Electronic Supplementary Material (ESI) for Journal of Materials Chemistry C.

Supporting Information

A New Class of Battery-free, Mechanically Powered, Piezoelectric $Ca_5Ga_6O_{14}:Tb^{3+}$ Phosphor with Self-recoverable Luminescence

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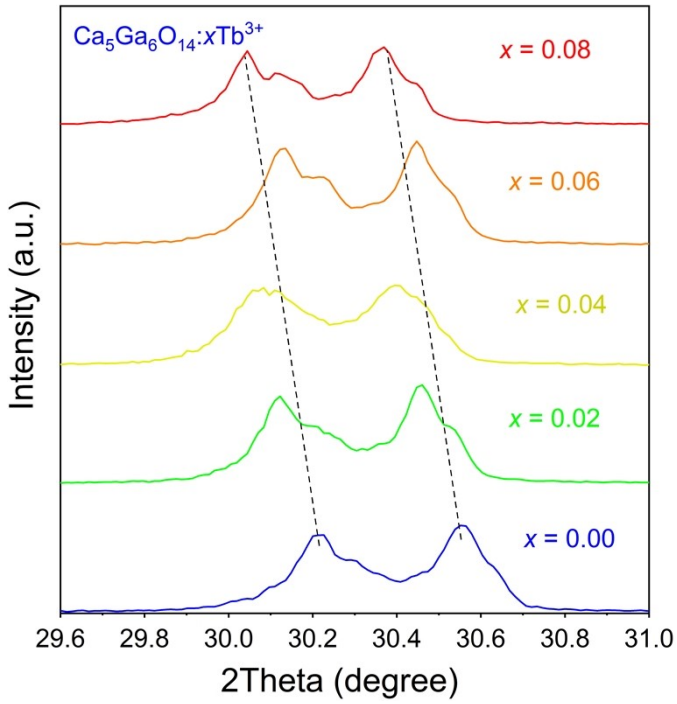

Figure S1. Enlarged view of the XRD diffraction peaks in the 2θ range of 29.6-31.0 degree.

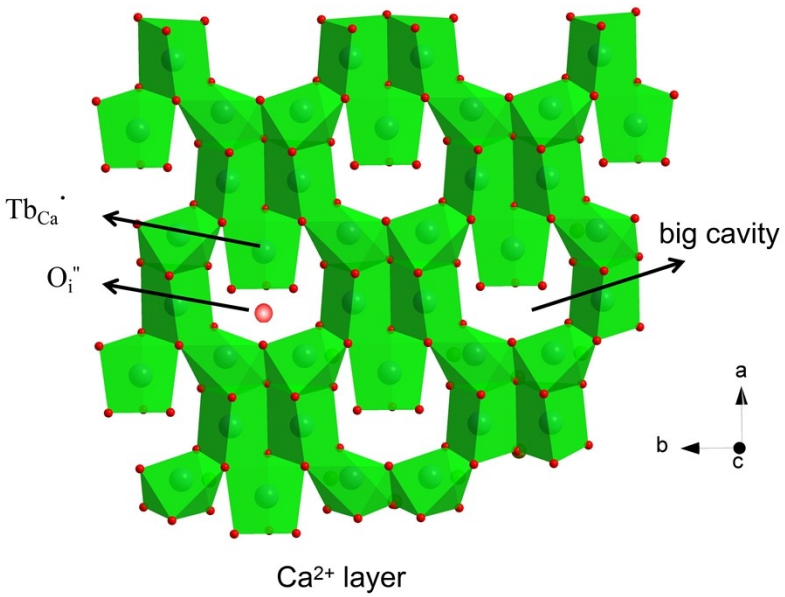

Figure S2. Monolayer crystal structure viewing along *c*-axis.

