Supporting Information

The Luminescence Property of $CsPb_xM_{1-x}Br_3$ Perovskite Nanocrystals Transformed from Cs_4PbBr_6 Mediated by Various Divalent Bromide MBr_2 Salts

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PL decay lifetime

The PL decay curve were fitted with a triexponential function

$$A(t) = A_1 exp(-\frac{t}{\tau_1}) + A_2 exp(-\frac{t}{\tau_2}) + A_3 exp(-\frac{t}{\tau_3})$$

where A_1, A_2, and A_3 are time independent coefficient constants, and t is time. τ_1, τ_2, and τ_3 are decay lifetimes because of the intrinsic exciton relaxation, the interaction between excitons and phonons, and the interaction between excitons and defects, respectively.

τ_{ave}, the average lifetime, can be calculated with a function

$$\tau_{ave} = \frac{A_1\tau_1^2 + A_2\tau_2^2 + A_3\tau_3^2}{A_1\tau_1 + A_2\tau_2 + A_3\tau_3}$$

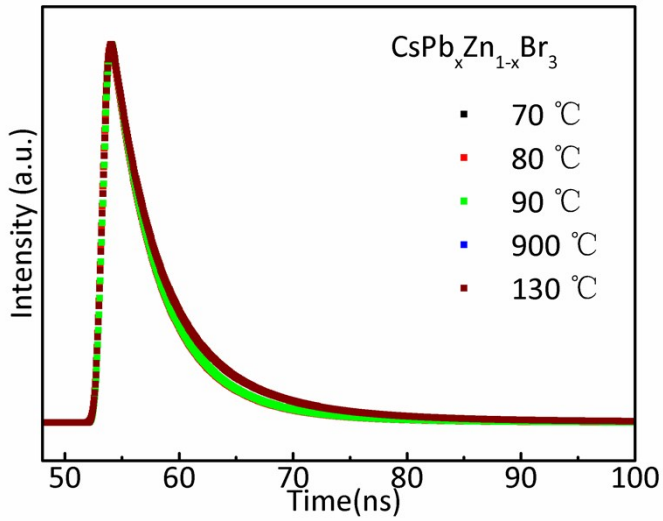

Figure S2. PL decay curves of $CsPb_xZn_{1-x}Br_3$ NCs synthesized at different temperature.

Table 1. Fluorescence lifetimes of $CsPb_xZn_{1-x}Br_3$ NCs.

Temperature	70℃	80℃	90℃	100℃	130℃
Average Time(ns)	5.04	4.79	4.33	4.31	4.70

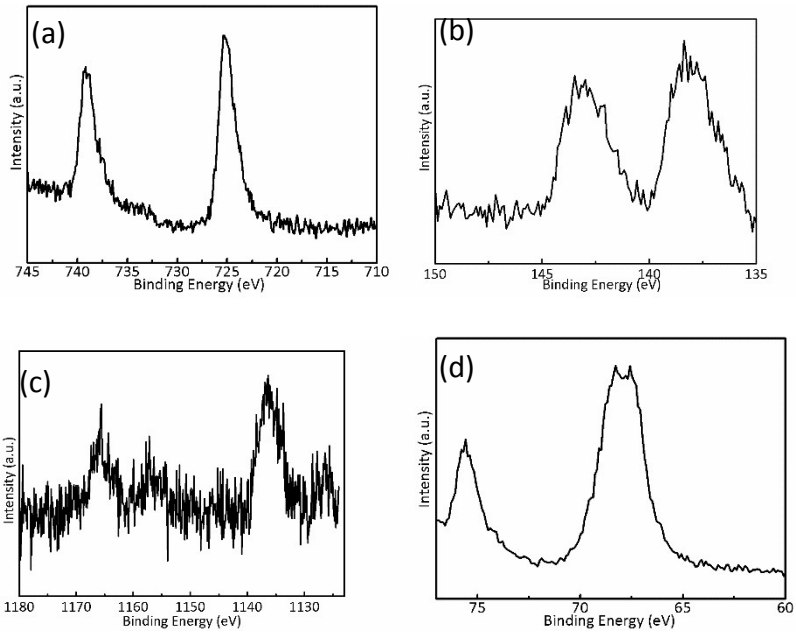

Figure S2. XPS spectra for $CsPb_xEu_{1-x}Br_3$ NCs. (a–d) The high-resolution XPS analysis corresponding to Cs 3d, Pb 4f, Eu 3d and Br 3d, respectively.

