Supporting Information

Metal Halide Perovskite Supercrystals: Gold-Bromide Complex Triggered Assembly of $CsPbBr_3$ Nanocubes

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Tables and Figures

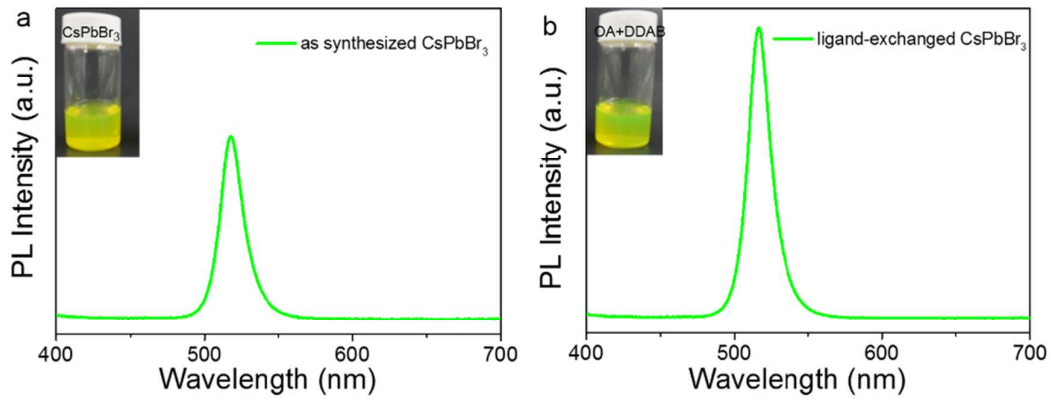

Figure S1. PL emission spectra of (a) as-synthesized $CsPbBr_3$ nanocubes (inset: the photo of as-synthesized $CsPbBr_3$ nanocubes suspension) and (b) ligand exchanged $CsPbBr_3$ nanocubes (inset: the photo of ligand exchanged $CsPbBr_3$ nanocubes suspension).

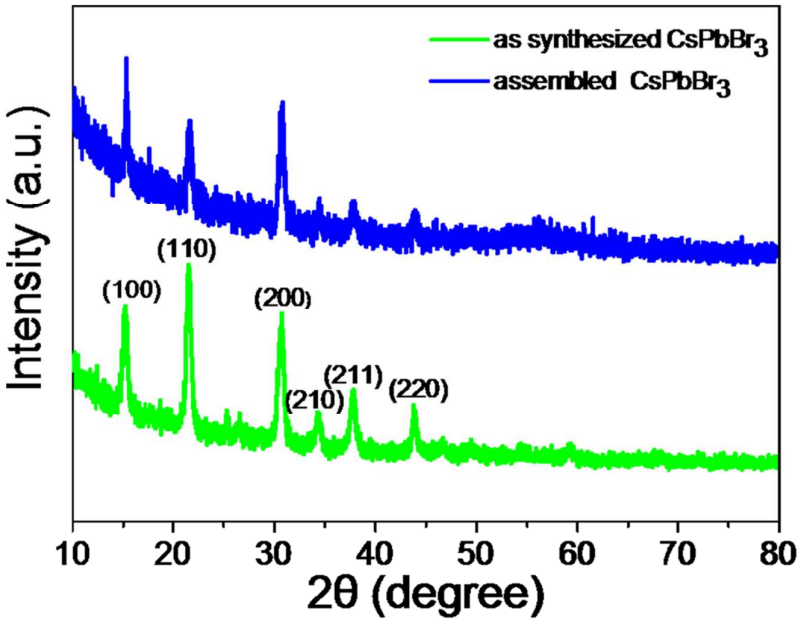

Figure S2. PXRD pattern of as-synthesized $CsPbBr_3$ nanocubes and the assembled $CsPbBr_3$ supercrystals.

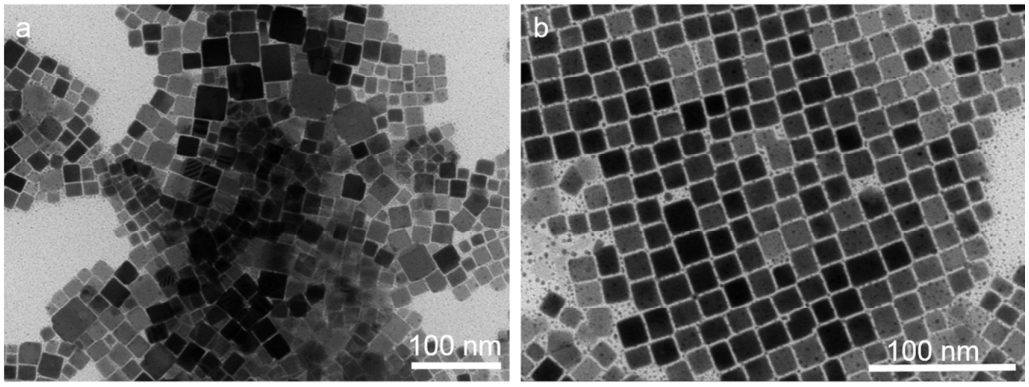

Figure S3. TEM image of $CsPbBr_3$ nanocubes with the addition of DDAB-$AuBr_3$ solution in the molar ratio of DDAB: $AuBr_3$ of (a) (2:1) and (b) (1:2).

