

## **Electronic Supplementary Information**

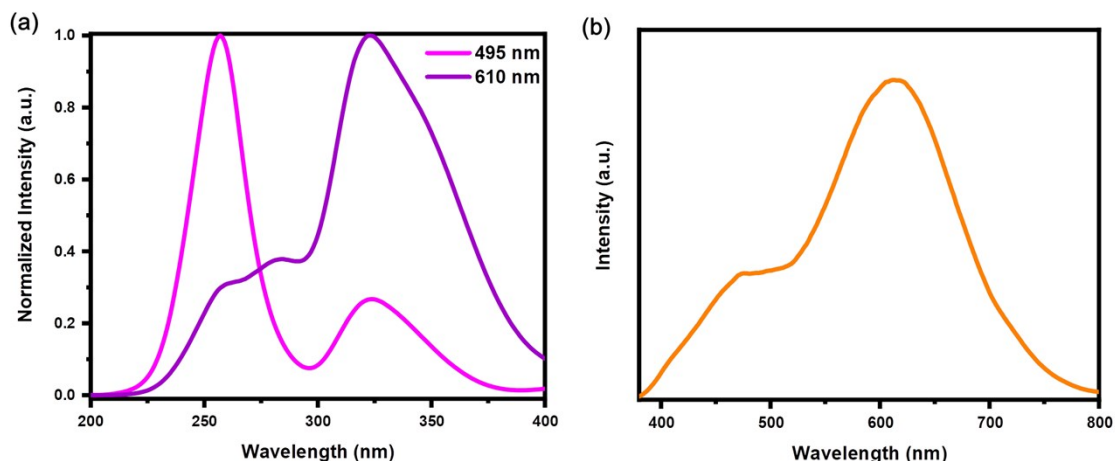
**An Ultraviolet Excitation Anti-Counterfeiting Materials of  $\text{Sb}^{3+}$**

**Doped  $\text{Cs}_2\text{ZrCl}_6$  Vacancy-Ordered Double Perovskite**

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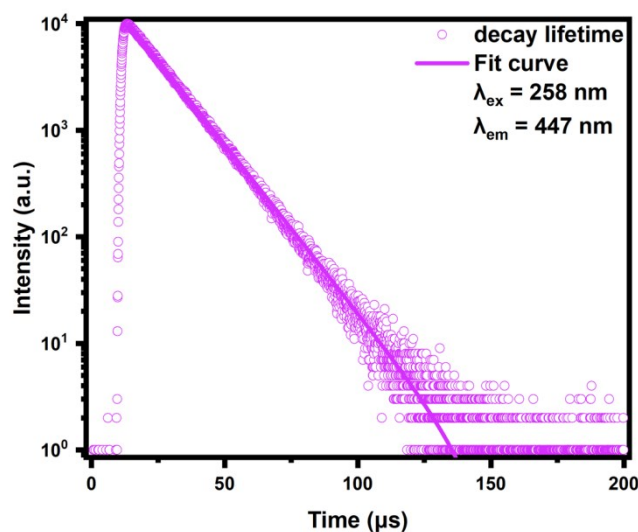
**Figure S1.** (a) PLE and (b) PL spectra of 1% Sb<sup>3+</sup> doped Cs<sub>2</sub>ZrCl<sub>6</sub> (monitoring at emission wavelength of 495 nm and 610 nm, excited by 285 nm).

**Table S1.** EDS results (atom%) from the points on the selected 10% Sb<sup>3+</sup> doped Cs<sub>2</sub>ZrCl<sub>6</sub> particle.

Element	Cs	Zr	Sb	Cl
Proportion	23.70	13.15	3.26	59.89

**Table S2.** feed ratio and ICP-OES results of Sb/(Sb + Zr).

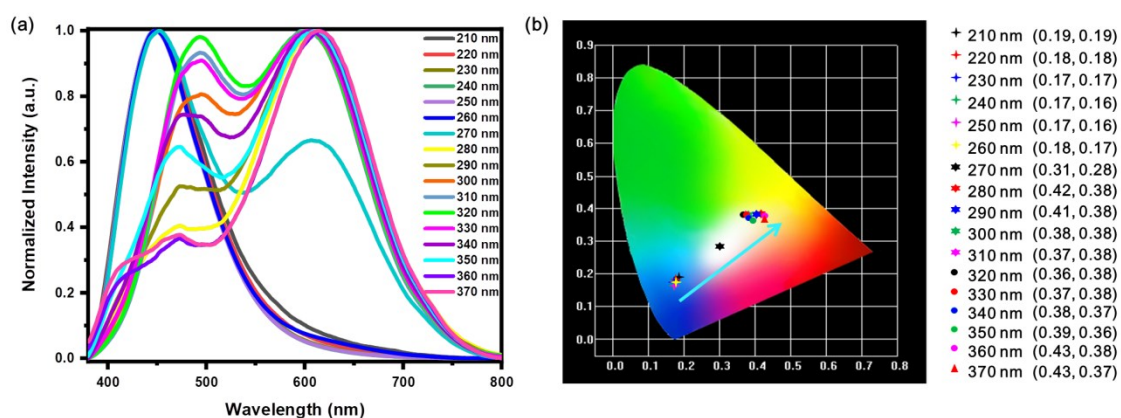
feed ratio	ICP-OES results
1%	0.34%
4%	1.61%
7%	2.94%
10%	3.53%
15%	4.36%
20%	5.72%



