Supporting Information

Construction of energy transfer channels from $[SbCl_6]^{3-}$ to Ln^{3+} (Ln^{3+} = Ho^{3+}, Er^{3+}) in $Cs_2NaGdCl_6$ for advanced anti-counterfeiting materials

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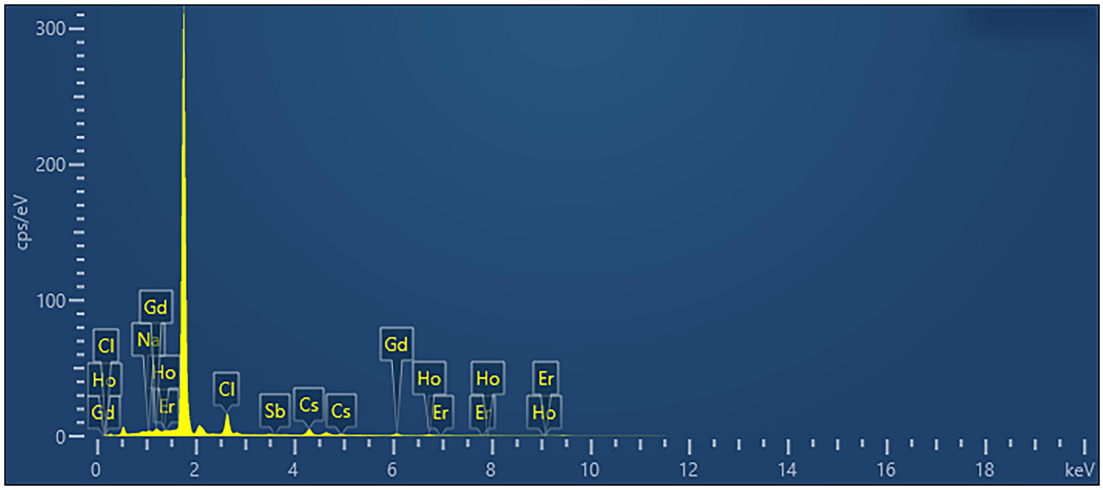

Fig. S1. Energy dispersive spectrum of CNGC:0.7%Sb^{3+}/1%Er^{3+}/8%Ho^{3+}.

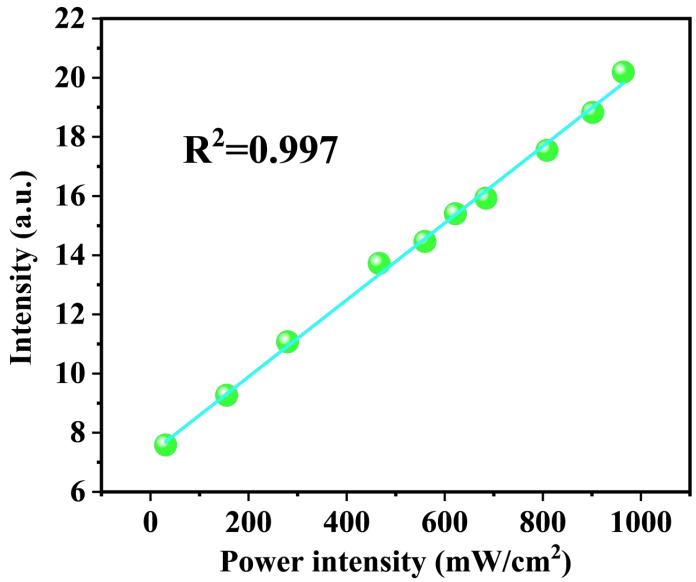

Fig. S2. PL intensity versus excitation power density at room temperature for CNGC:0.7%Sb^{3+}.

