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

Supporting Information

Extending the applications for lanthanide ions: efficient emitters in short-wave infrared persistent luminescence

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Table S1. Peak wavelengths and afterglow durations of $Ca_2SnO_4:Ln^{3+}$ persistent phosphors in the present work as well as other reported SWIR persistent phosphors.

Material	Peak Wavelength	Decay time	Reference
$Ca_2SnO_4:Er^{3+}$	1533 nm	>10 h	This work
$Ca_2SnO_4:Yb^{3+}$	1000 nm	>10 h	This work
$Ca_2SnO_4:Pr^{3+}$	1115 nm	>10 h	This work
$Ca_2SnO_4:Nd^{3+}$	1080 nm	~1 h	This work
$Ca_2SnO_4:Ho^{3+}$	1180 nm	~30 min	This work
$Ca_2SnO_4:Tm^{3+}$	1195 nm	~20 min	This work
$SrAl_2O_4:Eu^{2+},Dy^{3+},Er^{3+}$	1530 nm	>10 min	[1]
$Zn_3Ga_2Ge_2O_{10}:Ni^{2+}$	1290 nm	>10 h	[2]
$Y_3Al_2Ga_3O_{12}:Er^{3+},Ce^{3+},Cr^{3+}$	1532 nm	>10 h	[3]
$MgGeO_3:Yb^{3+}$	~1000 nm	>100 h	[4]

References

[1] N. Y. Yu, F. Liu, X. F. Li and Z. W. Pan, *Appl. Phys. Lett.*, 2009, **95**, 231110.
[2] F. Liu, Y. J. Liang, Y. F. Chen and Z. W. Pan, *Adv. Optical Mater*., 2016, **4**, 562.
[3] J. Xu, D. Murata, J. Ueda and S. Tanabe, *J. Mater. Chem. C*, 2016, **4**, 11096.
[4] Y. J. Liang, F. Liu, Y. F. Chen, X. J. Wang, K. N. Sun and Z. W. Pan, *Light Sci. Appl.*, 2016, **5**, e16124.

