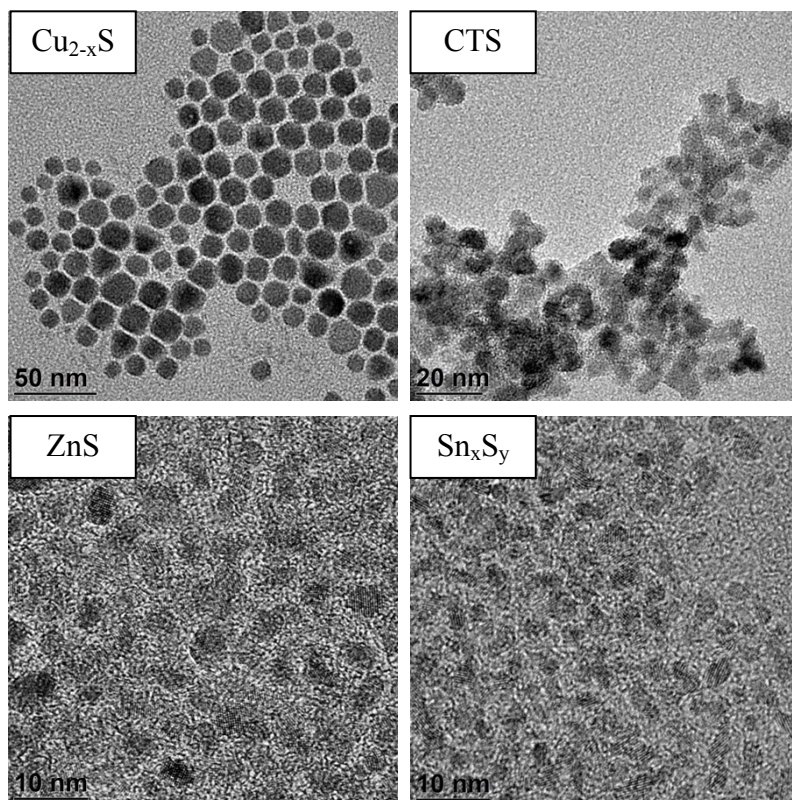


Fig. S2. TEM images of Cu_{2-x}S , CTS, ZnS and Sn_xS_y nanocrystals obtained with same reaction conditions as CZTS nanoparticles.

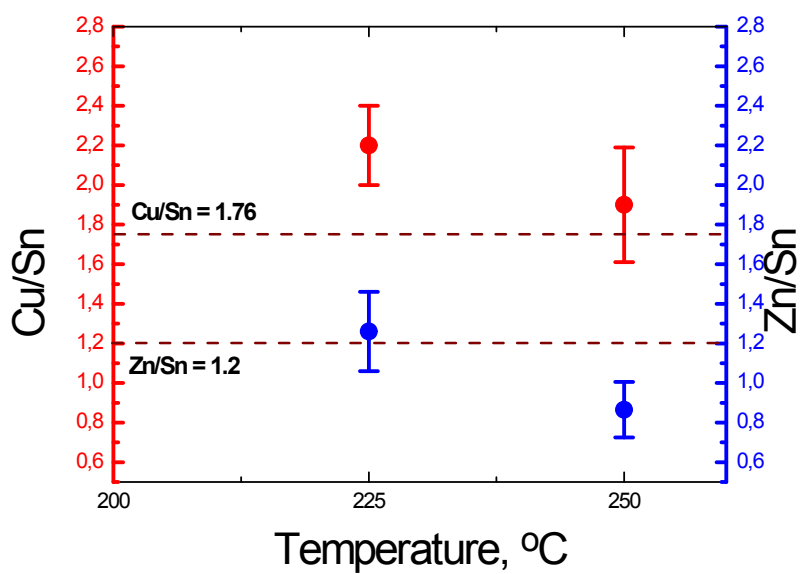


Fig. S3. Temperature dependence of Cu/Sn and Zn/Sn ratios of obtained nanoparticles synthesized with weight-in ratio of Zn/Sn=1.2 according to LA-ICP-MS analysis.