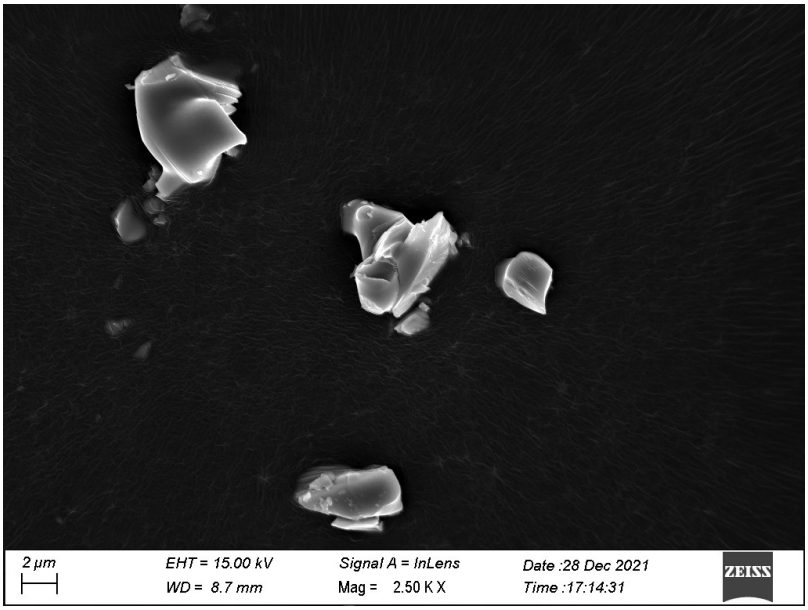

Figure S3. SEM image of the phosphor

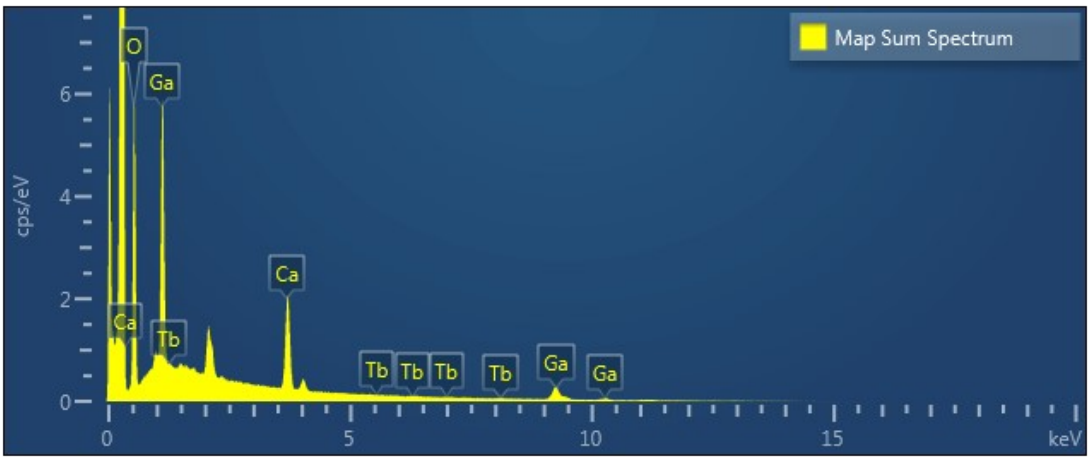

Figure S4. EDS analysis on the phosphor

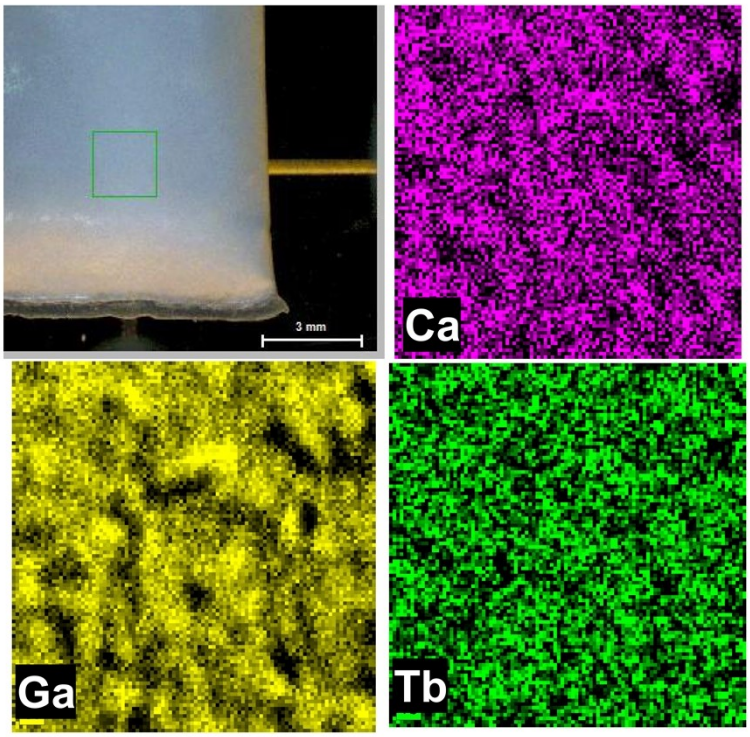

Figure S5. The distribution of Ca, Ga, and Tb^{3+} ions measured by XRF