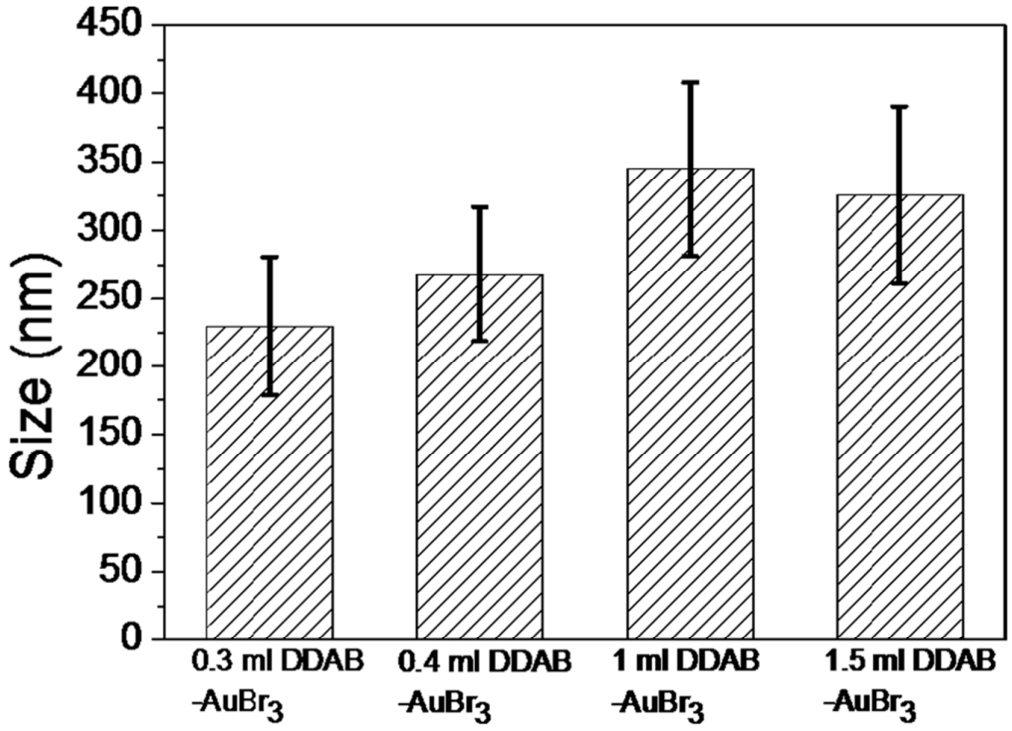

Figure S4. The variation of average size of the assembled $CsPbBr_3$ supercrystals with the increase of the amount of DDAB-$AuBr_3$ solution.

