Supporting Information

Energy Transfer from Self-Trapped Excitons to Rare Earth in Cs$_2$ZrCl$_6$ Perovskite Variant

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**Fig. S1.** (a) The CIE chromaticity diagram and digital photographs of Cs$_2$ZrCl$_6$. ($\lambda_{ex} = 265$ nm and 339 nm corresponding to point 1 and 2, respectively). (b) The original photograph of Cs$_2$ZrCl$_6$ excited by a 365 nm UV lamp.

**Fig. S2.** The PL spectra of Cs$_2$HfCl$_6$ and Cs$_2$SnCl$_6$. 

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Fig. S3. Wavelength-dependent (a) PL and (b) PLE spectra of Cs$_2$ZrCl$_6$.

Fig. S4. Dependence of the emission intensity at the defect band of Cs$_2$ZrCl$_6$ on the excitation intensity (108-1440 mW/cm$^2$) at 300 K ($\lambda_{ex} = 375$ nm).
Fig. S5. The PLE spectra of Tb$^{3+}$ monitored at 548 nm and 622 nm of Cs$_2$Zr$_{0.9}$Cl$_6$:$0.1$Tb$^{3+}$.

Fig. S6. The PLE spectra of STEs for Cs$_2$Zr$_{1-x}$Cl$_6$:$x$Tb$^{3+}$. 
Fig. S7. The CIE chromaticity diagram and digital photograph of Cs$_2$Zr$_{0.92}$Cl$_{6}$:0.08Tb$^{3+}$. ($\lambda_{\text{ex}} = 339$ nm).

Fig. S8. Normalized PL decay curves of Cs$_2$Zr$_{1-x}$Cl$_6$:xTb$^{3+}$ ($x = 0$, 0.05, 0.08, and 0.10) excited at 265 nm and monitored at 453 nm.
Fig. S9. Normalized temperature-dependent PLE spectra of Cs$_2$ZrCl$_6$ monitored by STEs emission.