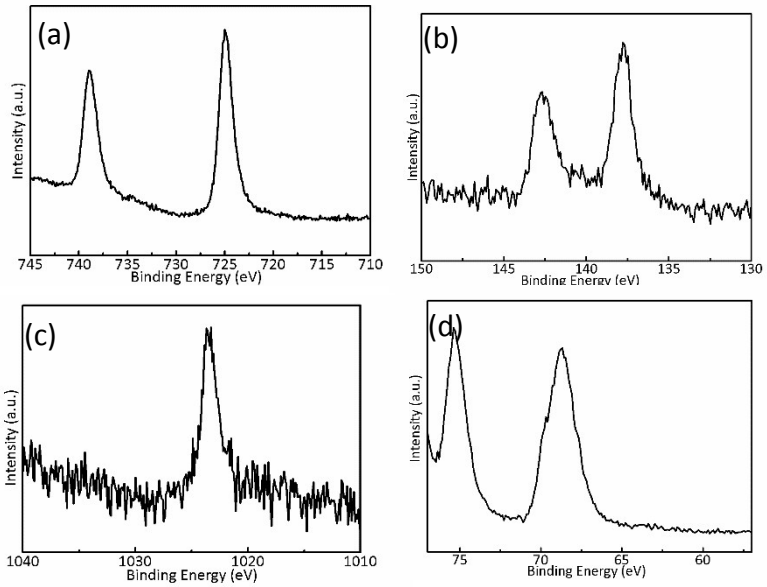

Figure S3. XPS spectra for $CsPb_xZn_{1-x}Br_3$ NCs. (a–d) The high-resolution XPS analysis corresponding to Cs 3d, Pb 4f, Zn 2p and Br 3d, respectively.

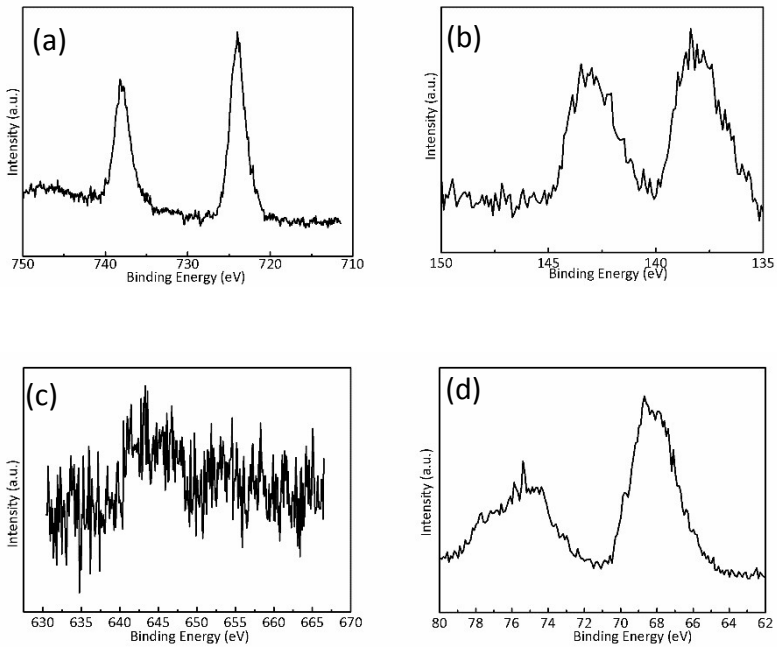

Figure S4. XPS spectra for $CsPb_xMn_{1-x}Br_3$ NCs. (a–d) The high-resolution XPS analysis corresponding to Cs 3d, Pb 4f, Mn 2p and Br 3d, respectively.