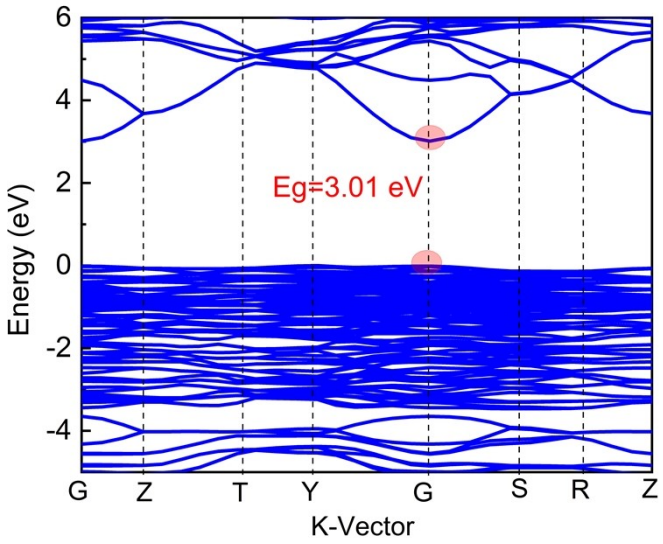

Figure S6. The calculated energy band structure of $Ca_5Ga_6O_{14}$ host.

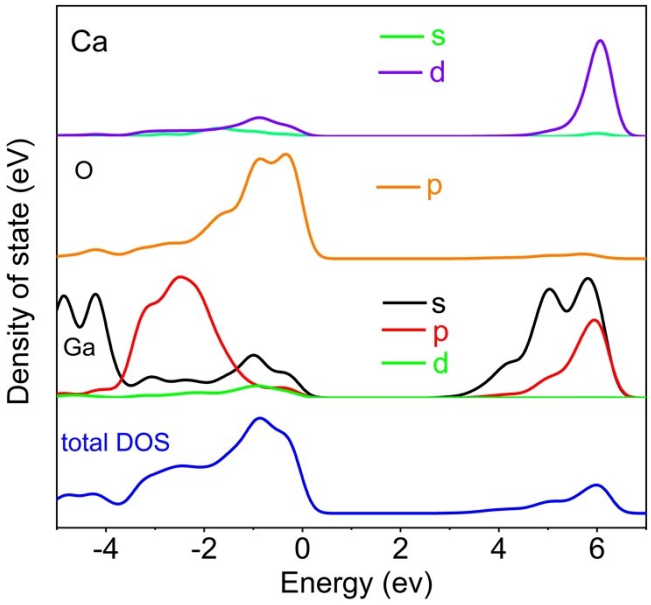

Figure S7. The partial (of Ca, Ga and O atom) and the total density state density of states for $Ca_5Ga_6O_{14}$ host.

