Supplementary Materials

PL spectra and PL dynamics of CsPbBr₃ quantum dots in solution and film

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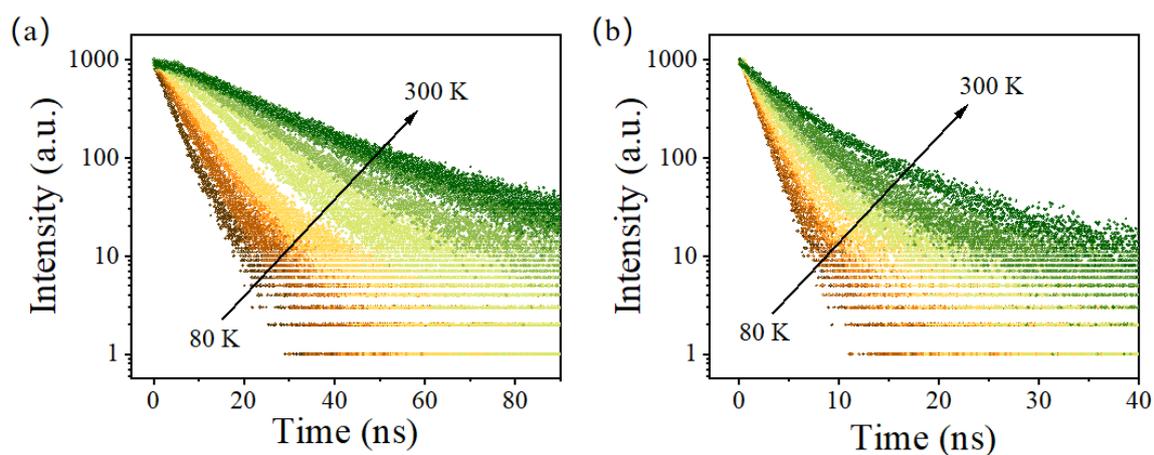[2] School of Microelectronics, Nanjing University of Science and Technology, Nanjing 210094, China

Fig. S1. (Color online) Variation of the decay curve of lifetime at the peak position with temperature. (a) TRPL of CsPbBr$_3$ QDs solution; (b) TRPL of CsPbBr$_3$ QDs film.
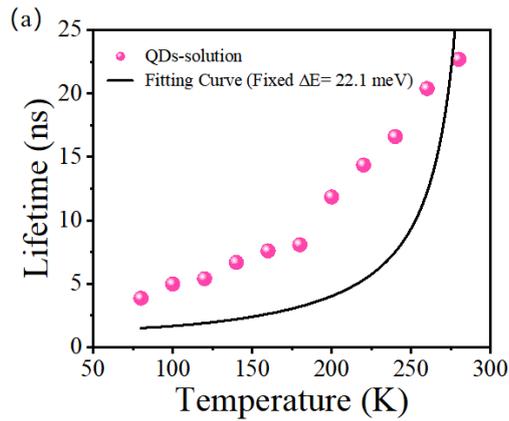
Fig. S2. (Color online) The lifetime evolution trend of CsPbBr$_3$ solution with temperature. Solid line is fitted with Eq. 2 too, but ΔE was taken from the fitting result of film (22.1. meV), leaving the τ_{nr1} as a free parameter. Obviously, the fitting is not acceptable.

When analyzing the temperature lifetime curve of solution samples, we tried to fix the trap energy level depth (ΔE) to the fitted value from the thin film. Under this parameter constraint, the fitted curve never converged to the experimental data.
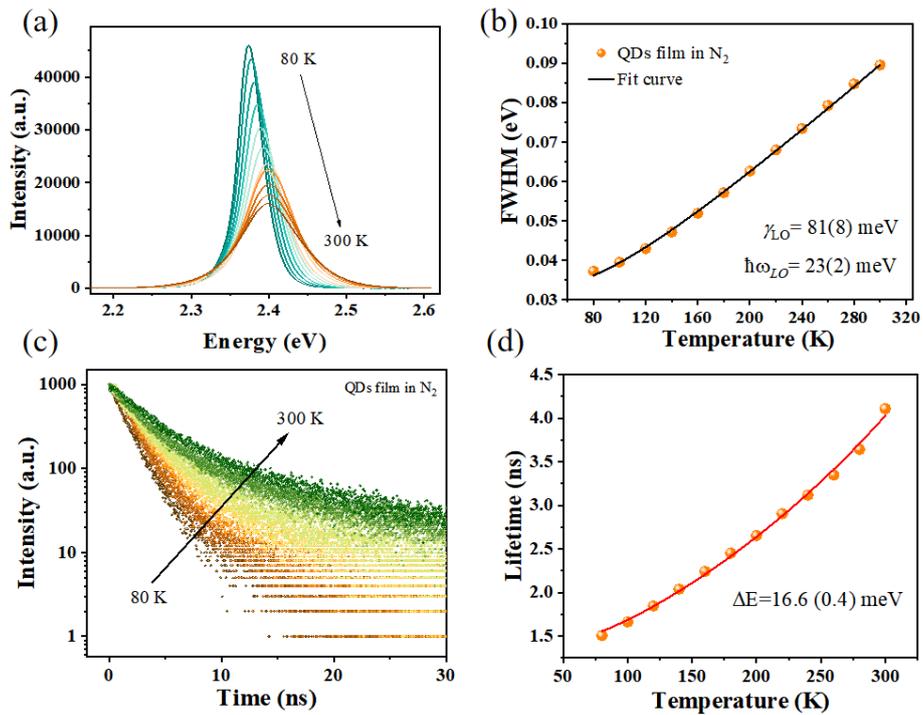
Fig. S3. (Color online) (a) and (b) Temperature dependent PL spectra of CsPbBr$_3$ QDs film prepared in N$_2$ and its FWHM with fitting curve using Eq. 1 in manuscript. (c) TRPL and (d) Lifetime of the peak position with temperature as the function of temperature of CsPbBr$_3$ QDs film, with the fitting using Eq. 2 in manuscript. The lifetime is obtained by fitting the TRPL dynamics with a single exponential function, which is also used in Fig. 4 of manuscript.

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Table S1. shows the fitting parameters of TRPL with solution and films. "Film in air" means the film prepared in ambient, "Film in N$_2$" means the film prepared in N$_2$ filled glove box.

	τ_r (ns)	τ_{nr1} (ns)	γ	D	ΔE (meV)
Solution	1.49*	22.3**	0.19 ± 0.1	95 ± 0.9	4.0 ± 0.2
Film in air	1.49*	22.3 ± 0.1	0.23 ± 0.2	120 ± 3.3	22.1 ± 0.6
Film in N$_2$	1.49*	22.3 **	0.20 ± 0.1	101.1 ± 0.5	16.6 ± 0.4

*from Ref. [37]. ** regard as same with the τ_{nr1} in film prepared in air