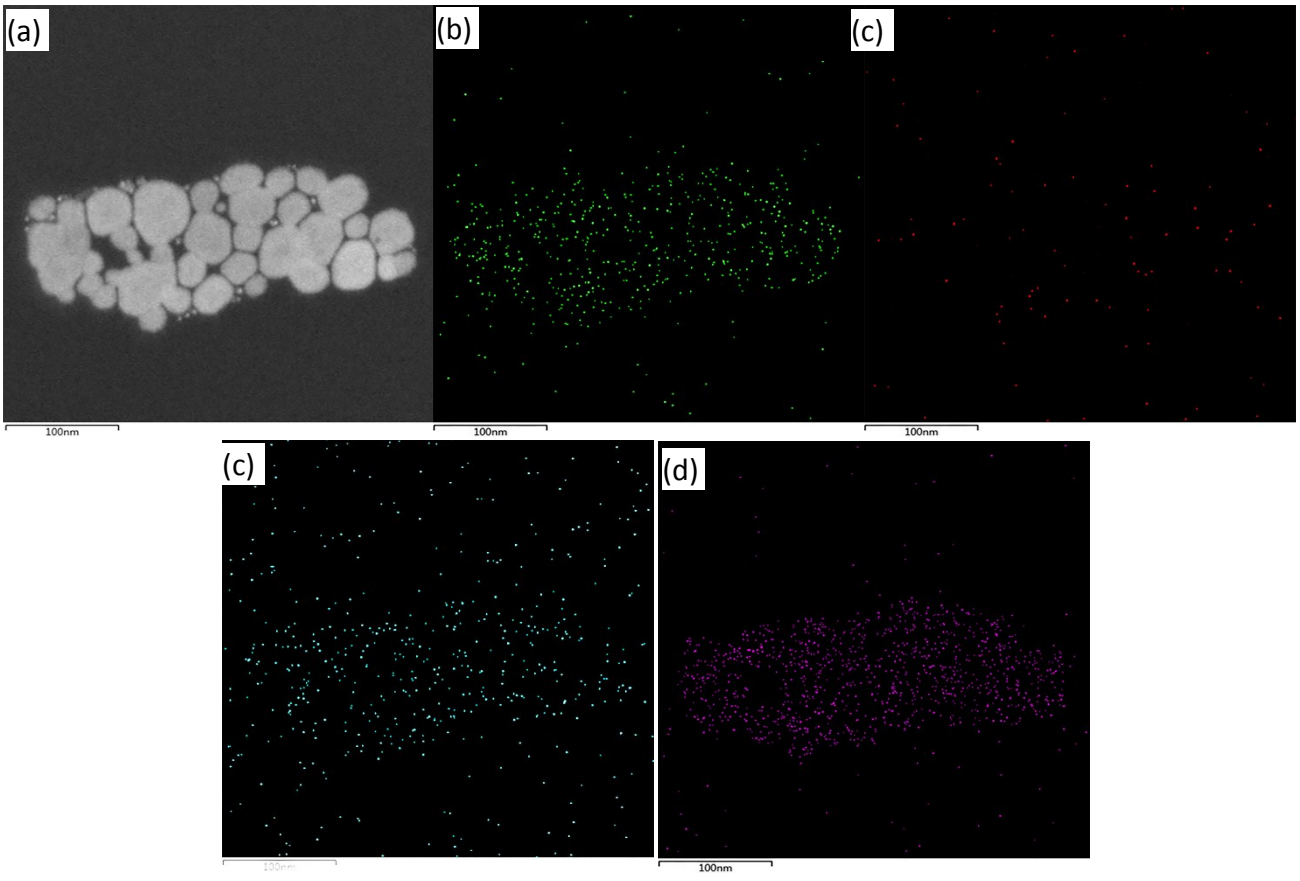

Figure S5. EDS element mapping images of $CsPb_xZn_{1-x}Br_3$ NCs. (a-e) images of Cs, Pb, Zn and Br.