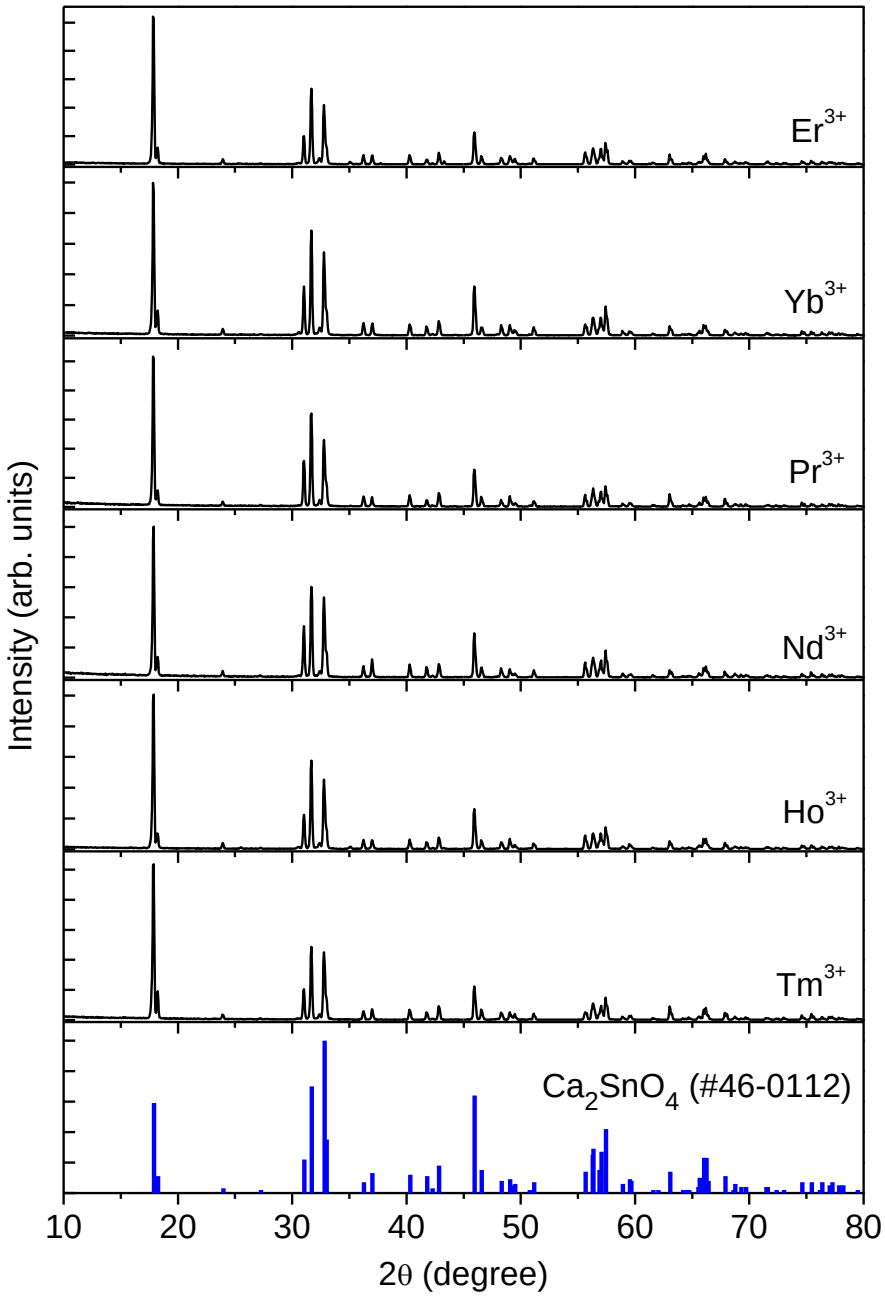

Figure S1. X-ray diffraction patterns of Ca_2SnO_4:Ln^{3+} (Ln = Er, Yb, Pr, Nd, Ho, Tm) phosphors. The indexation of orthorhombic Ca_2SnO_4 host (#46-0112) is also presented. The patterns were acquired on a PANalytical X'Pert Pro x-ray diffractometer using Cu Kα1 radiation (λ = 1.5406 Å). The doping of Ln^{3+} ions does not change the crystal structure of the Ca_2SnO_4 host.