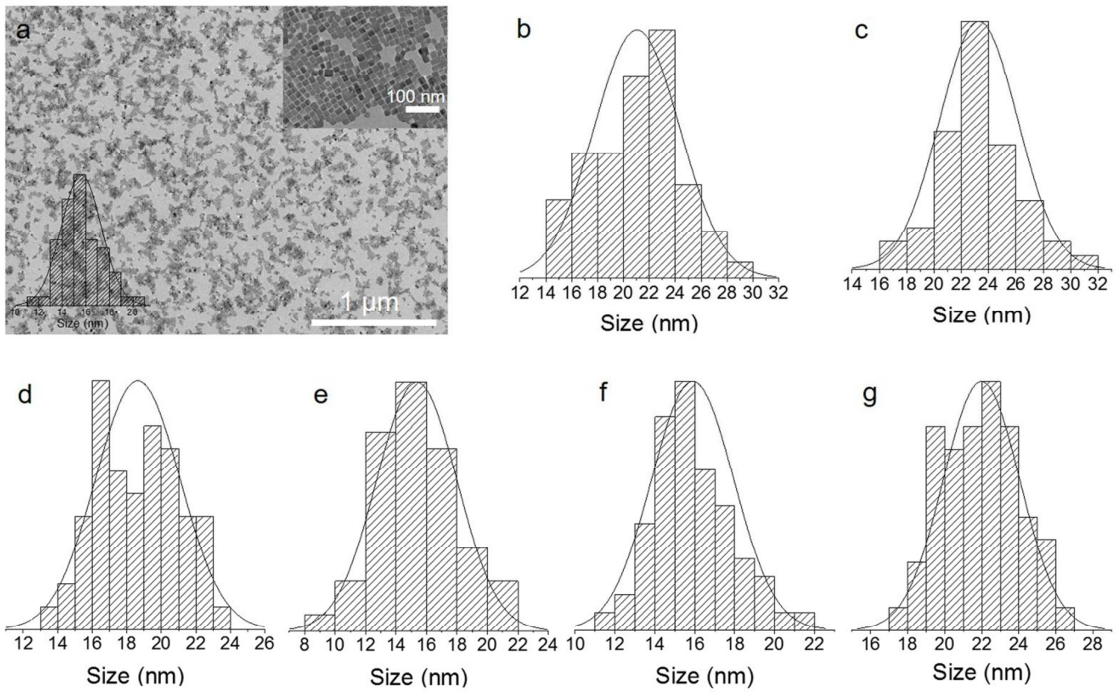

Figure S5. (a) TEM image of as-synthesized $CsPbBr_3$ nanocubes with larger size (Inset: single particle size variation of as-synthesized $CsPbBr_3$ nanocubes). (b)-(g) single particle size variation of $CsPbBr_3$ nanocubes after addition of DDAB-$AuBr_3$ solution, 0.1 ml, 0.2 ml, 0.3 ml, 0.4 ml, 1 ml and 1.5 ml respectively.

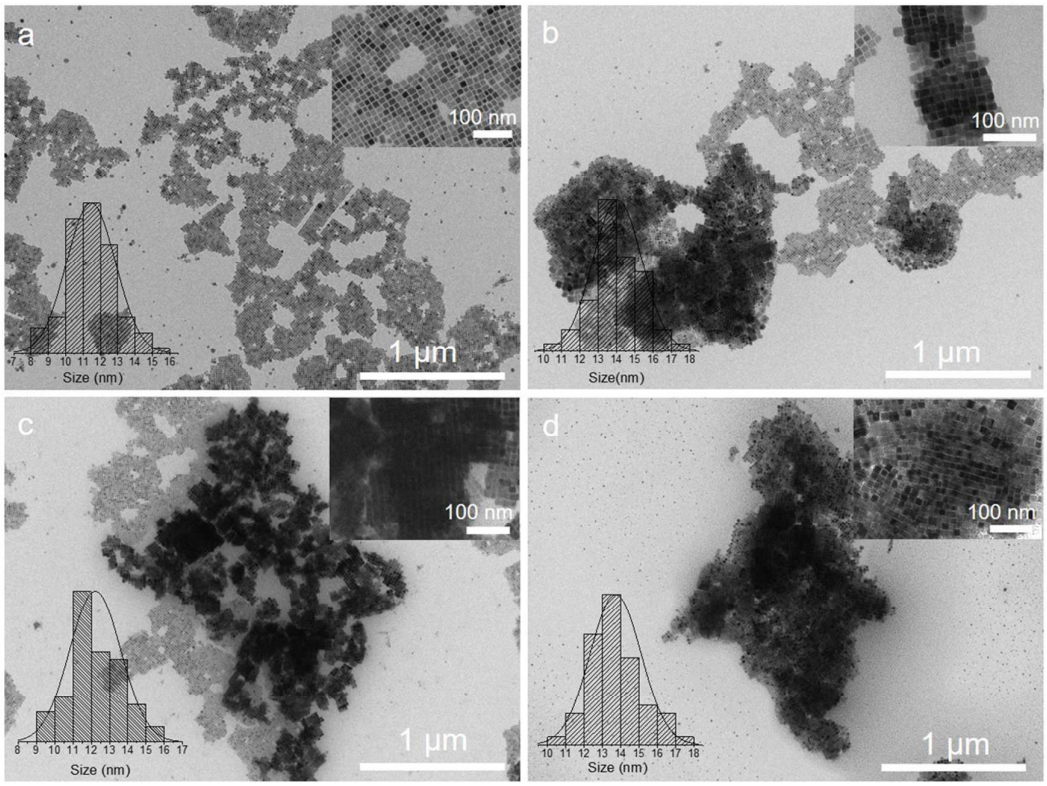

Figure S6. (a) TEM image of as-synthesized $CsPbBr_3$ nanocubes with smaller size (Inset: single particle size distribution of as-synthesized $CsPbBr_3$ nanocubes). (b)-(d) TEM images of the assembled $CsPbBr_3$ nanocubes with addition of different amount of DDAB-$AuBr_3$ solution, 0.2 ml, 0.4 ml and 1 ml, respectively (Inset: corresponding single particle size distributions of $CsPbBr_3$ nanocubes after assembly).