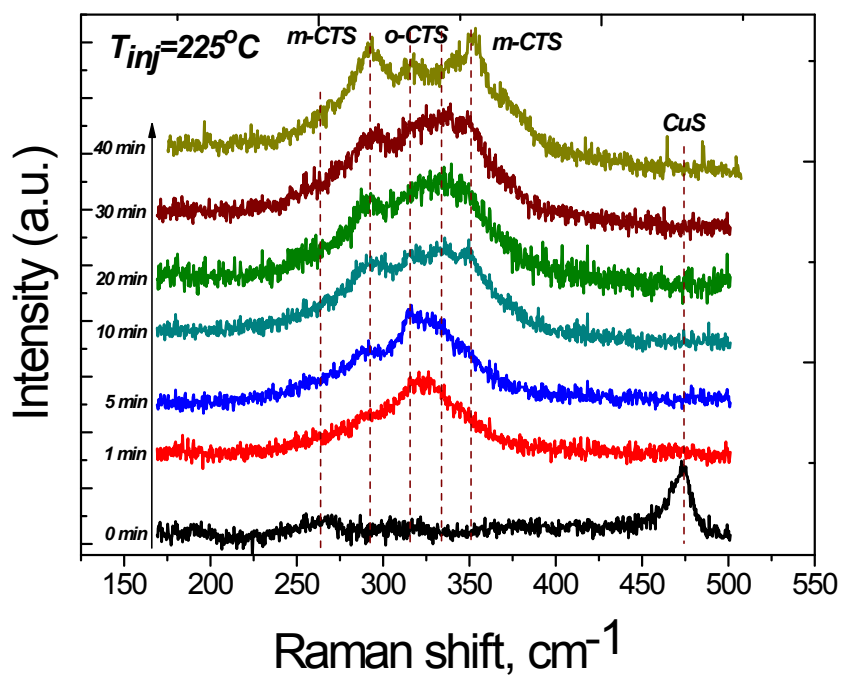


Fig. S4. Evolution of Raman signal of CTS nanoparticles with increasing of the growth time at 225°C .

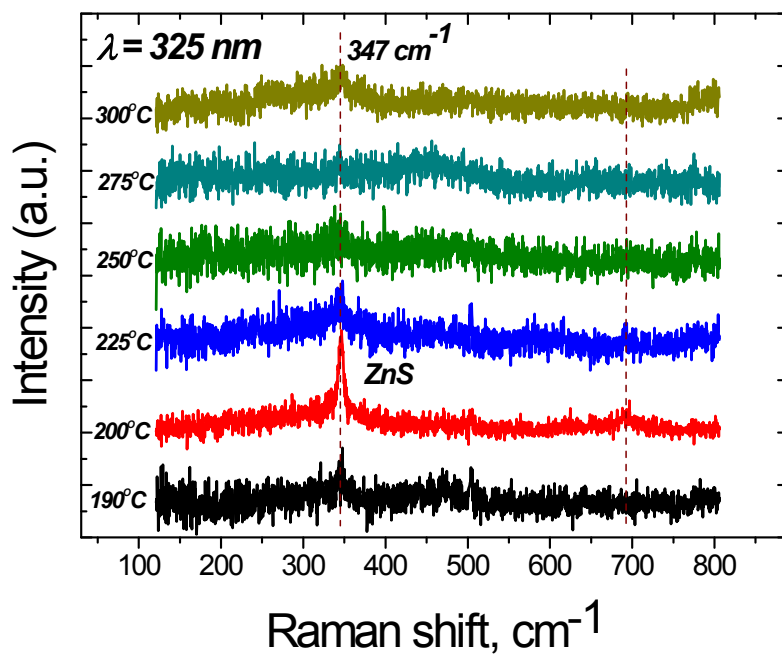


Fig. S5. Raman spectrum of nanocrystals synthesized at different injection temperatures measured with UV excitation laser ($\lambda_{exc} = 325 \text{ nm}$).