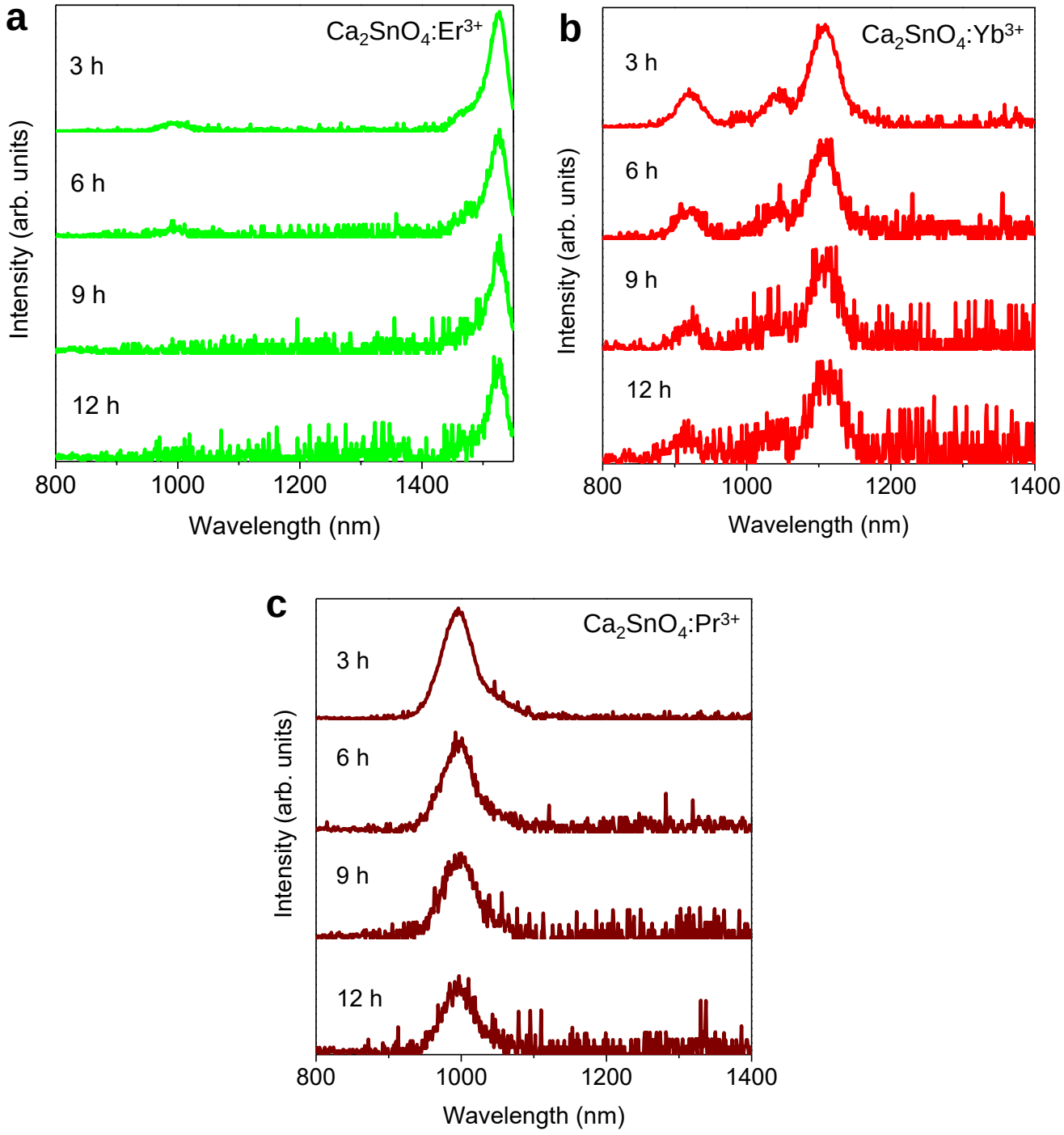

Figure S2. Persistent luminescence emission spectra of (a) $Ca_2SnO_4:Er^{3+}$, (b) $Ca_2SnO_4:Yb^{3+}$, and (c) $Ca_2SnO_4:Pr^{3+}$ persistent phosphors at 3–12 h after the stoppage of the irradiation. The sample was irradiated by a 254 nm UV lamp for 10 min.