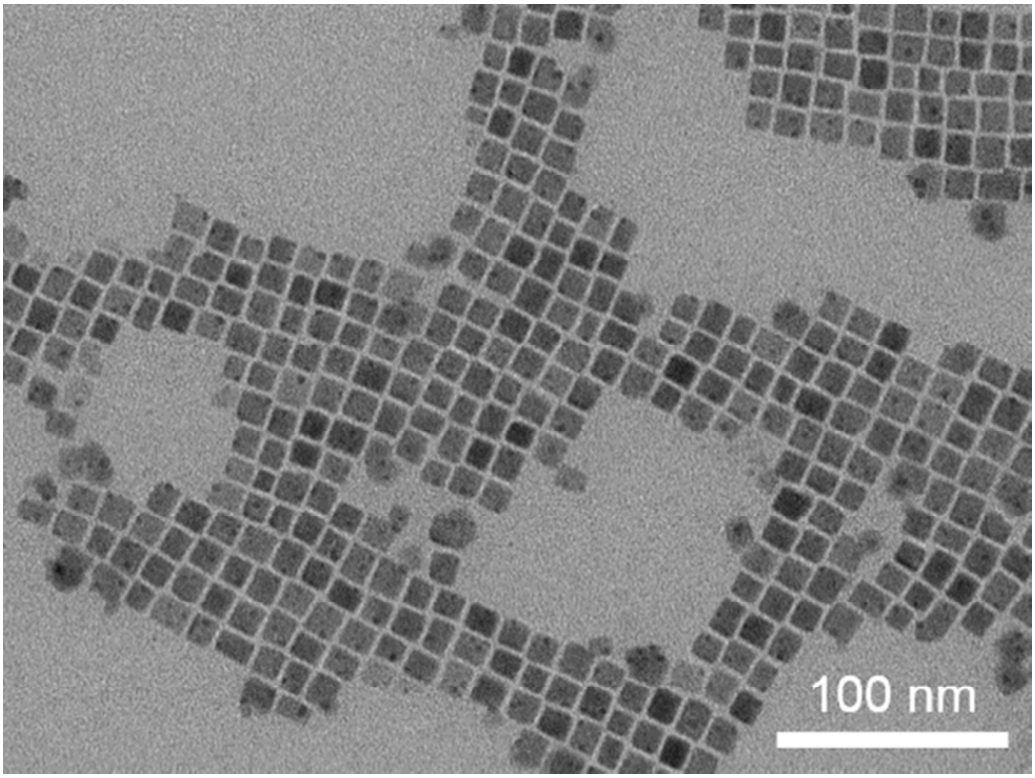

Figure S7. TEM image of $CsPbBr_3$ nanocubes with the addition of only DDAB solution after the ligand-exchange.

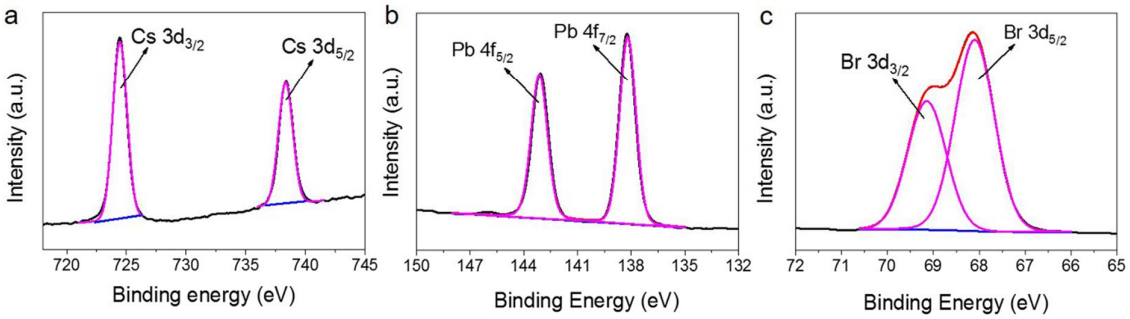

Figure S8. (a)-(c) XPS spectra of $CsPbBr_3$ nanocubes for the Cs (3d), Pb (4f) and Br (3d) as marked in corresponding curves, respectively.