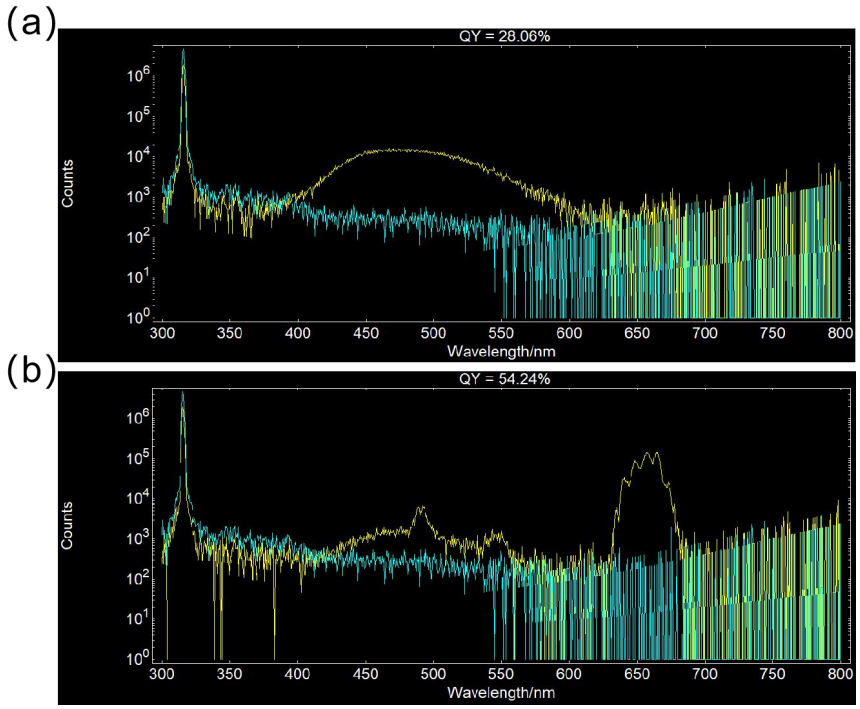

Fig. S3. PLQY of (a) CNGC:0.7%Sb^{3+} and (b) CNGC:0.7%Sb^{3+}/8%Ho^{3+} collected with integrating sphere (λ_{ex} = 316 nm).