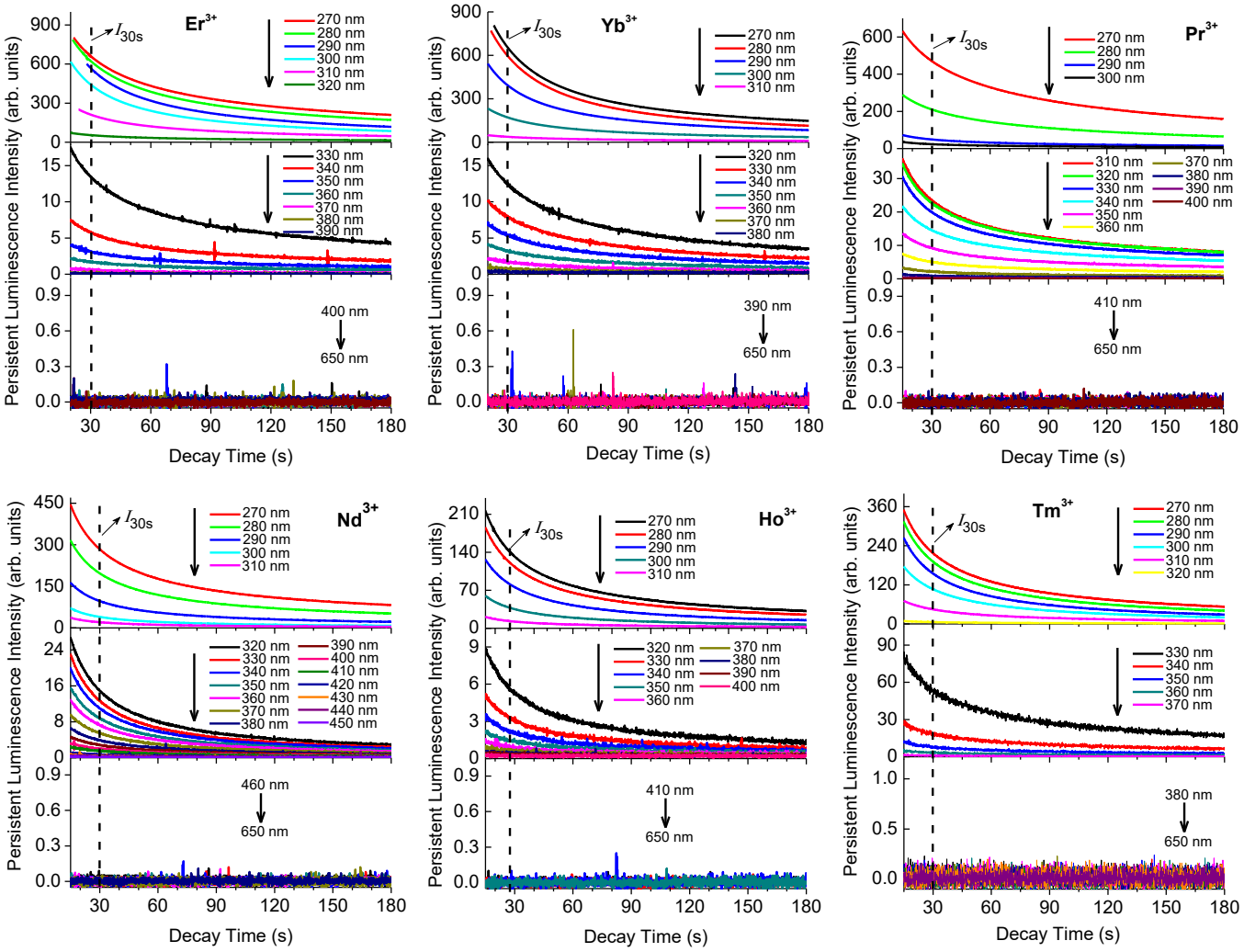

Figure S3. Room temperature persistent luminescence decay curves of $Ca_2SnO_4:Ln^{3+}$ (Ln = Er, Yb, Pr, Nd, Ho, Tm) persistent phosphors irradiated by monochromatic light between 270–650 nm for 5 min. The monitoring wavelengths are 1533 nm for Er^{3+} (a), 1000 nm for Yb^{3+} (b), 1115 nm for Pr^{3+} (c), 1080 nm for Nd^{3+} (d), 1180 nm for Ho^{3+} (e), and 1195 nm for Tm^{3+} (f). The persistent luminescence intensity at time of 30 s after the stoppage of the irradiation (I_{30s}) was used to plot the persistent luminescence intensity as a function of excitation wavelength shown in Fig. 4 in the main text.