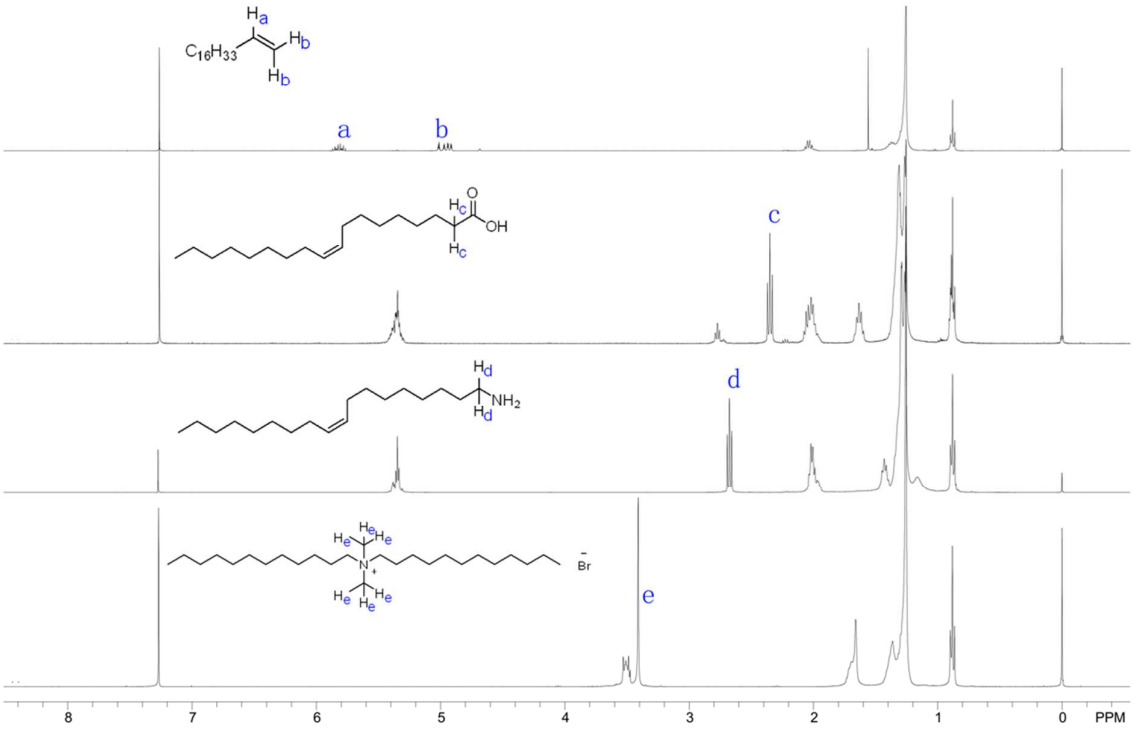

Figure S9. The ^{1}H NMR reference spectrum of ODE, oleic acid, oleylamine and DDAB.

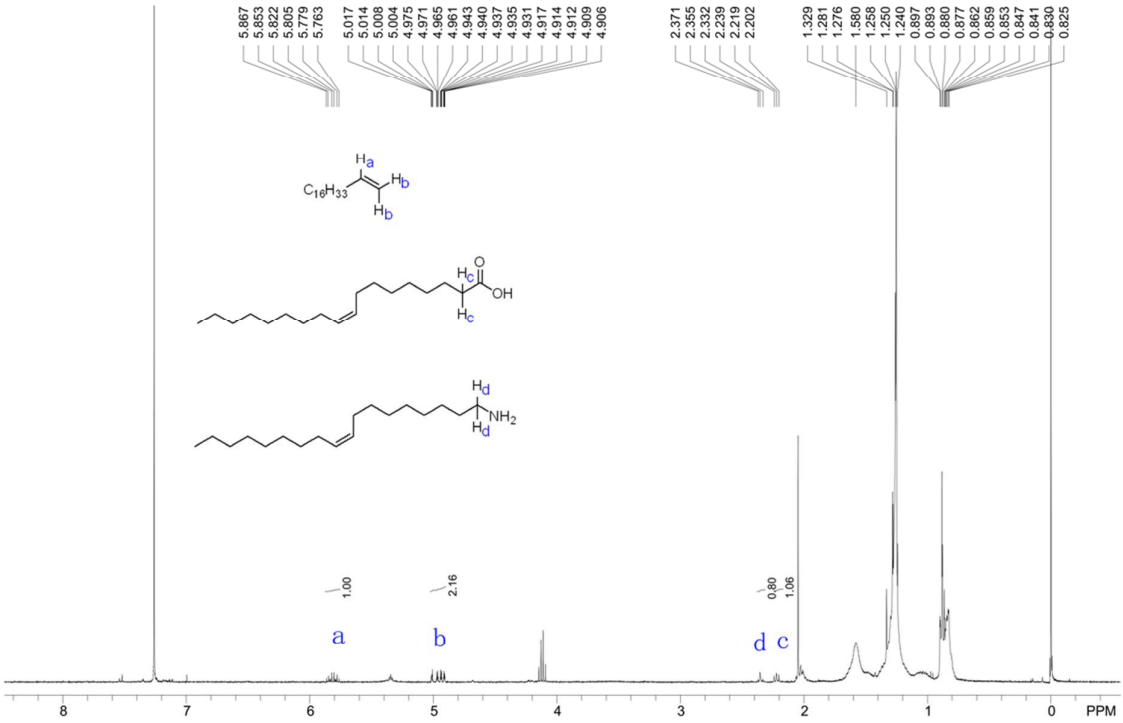

Figure S10. ^{1}H NMR spectrum of $CsPbBr_3$ nanocubes.