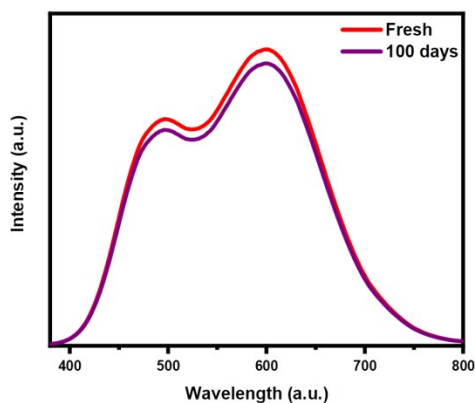
**Figure S2.** Time-resolved PL spectra of Cs<sub>2</sub>ZrCl<sub>6</sub>,  $\lambda_{\text{ex}} = 258 \text{ nm}$ ,  $\lambda_{\text{em}} = 447 \text{ nm}$ .

**Table S3.** PL lifetime of 10% Sb<sup>3+</sup> doped Cs<sub>2</sub>ZrCl<sub>6</sub>.

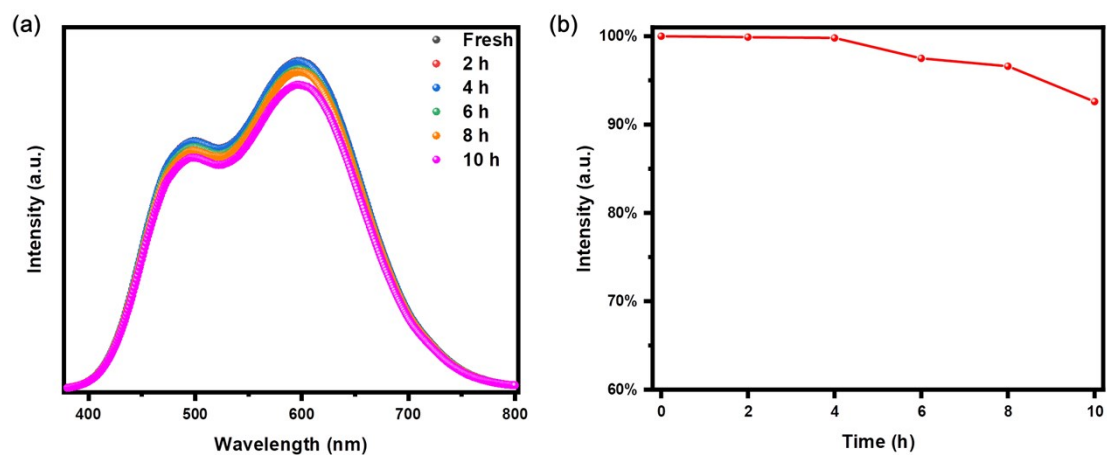
Wavelength	Lifetime	$\tau_{ave}$
258 nm and 447 nm	1.05 $\mu$ s (63.28%) 11.29 $\mu$ s (36.72%)	2.41 $\mu$ s
285 nm and 610 nm	8.57 $\mu$ s	
325 nm and 496 nm	1.00 $\mu$ s (35.97%) 9.86 $\mu$ s (64.03%)	3.34 $\mu$ s
365 nm and 610 nm	10.50 $\mu$ s	



**Figure S3.** (a) Wavelength-dependent PL spectra and (b) CIE color coordinates of 1% Sb<sup>3+</sup> doped Cs<sub>2</sub>ZrCl<sub>6</sub> at different excitation wavelengths for 1% Sb<sup>3+</sup> doped Cs<sub>2</sub>ZrCl<sub>6</sub>.



**Figure S4.** PL intensity of 10% Sb<sup>3+</sup> doped Cs<sub>2</sub>ZrCl<sub>6</sub> for fresh and 100 days under natural conditions.



**Figure S5.** (a) Emission spectra of the fresh 10% Sb<sup>3+</sup> doped Cs<sub>2</sub>ZrCl<sub>6</sub> after water vapor treatment at different times (relative humidity maintained at 100%). (b) The PL intensity of the samples changes.