

**A non-rare earth doped broadband emission phosphor located in
NIR-II for ethanol concentration detection**

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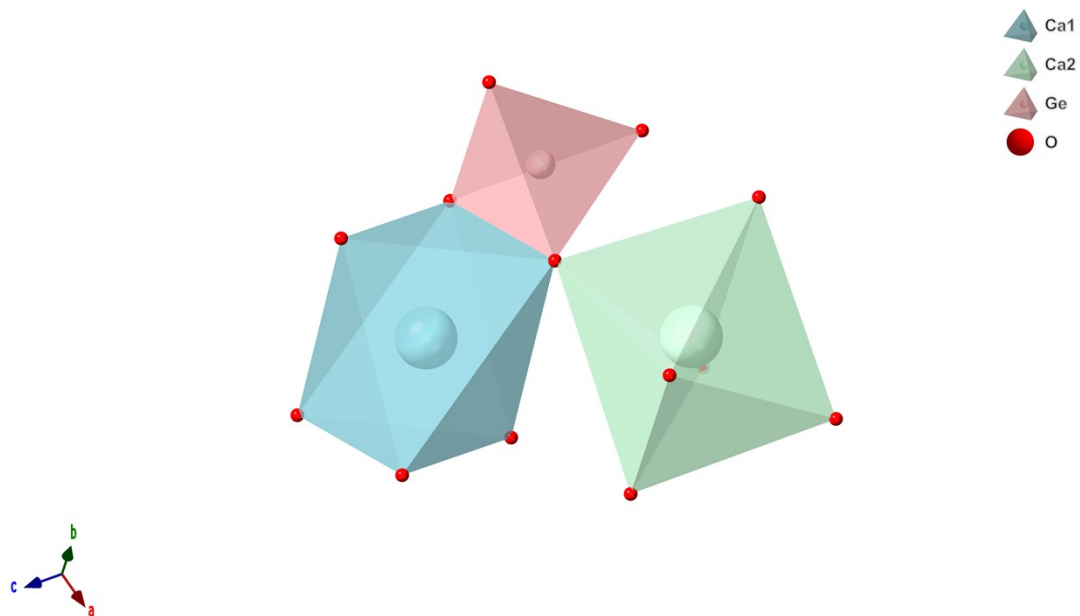


Figure S1. Visualization of Ca^{2+} and Ge^{4+} polyhedra in Ca_2GeO_4 structures.

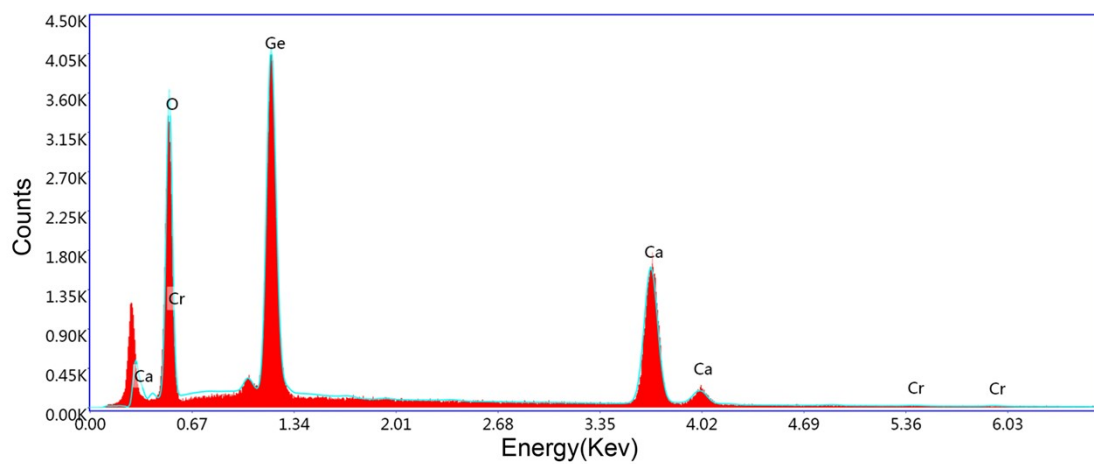


Figure S2. EDS spectrum of $\text{Ca}_2\text{GeO}_4: 0.003\text{Cr}$.

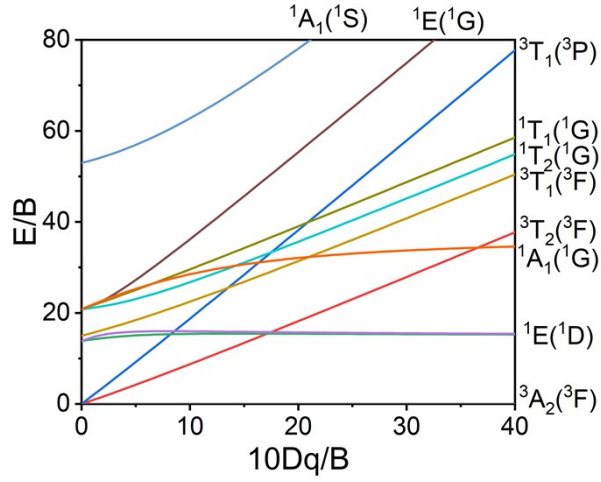


Figure S3. T-S diagram for Cr^{4+} in the tetrahedral coordination environment.