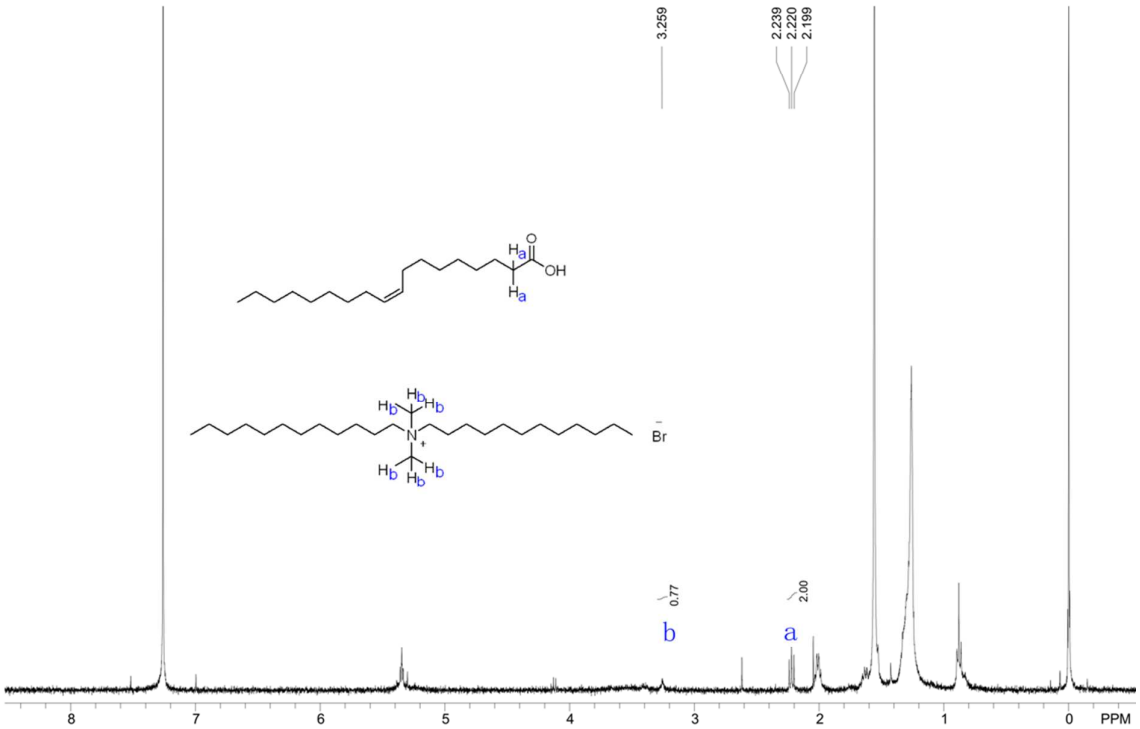

Figure S11. ^{1}H NMR spectrum of assembled $CsPbBr_3$ with addition of 0.5 ml DDAB-$AuBr_3$ solution.

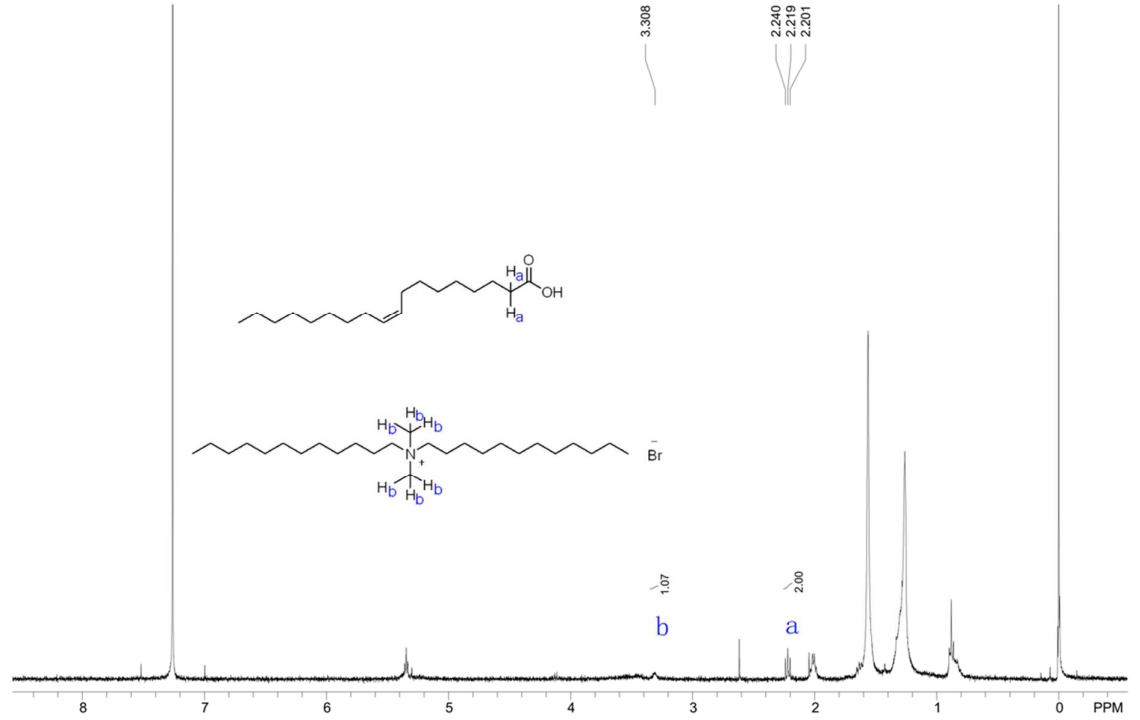

Figure S12. ^{1}H NMR spectrum of assembled $CsPbBr_3$ with addition of 1 ml DDAB-$AuBr_3$ solution.