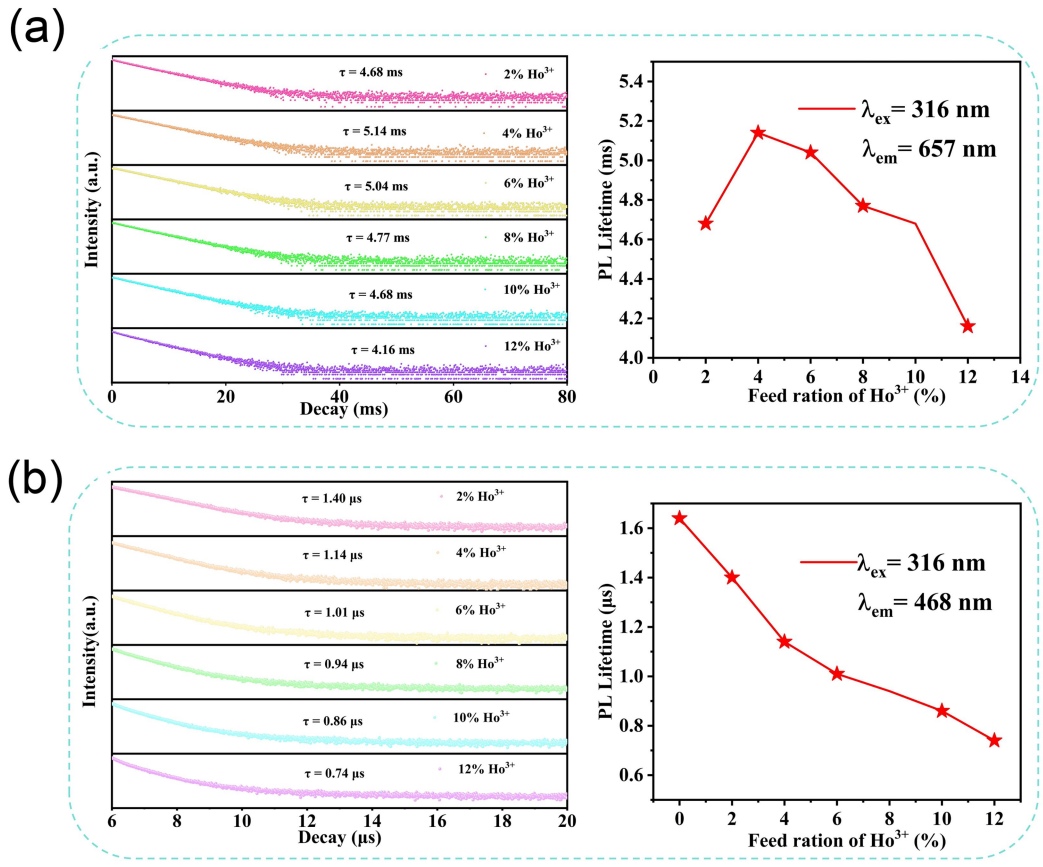

Fig. S4. PL decay curves and lifetimes of the CNGC:0.7%Sb^{3+}/yHo^{3+} monitored at 657 nm (a) and 468 nm (b), respectively.

Tab. S1. Lifetimes monitored at 468 nm under the excitation of 316 nm and the corresponding energy transfer efficiency (η_{ET}).

Samples	Lifetime (μs)	η_{ET}
CNGC:0.7%Sb^{3+}	1.64	0
CNGC:0.7%Sb^{3+}/2%Ho^{3+}	1.40	15%
CNGC:0.7%Sb^{3+}/4%Ho^{3+}	1.14	30%
CNGC:0.7%Sb^{3+}/6%Ho^{3+}	1.01	38%
CNGC:0.7%Sb^{3+}/8%Ho^{3+}	0.94	43%
CNGC:0.7%Sb^{3+}/10%Ho^{3+}	0.86	48%
CNGC:0.7%Sb^{3+}/12%Ho^{3+}	0.74	55%

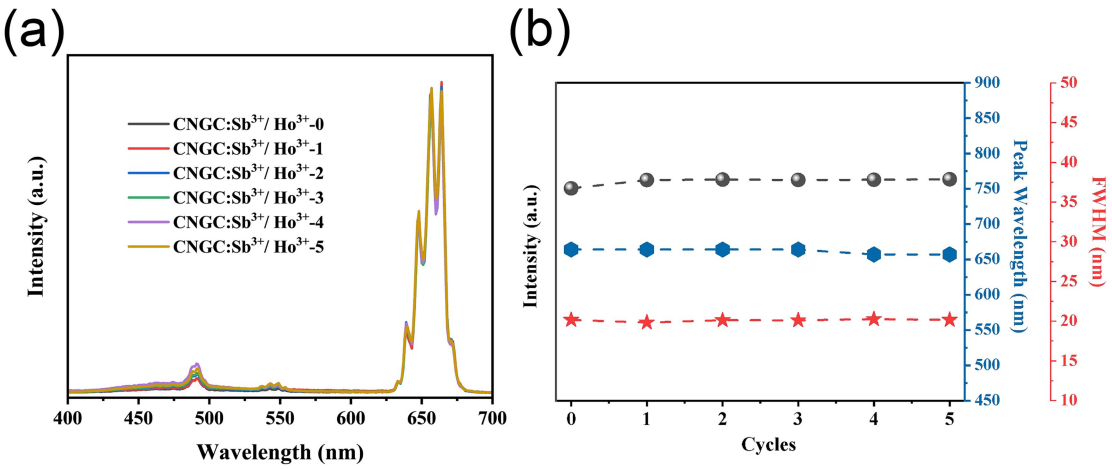

Fig. S5. (a) PL spectra of CNGC:0.7%Sb^{3+}/8%Ho^{3+} and (b) the corresponding variation of emission intensity, peak wavelengths and FWHM values in five cycles of soak-drying. Here, the number following CNGC represents the number of cycles.