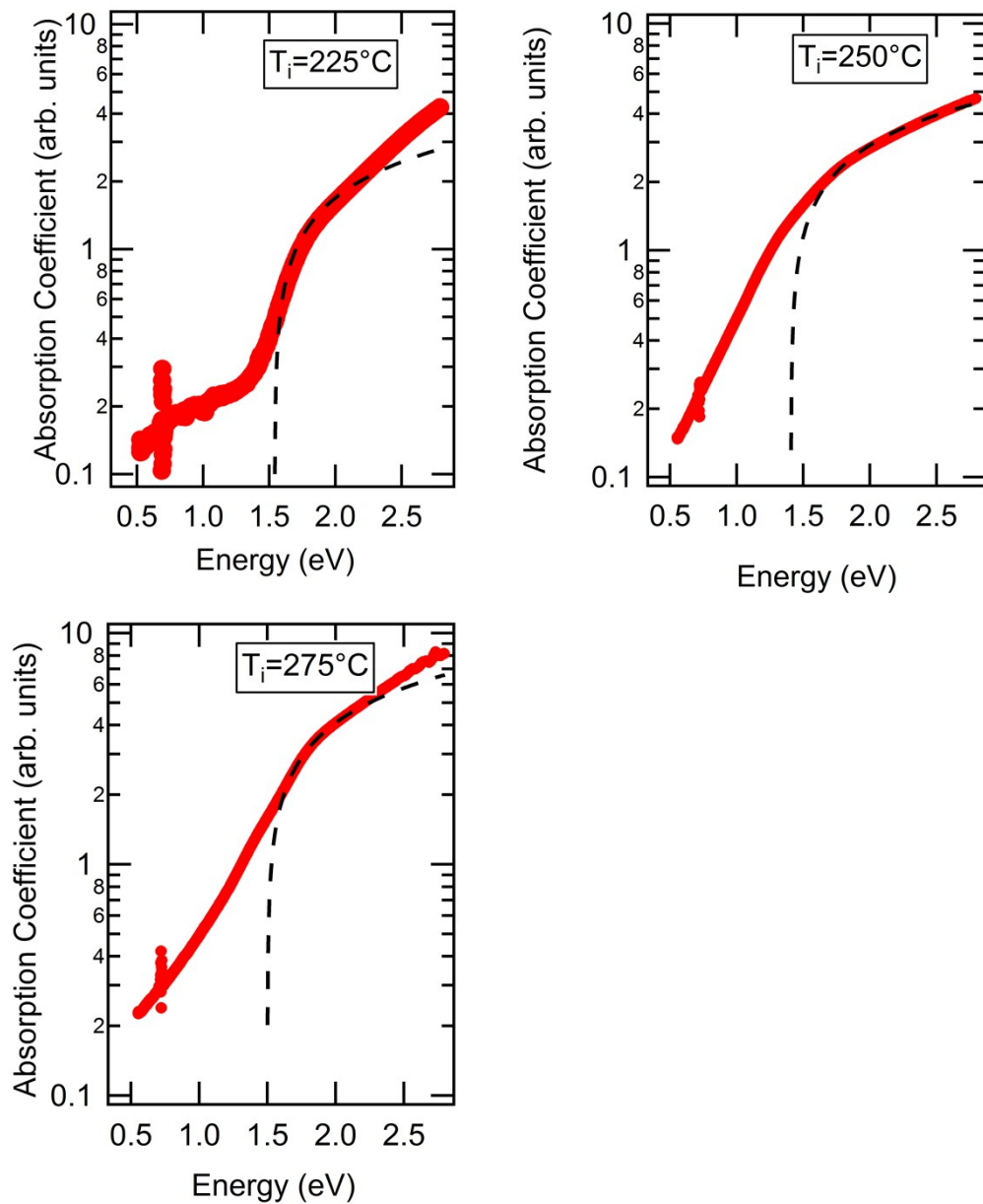


Fig. S6. Absorption coefficient of CZTS nanocrystals (red line) and fit absorption model $\sim(E - E_g)^{0.5}$ (dashed line), where E – the photon energy and E_g – the band gap.

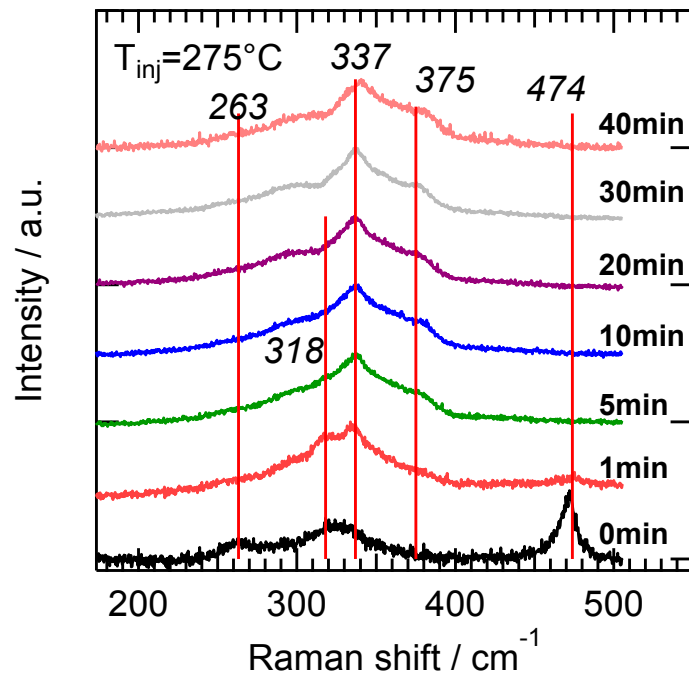


Fig. S7. Evolution of Raman signal of CZTS nanoparticles synthesized at 275°C with increasing of the growth time.