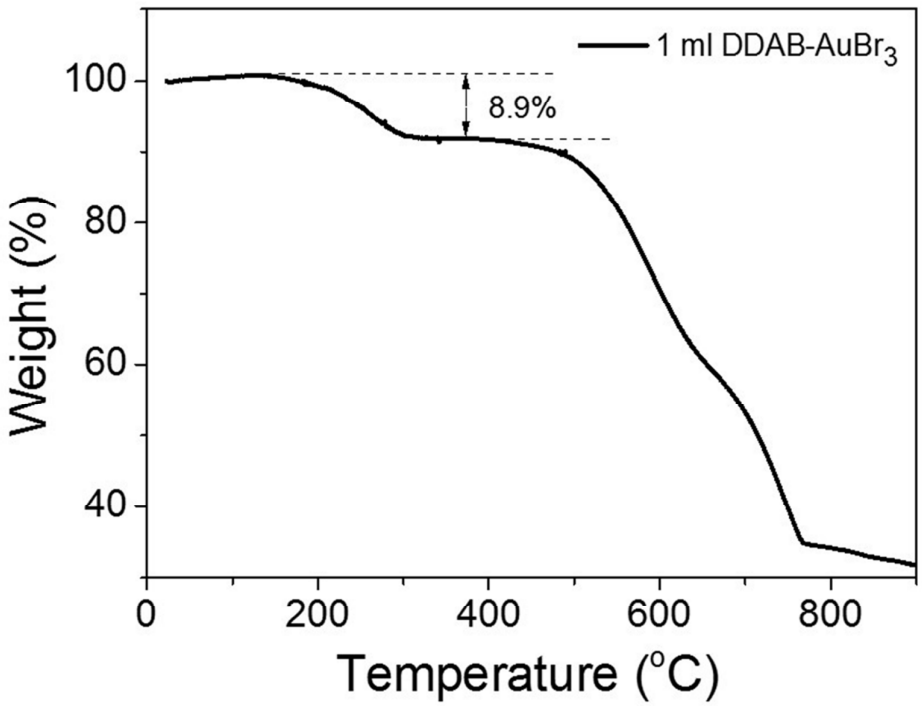

Figure S13. The TGA curves of assembled $CsPbBr_3$ with addition of 1 ml of DDAB-$AuBr_3$ solution.

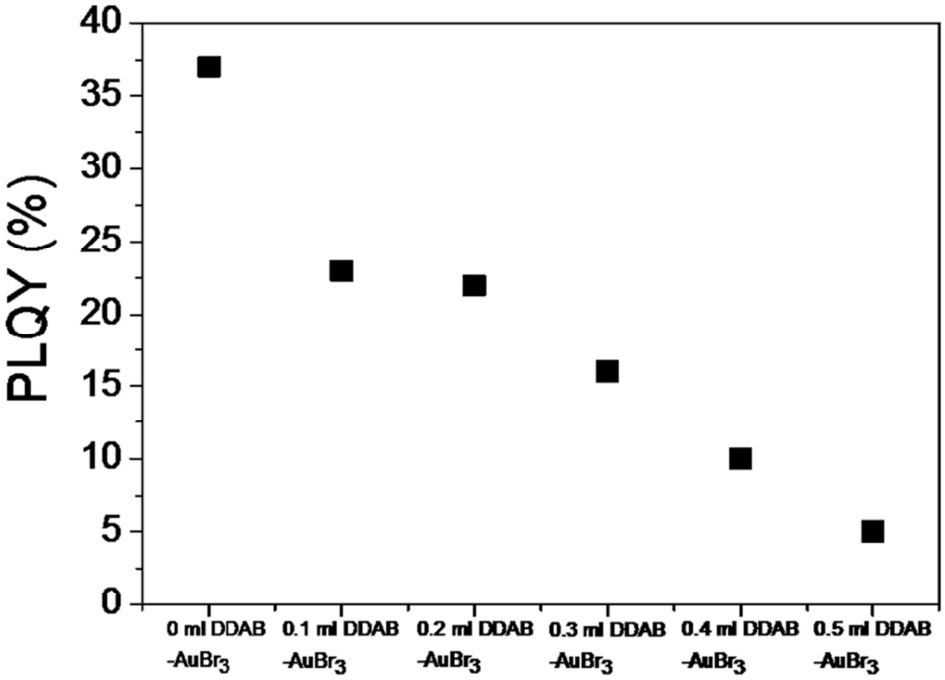

Figure S14. The plot of PLQY variation of the assembled $CsPbBr_3$ nanocubes with different amount of DDAB-$AuBr_3$ solution added into the $CsPbBr_3$ nanocube suspension.