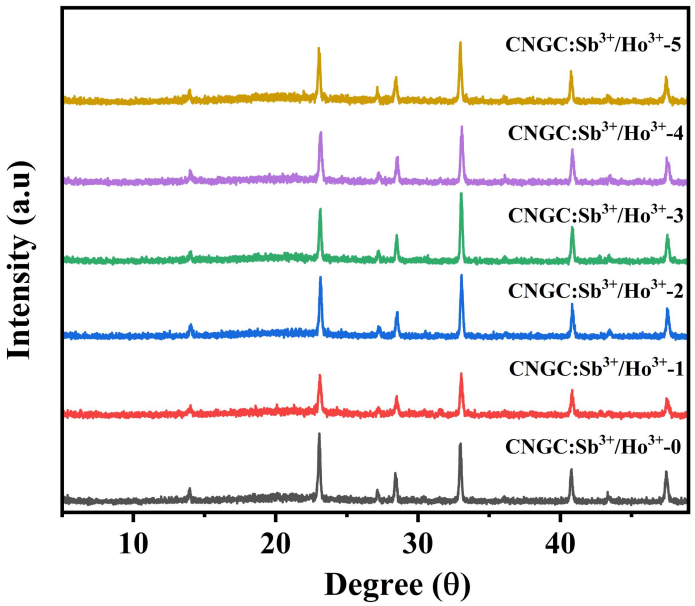

Fig. S6. XRD patterns of CNGC:0.7%Sb^{3+}/8%Ho^{3+} in five cycles of soak-drying. Here, the number following CNGC represents the number of cycles.

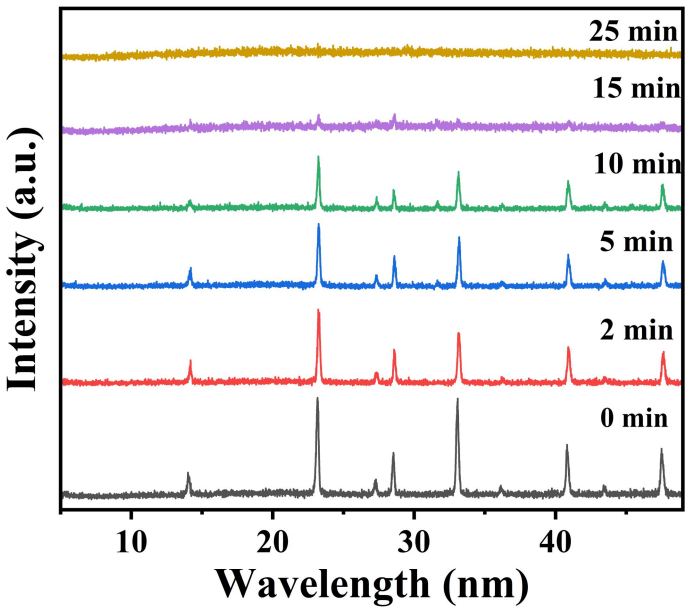

Fig. S7. Time-resolved XRD patterns of CNGC under steam treatment.

