Supplementary Information

Efficient near-infrared luminescence in garnet $Na_2CaTi_2Ge_3O_{12}:Cr^{3+}$ for light-emitting-diodes applications

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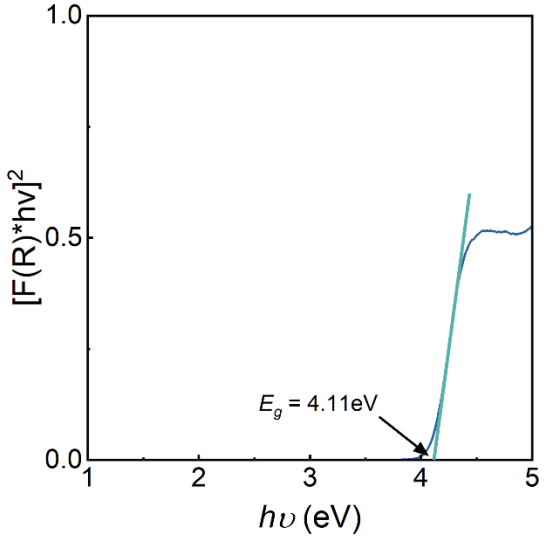

Fig. S1. The optical band gap of $Na_2CaTi_2Ge_3O_{12}$ sample estimated based on Kubelka–Munk function.