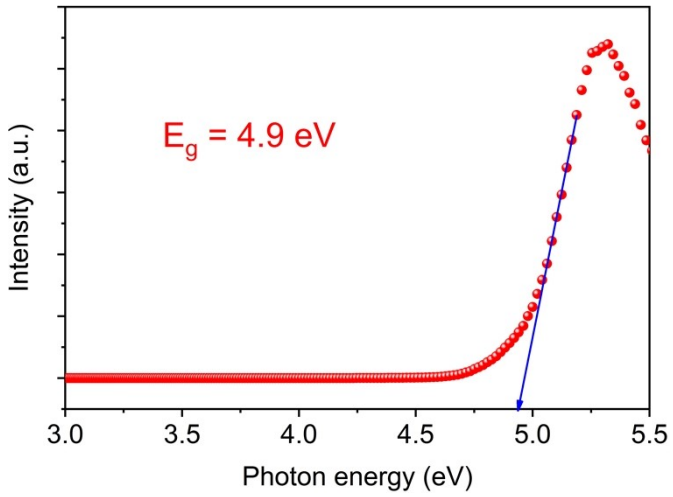

Figure S8. The calculated bandgap for $Ca_5Ga_6O_{14}$

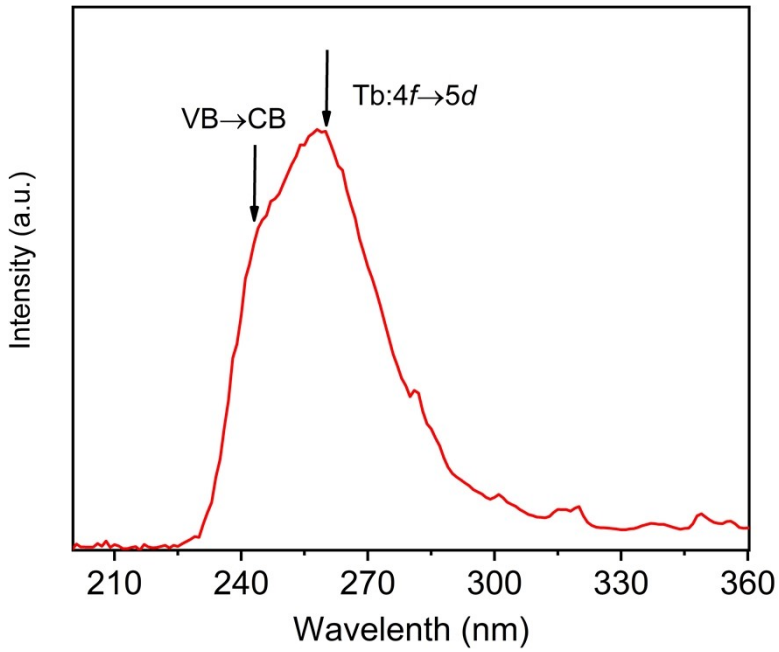

Figure S9. The PLE spectra of $Ca_5Ga_6O_{14}$:Tb^{3+} phosphor by monitoring at 543 nm emission

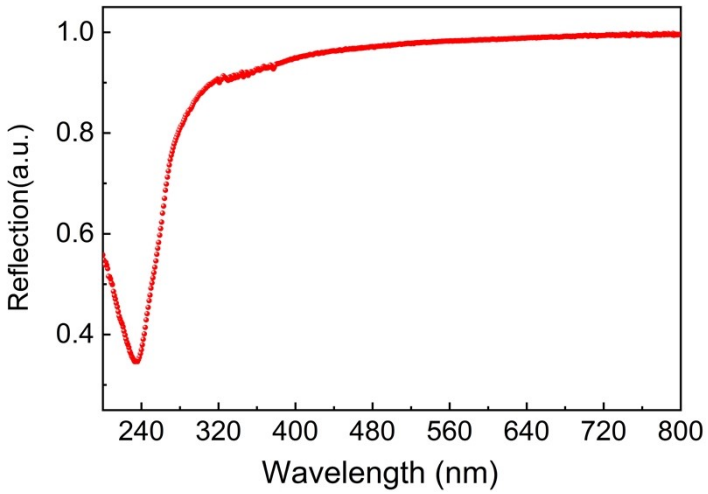

Figure S10. The absorption spectra of $Ca_5Ga_6O_{14}:Tb^{3+}$ phosphor showing a strong absorption dip at 240 nm.