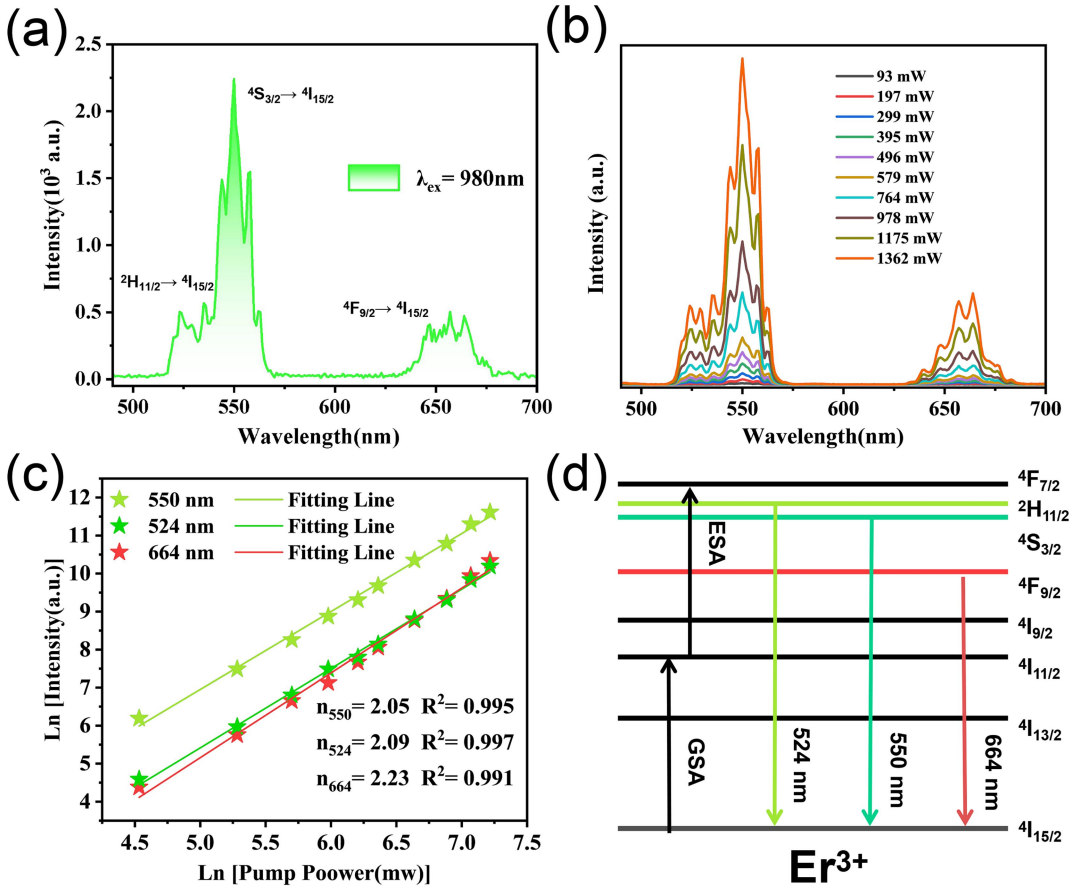

Fig. S8. (a) UC PL spectrum, (b) UC PL spectra with different excitation power intensity, (c) the dependence of pump power and UC PL intensity and (d) UC mechanism diagram of CNGC:0.7%Sb^{3+}/1%Er^{3+}/8%Ho^{3+}.

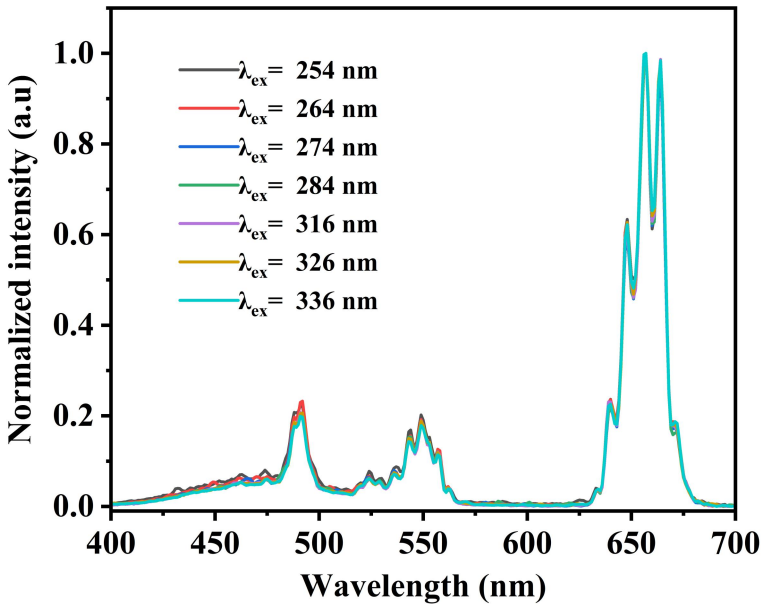

Fig. S9. PL spectra of CNGC:0.7%Sb^{3+}/1%Er^{3+}/8%Ho^{3+} under different UV excitation wavelengths.