Supporting Information

Near-infrared afterglow enhancement of $ZnGa_2O_4:Cr^{3+}$ via regulating trap distribution guided by VRBE diagram

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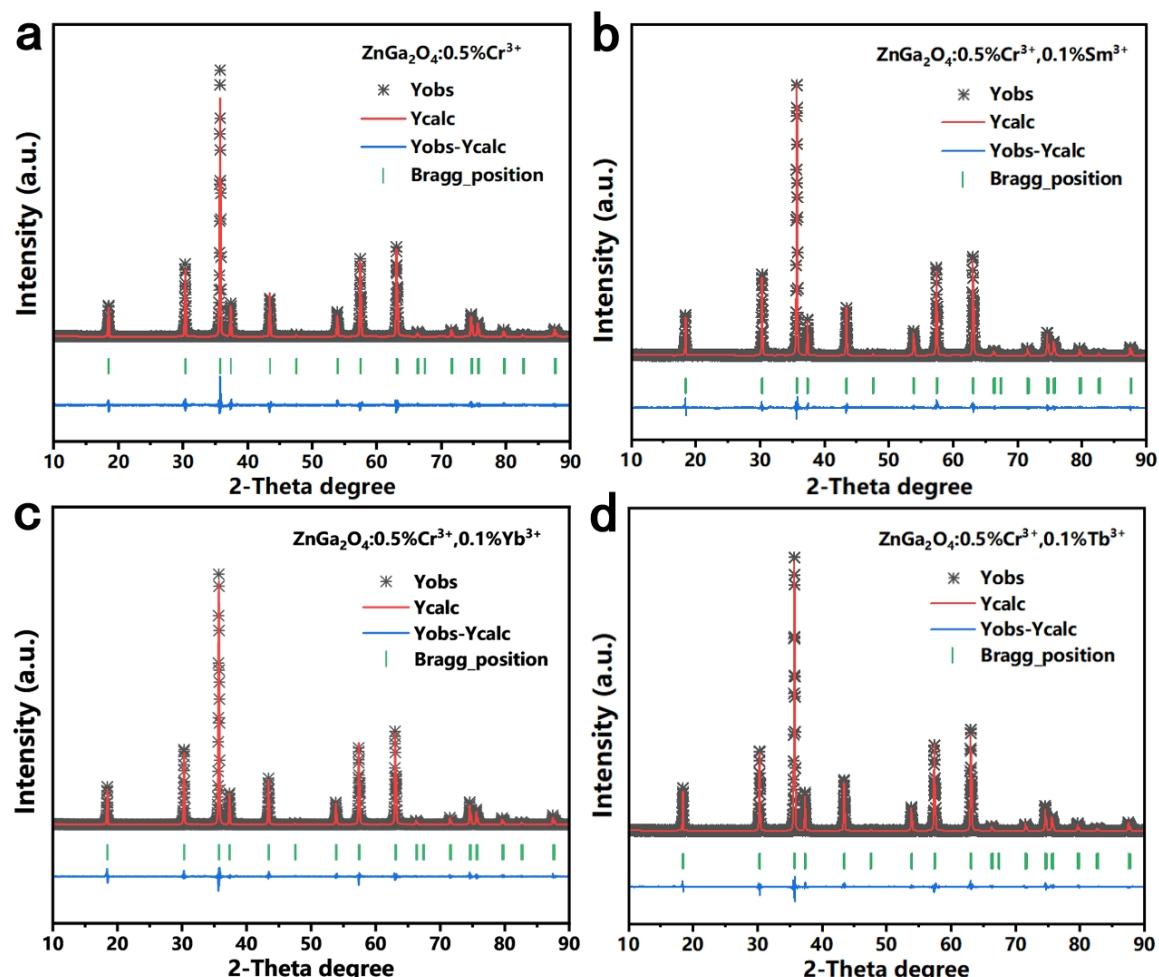
Fig. S1 XRD refinement of (a) $ZnGa_2O_4:0.5\%Cr^{3+}$, (b) $ZnGa_2O_4:0.5\%Cr^{3+},0.1\%Sm^{3+}$, (c) $ZnGa_2O_4:0.5\%Cr^{3+},0.1\%Yb^{3+}$ and (d) $ZnGa_2O_4:0.5\%Cr^{3+},0.1\%Tb^{3+}$.

Table S1 XRD refinement results and lattice parameters of $ZnGa_2O_4$:0.5%Cr^{3+} and $ZnGa_2O_4$:0.5%Cr^{3+},0.1%Ln^{3+}(Ln=Sm,Yb,Tb)