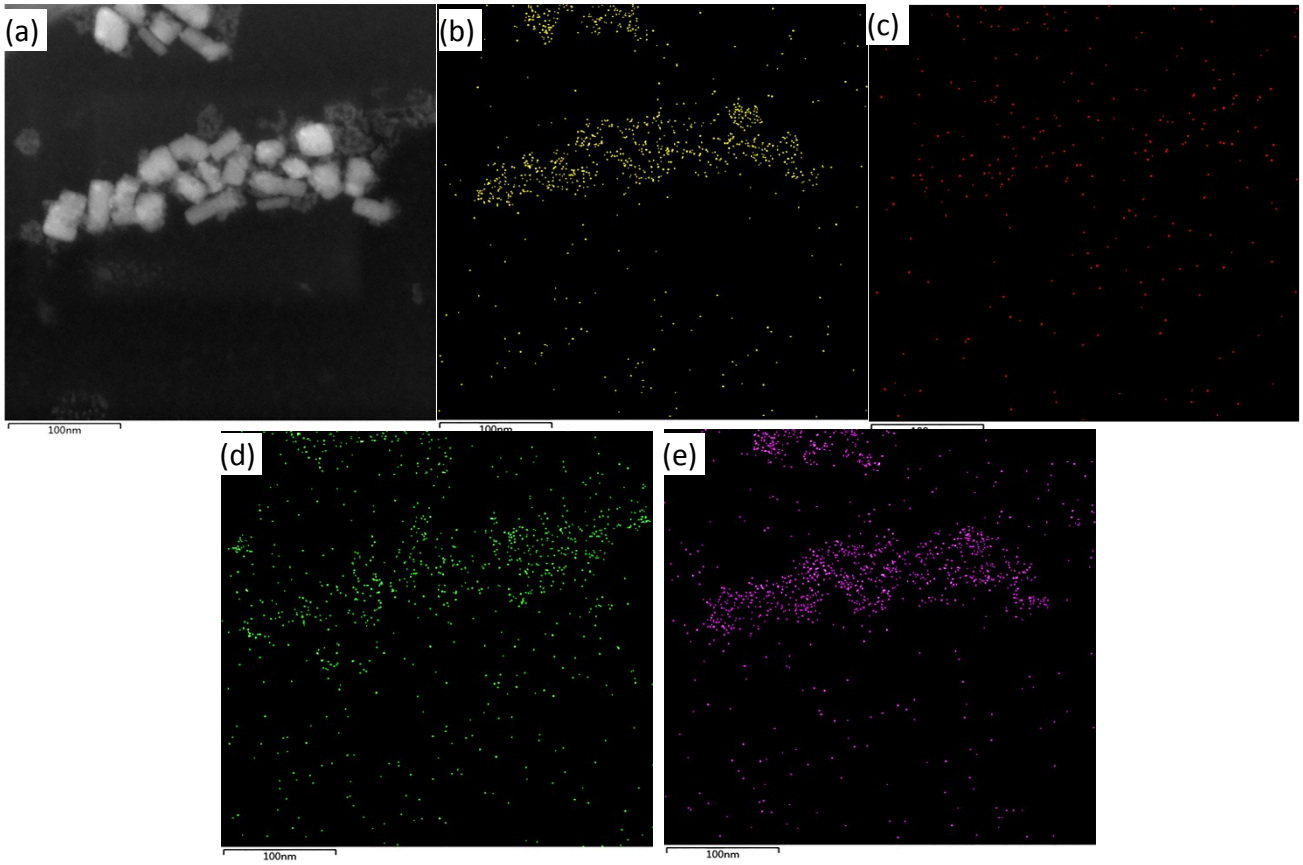

Figure S6. EDS element mapping images of $CsPb_xMn_{1-x}Br_3$ NCs. (a-e) images of Cs, Pb, Mn and Br.