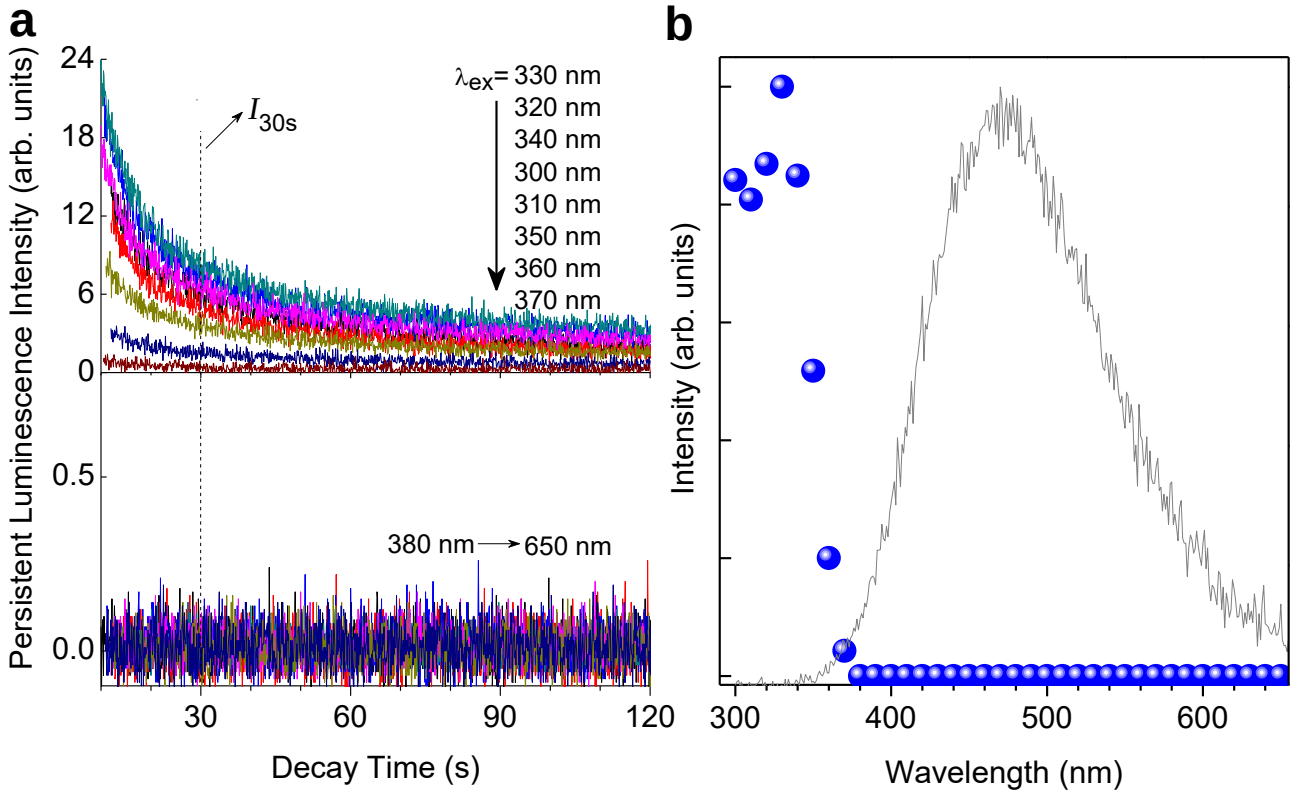

Figure S4. Persistent luminescence properties of Ca_2SnO_4 host. (a) Persistent luminescence decay curves of Ca_2SnO_4 host irradiated by monochromatic light between 300–650 nm for 5 min. The monitoring wavelength is 470 nm. (b) Persistent luminescence excitation (blue balls curve) and emission (black curve) spectra. The persistent luminescence excitation spectrum was obtained by plotting the persistent luminescence intensities at 30 s decay (I_{30s}; indicated by the vertical dash line in (a) as a function of the excitation wavelengths (300–650 nm). The persistent luminescence emission spectrum was recorded at 1 min delay after the host was irradiated by 260 nm light for 5 min. The un-doped Ca_2SnO_4 host emits visible afterglow peaked at ~470 nm.