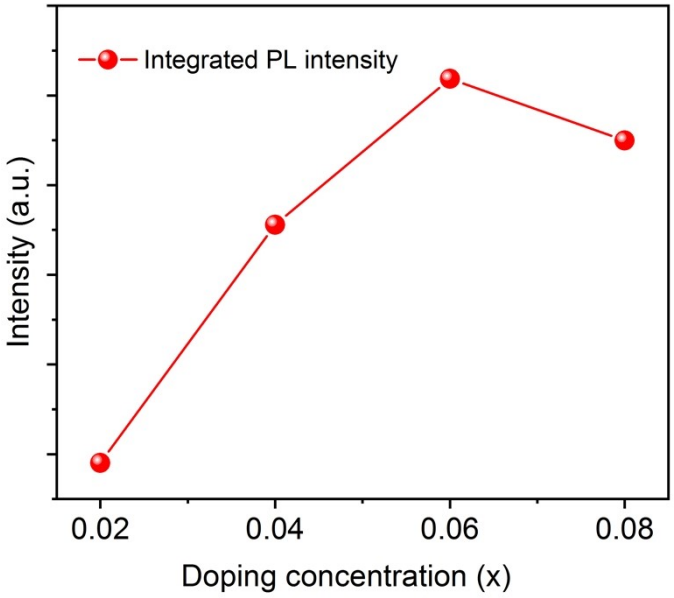

Figure S11. Integrated PL intensity of $Ca_5Ga_6O_{14}:xTb^{3+}$ phosphor

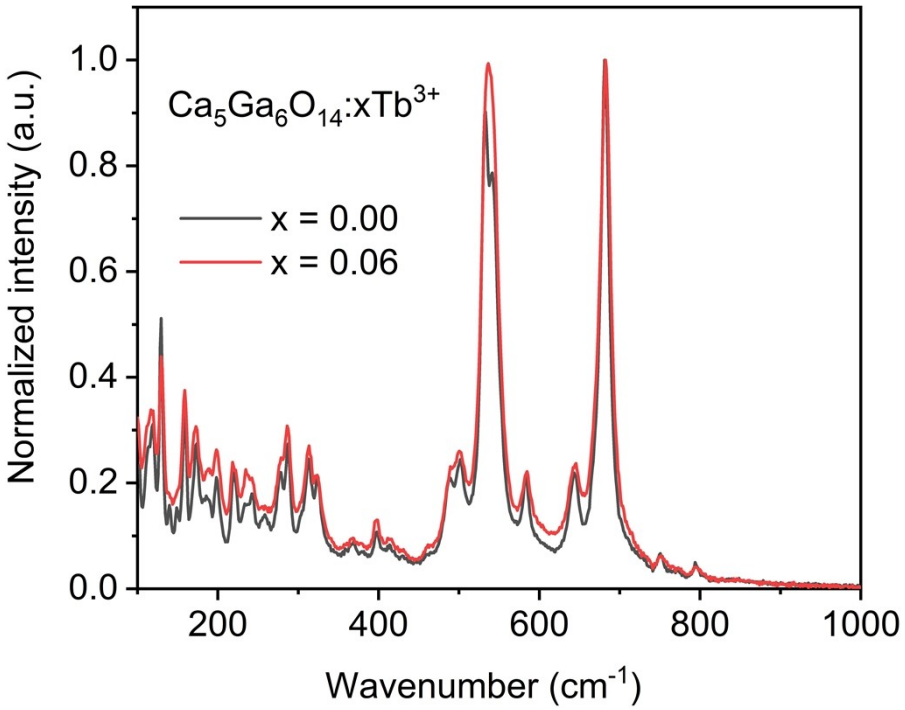

Figure S12. Raman spectra of $Ca_5Ga_6O_{14}$:*x*Tb^{3+} (*x* = 0.00 and 0.06) phosphors