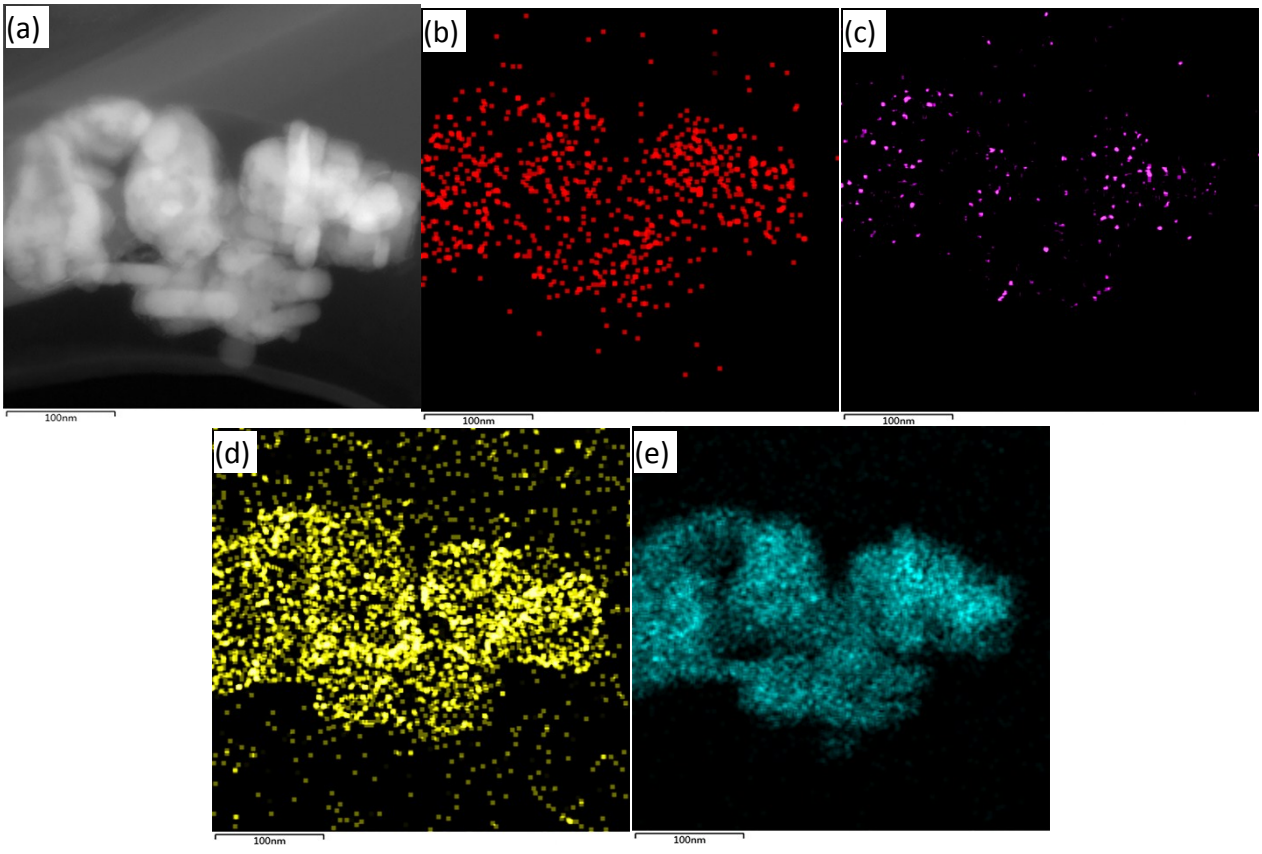

Figure S7. EDS element mapping images of $CsPb_xEu_{1-x}Br_3$ NCs. (a-e) images of Cs, Pb, Eu and Br.

Table S2. Substitution rates for lead ions in $CsPb_xM_{1-x}Br_3$ NCs

	Cs^+ (%)	Pb^{2+} (%)	M^{2+} (%)	Br^- (%)	$M^{2+}/ (Pb^{2+} + M^{2+})$ (%)
$CsPb_xMn_{1-x}Br_3$	1.99	0.51	1.57	8.9	75.48
$CsPb_xEu_{1-x}Br_3$	12.09	6.61	7.04	7.16	51.58
$CsPb_xZn_{1-x}Br_3$	3.17	0.45	1.94	12.57	81.17