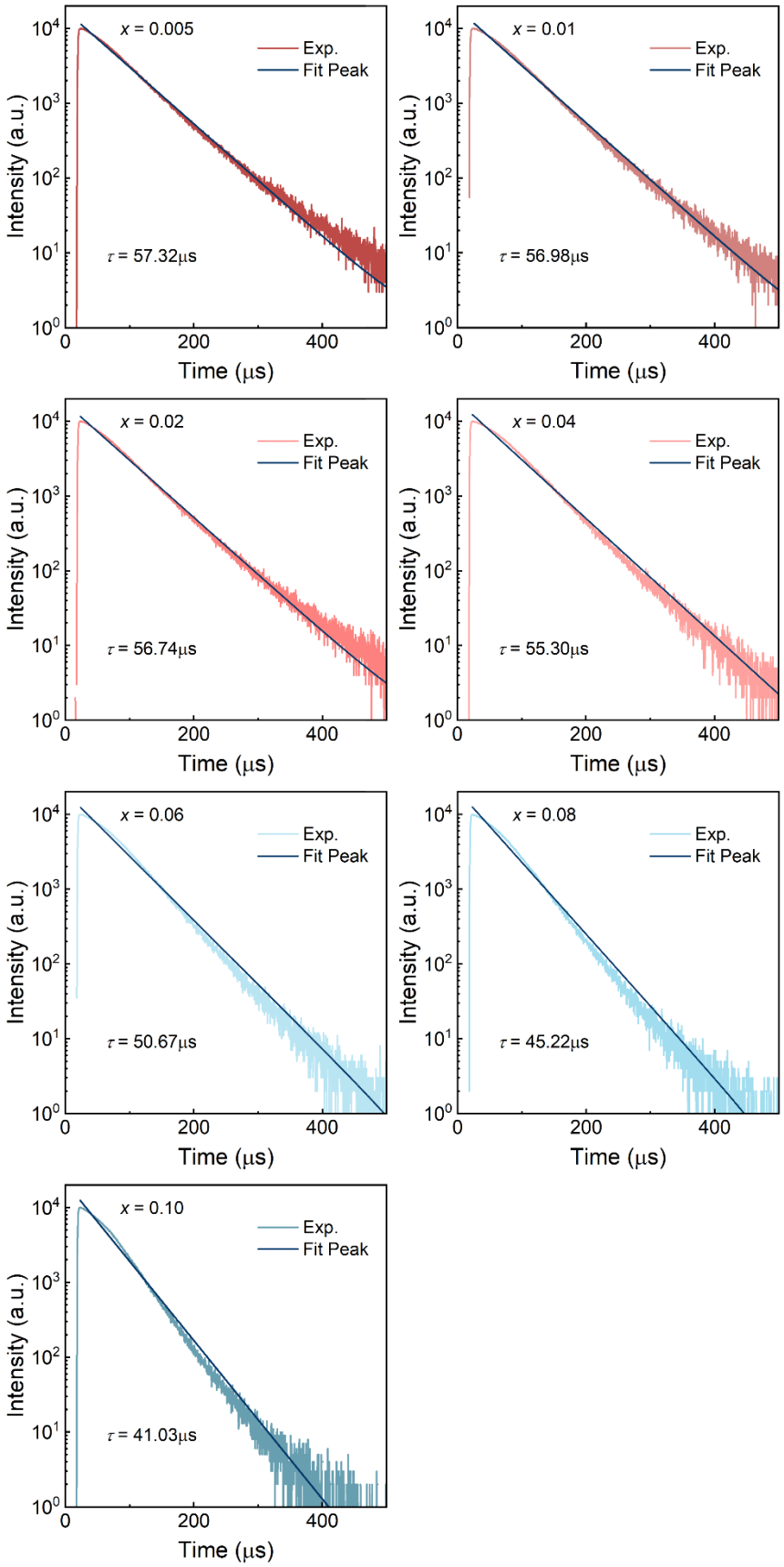

Fig. S2. Decay curves of $Na_2CaTi_{2-x}Ge_3O_{12}$:xCr^{3+} (x = 0.005-0.10) fitted by single exponential function.

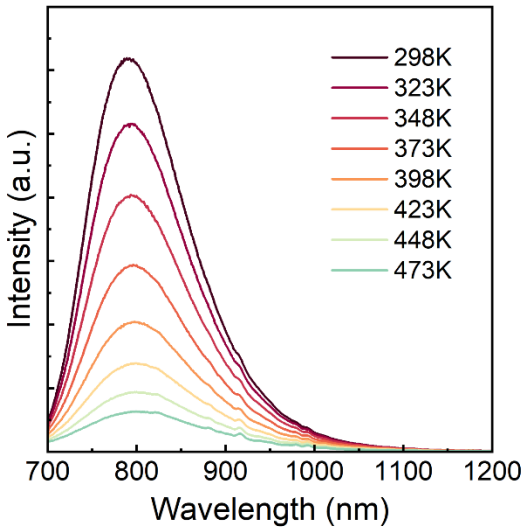

Fig. S3. The temperature-dependent emission spectra of $Na_2CaTi_{1.94}Ge_3O_{12}:0.06Cr^{3+}$ sample in temperature range of 298 to 473 K under 465 nm excitation.

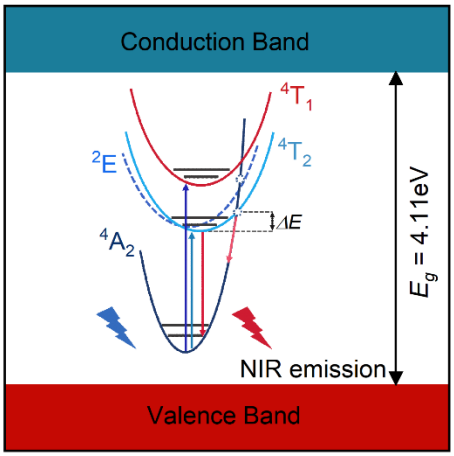

Fig. S4. Configuration coordinate diagram for Cr^{3+} ion luminescence.

Table S1. The Refined Atomic Positions of $Na_2CaTi_2Ge_3O_{12}$.

Atom	Wyck. position	Occ.	x	y	z	U_{iso}
Na (1)	24c	0.66667	0.125	0	0.25	0.01298
Ca (1)	24c	0.33333	0.125	0	0.25	0.01298
Ti (1)	16a	1	0	0	0	0.01545
Ge (1)	24d	1	0.375	0	0.25	0.01415
O (1)	96h	1	0.098690	0.204770	0.288250	0.01505

Table S2. The Refined Atomic Positions of $Na_2CaTi_{1.94}Cr_{0.06}Ge_3O_{12}$.

Atom	Wyck. position	Occ.	x	y	z	U_{iso}
Na (1)	24c	0.66667	0.125	0	0.25	0.01257
Ca (1)	24c	0.33333	0.125	0	0.25	0.01257
Ti (1)	16a	0.97	0	0	0	0.01504
Cr (1)	16a	0.03	0	0	0	0.01504
Ge (1)	24d	1	0.375	0	0.25	0.01374
O (1)	96h	1	0.098690	0.204770	0.288250	0.01464

Table S3. Input and Output Parameters of Fabricated Device.

Driving currents (mA)	Input power (mW)	NIR Output Power (mW)	Conversion Efficiency
25	65.5	4.852416504	7.41%
50	135	9.541780358	7.07%
75	207	14.07706514	6.80%
100	281	18.23501866	6.49%
125	357.5	21.797598	6.10%
150	435	24.55317315	5.64%
175	514.5	28.42484603	5.52%
200	594	31.09315895	5.23%
225	675	32.94756445	4.88%

250	757.5	36.17725033	4.78%
275	841.5	37.33464158	4.44%
300	927	39.06731262	4.21%
325	1014	42.89356133	4.23%
350	1102.5	43.72146745	3.97%
375	1192.5	46.60280484	3.91%
400	1280	48.19769809	3.77%
425	1372.75	49.06416016	3.57%
450	1462.5	48.51118964	3.32%