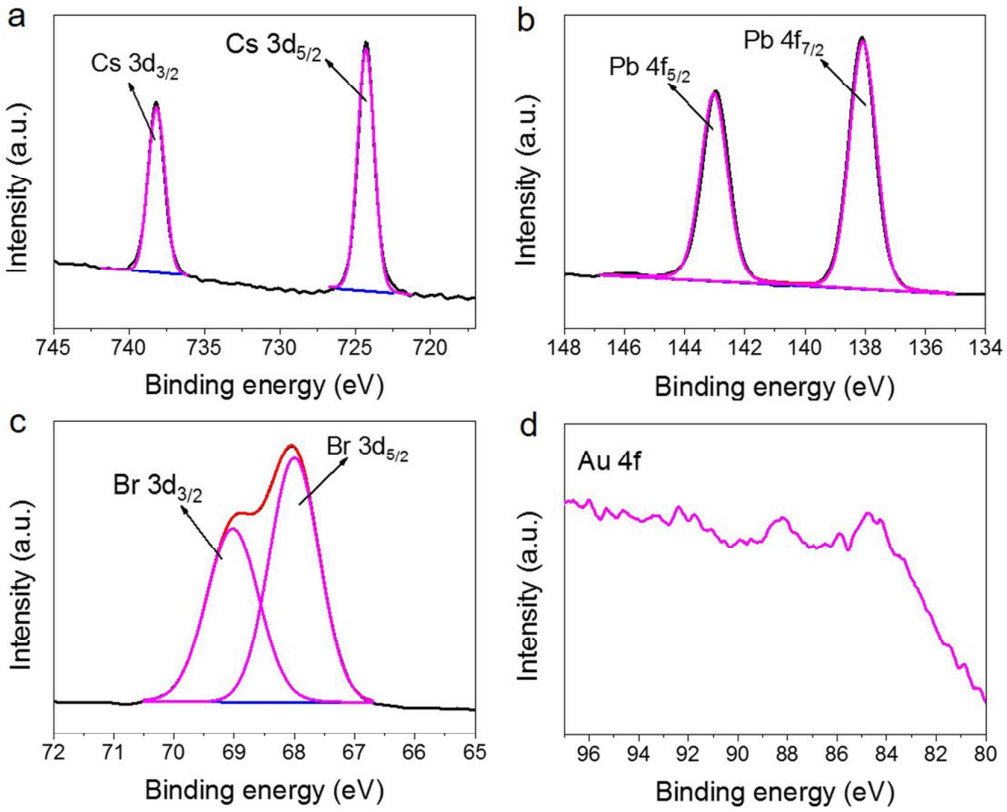

Figure S15. (a)-(d) XPS spectra of assembled $CsPbBr_3$ nanocubes after the heating treatment for the Cs (3d), Pb (4f), Br (3d) and Au (4f) as marked in corresponding curves respectively.

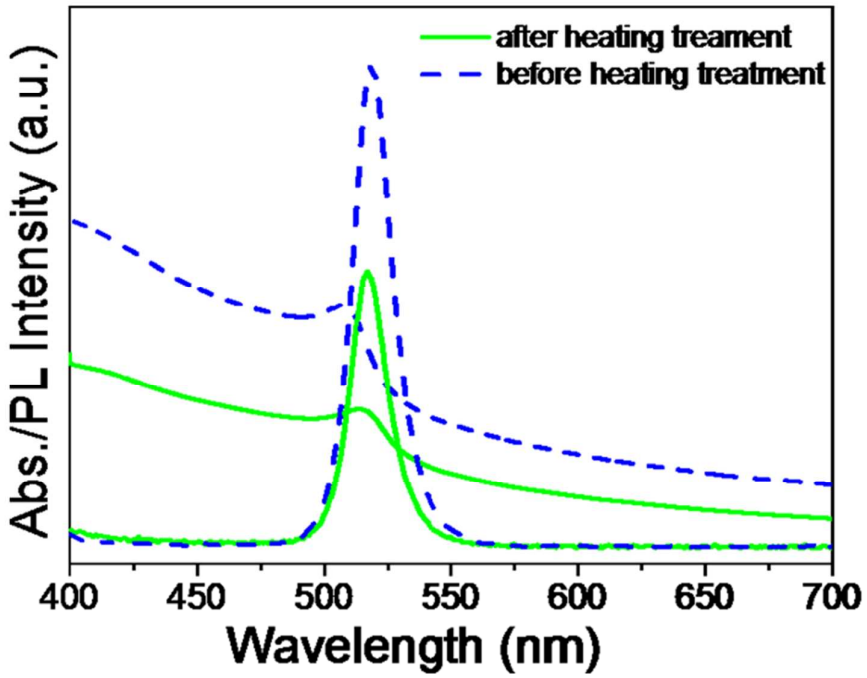

Figure S16. UV-vis absorption spectra and PL emission spectra of the assembled $CsPbBr_3$ nanocubes before and after the heating treatment.

Table S1 The summary of the zeta potential of as-synthesized $CsPbBr_3$ nanocubes, ligand exchanged $CsPbBr_3$ nanocubes, and assembled $CsPbBr_3$ supercrystals

Zeta potential (mV) / Products	Test 1	Test 2	Test 3	average
as-synthesized $CsPbBr_3$	-5.03	-2.82	-4.11	-3.98
ligand exchanged $CsPbBr_3$	-1.28	-10.2	-3.28	-4.92
assembled $CsPbBr_3$	-9.97	-6.33	-3.16	-6.48