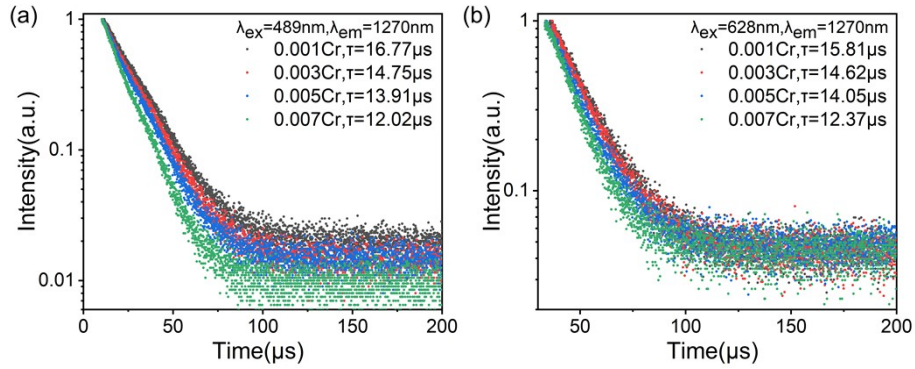


Figure S4. The decay curves of $\text{Ca}_2\text{GeO}_4:\text{xCr}$ ($\lambda_{\text{ex}}=489$ nm (a); $\lambda_{\text{ex}}=628$ nm (b); $\lambda_{\text{em}}=1270$ nm).

Table S1. The lifetimes of $\text{Ca}_2\text{GeO}_4:\text{xCr}$ ($\lambda_{\text{ex}}=489$ nm ; $\lambda_{\text{ex}}=628$ nm).

$\lambda_{\text{ex}}=489\text{nm}$	0.001Cr	0.003Cr	0.005Cr	0.007Cr
τ	16.77 μs	14.75 μs	13.91 μs	12.02 μs
τ_1	2.69 μs	3.09 μs	3.74 μs	5.67 μs
τ_2	17.31 μs	16.63 μs	15.16 μs	13.26 μs

$\lambda_{\text{ex}}=628\text{nm}$	0.001Cr	0.003Cr	0.005Cr	0.007Cr
τ	15.81 μs	14.62 μs	14.05 μs	12.37 μs
τ_1	15.81264 μs	14.62093 μs	14.05404 μs	12.37425 μs
τ_2	15.81028 μs	14.62262 μs	14.05331 μs	12.37541 μs

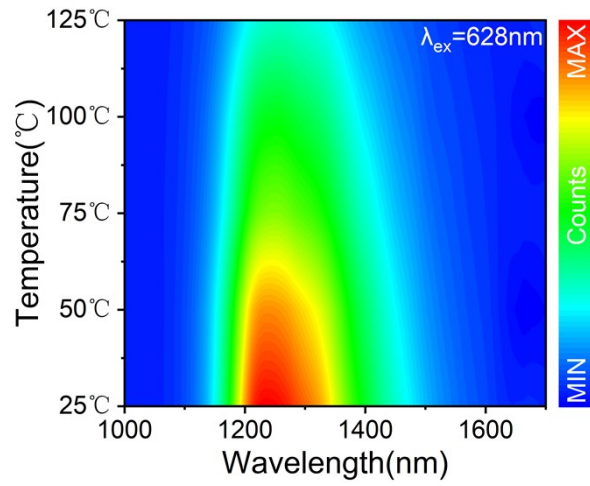


Figure S5. Temperature-dependent PL spectra of $\text{Ca}_2\text{GeO}_4:0.003\text{Cr}$ ($\lambda_{\text{ex}}=628$ nm).

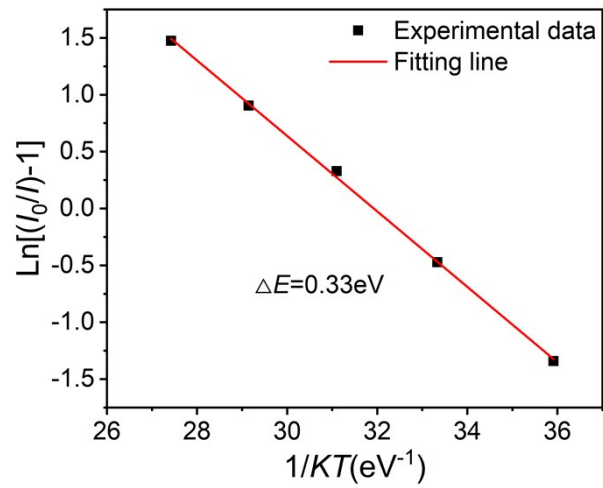


Figure S6. The plots of $\text{Ln} (I/I_0-1)$ versus $1/KT$.