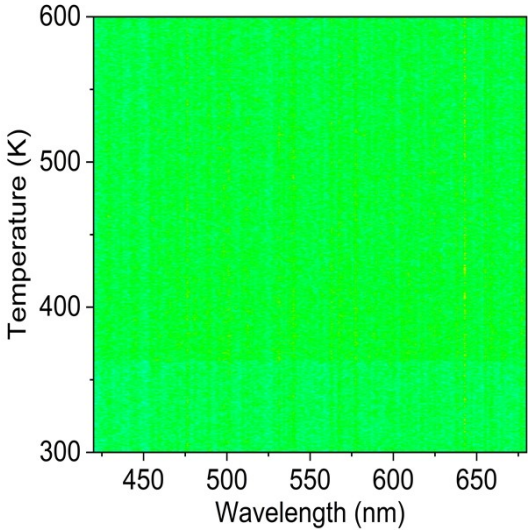

Figure S13. Temperature-wavelength-intensity plot of three-dimensional TL mapping of $Ca_5Ga_6O_{14}$:6%Tb^{3+} phosphor after thermal annealing at 673 K.

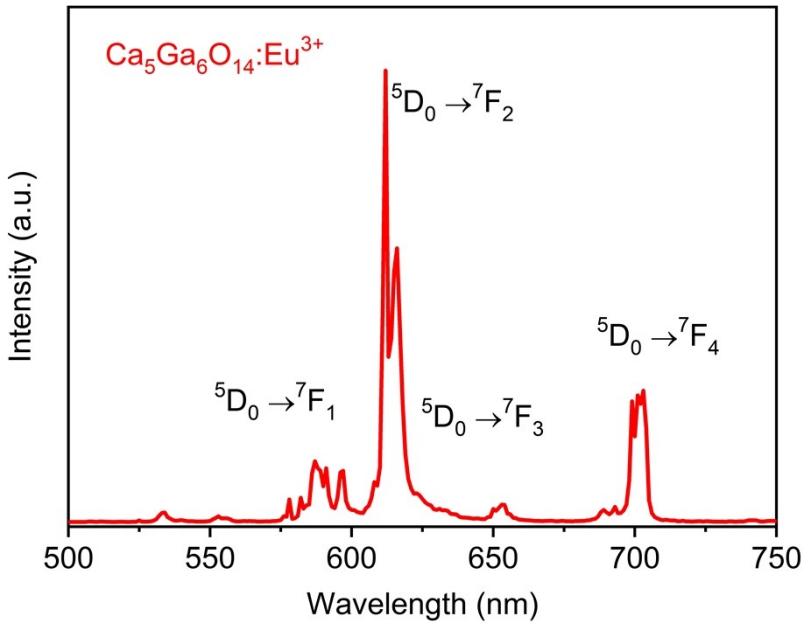

Figure S14. PL spectra of $Ca_5Ga_6O_{14}:Eu^{3+}$ phosphor under 260 nm UV light excitation

Table S1 EDS analysis on element compositions

Element	Line Type	Apparent Concentration	k Ratio	Wt%	Wt% Sigma	Atomic %
O	K series	6.65	0.02237	51.16	0.26	79.28
Ca	K series	2.32	0.02073	13.37	0.12	8.27
Ga	L series	3.21	0.03007	34.65	0.22	12.32
Tb	L series	0.10	0.00097	0.82	0.30	0.13
Total:				100.00		100.00

Table S2 CIE coordination (x, y) of the $Ca_5Ga_6O_{14}:xTb^{3+}$ phosphors with different doping concentrations

Tb^{3+} doping concentrations	CIE-x	CIE-y
0.02	0.328	0.485
0.04	0.339	0.519
0.06	0.338	0.529
0.08	0.342	0.538

Table S3 The reported piezoelectric strain tensor d_{ij} in unite of pm/V

Compound	d_{33}	d_{31}	d_{15}
AlN	5.4	-2.1	-2.9
GaN	2.7	-1.4	-1.8
ϵ-Ga_2O_3	4.85	-0.48	9.622

Table S4 The reported piezoelectric stress tensor e_{ij} in unite of $10^{-10}C/m^2$

Compound	e_{33}	e_{31}	e_{15}
AlN	1.61	-0.65	-0.34
ZnO	1.33	-0.65	-0.49
GaN	0.67	-0.37	-0.23
ϵ-Ga_2O_3	0.941	0.011	0.595