Sample	$a=b=c$ (Å)	V (Å)	$\alpha=\beta=\gamma$
$ZnGa_2O_4$:0.5%Cr^{3+}	8.33852(7)	579.785(8)	90°
$ZnGa_2O_4$:0.5%Cr^{3+},0.1%Sm^{3+}	8.33512	579.075	90°
$ZnGa_2O_4$:0.5%Cr^{3+},0.1%Yb^{3+}	8.33761(10)	579.594(12)	90°
$ZnGa_2O_4$:0.5%Cr^{3+},0.1%Tb^{3+}	8.33436	578.917	90°
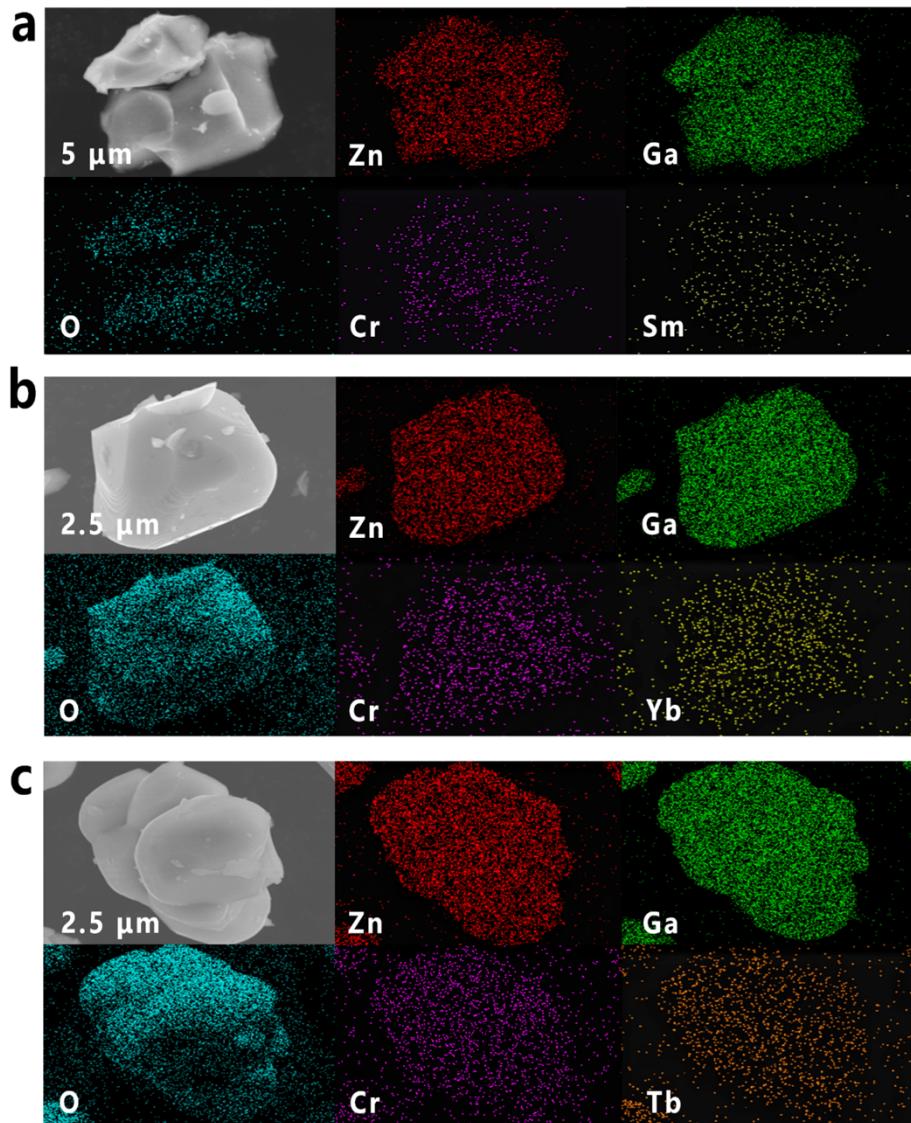
**Fig. S2** SEM image of a single crystal and the corresponding EDS elemental mapping images of (a) $ZnGa_2O_4$:0.5%Cr^{3+},0.1%Sm^{3+}. (b)$ZnGa_2O_4$:0.5%Cr^{3+},0.1%Yb^{3+}. (c)

$ZnGa_2O_4:0.5\%Cr^{3+},0.1\%Tb^{3+}$
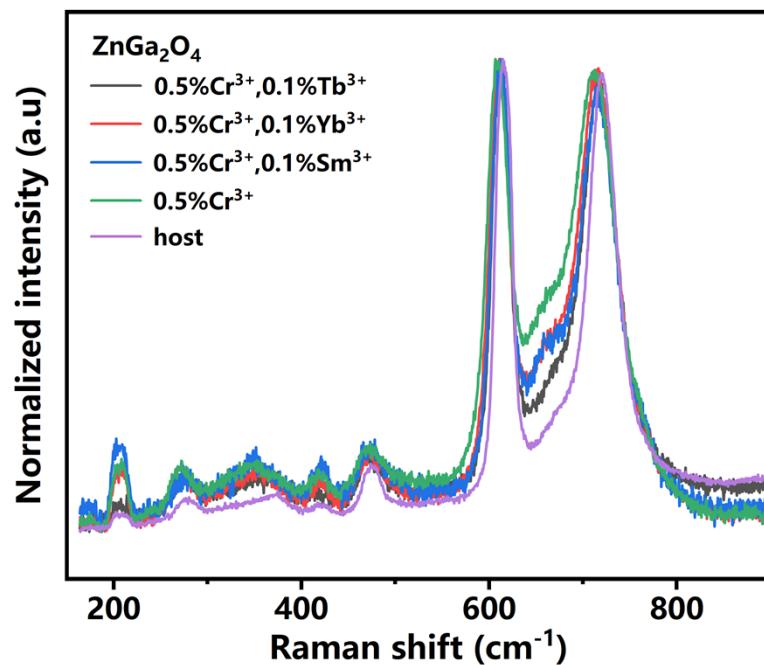
Fig. S3 Normalized Raman spectra of $ZnGa_2O_4$, $ZnGa_2O_4:0.5\%Cr^{3+}$ and $ZnGa_2O_4:0.5\%Cr^{3+},0.1\%Ln^{3+}(Ln=Sm,Yb,Tb)$

Table S2 Trap depth and standard deviation of the samples

	Sample 1 (eV)	Sample 2 (eV)	Sample 3 (eV)	Sample 4 (eV)	Standard deviation (eV)
Sm^{3+}	0.720	0.726	0.730	0.724	0.004
Yb^{3+}	0.712	0.704	0.726	0.716	0.008
Tb^{3+}	0.700	0.702	0.712	0.710	0.007
Cr^{3+}	0.690	0.692	0.711	0.696	0.008