Supplementary Information (SI) for Dalton Transactions.

Emission and ESA/GSA thermographic properties of Pr-doped tungstate phosphors under Vacuum Ultraviolet and Visible Excitation

R. Lisiecki, N. Rebrova, P.J. Dereń*

Institute of Low Temperature and Structure Research, Polish Academy of Sciences, Okólna 2, 50-422, Wrocław, Poland

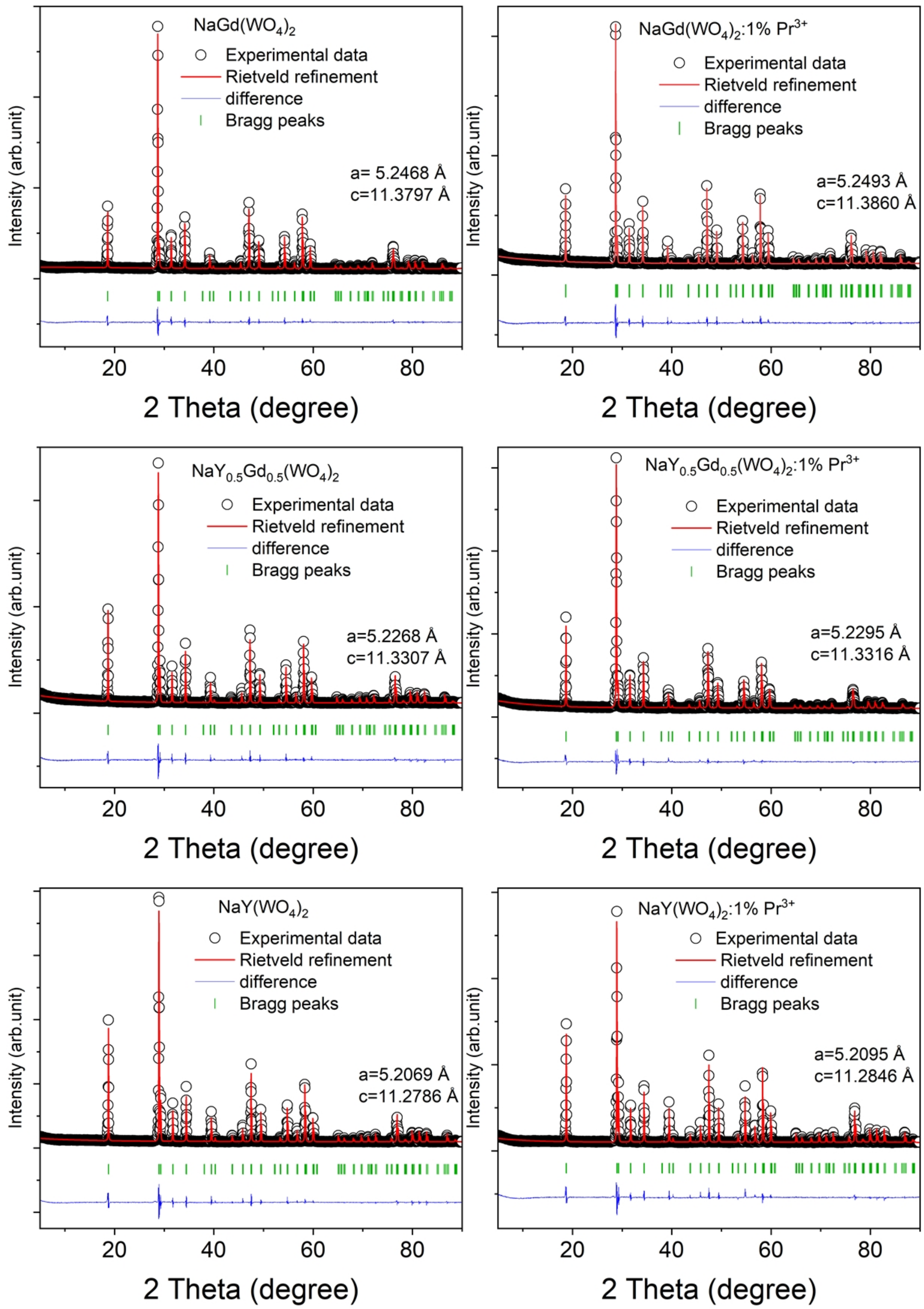

Figure S1. Rietveld refinement patterns of XRD data for hosts and 1 % Pr^{3+}-doped $NaGd(WO_4)_2$, $NaY(WO_4)_2$, and $NaGd_{0.5}Y_{0.5}(WO_4)_2$ samples.

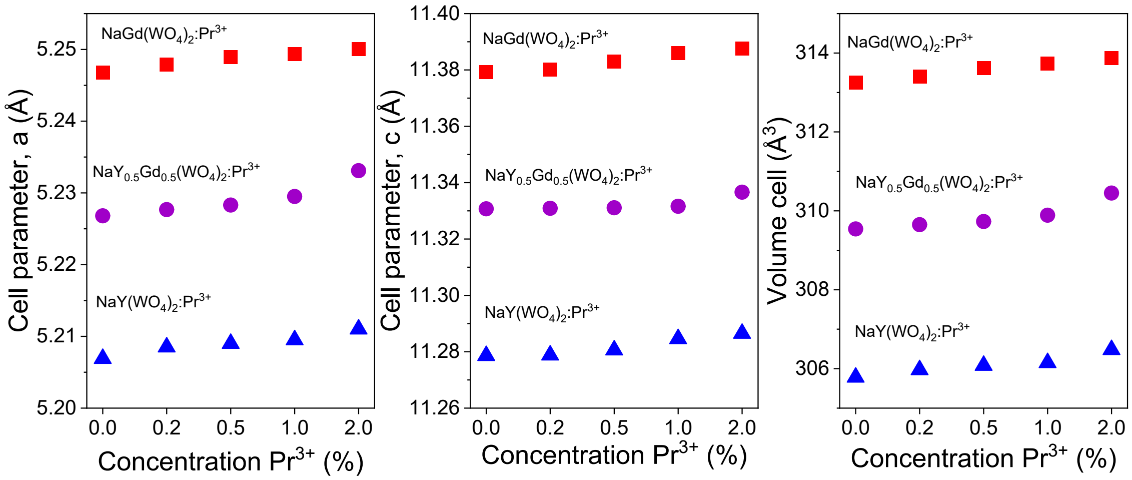

Figure S2. Lattice parameters and the cell volume vs Pr^{3+} concentration for $NaGd(WO_4)_2:Pr^{3+}$, $NaY(WO_4)_2:Pr^{3+}$, and $NaGd_{0.5}Y_{0.5}(WO_4)_2:Pr^{3+}$ samples.

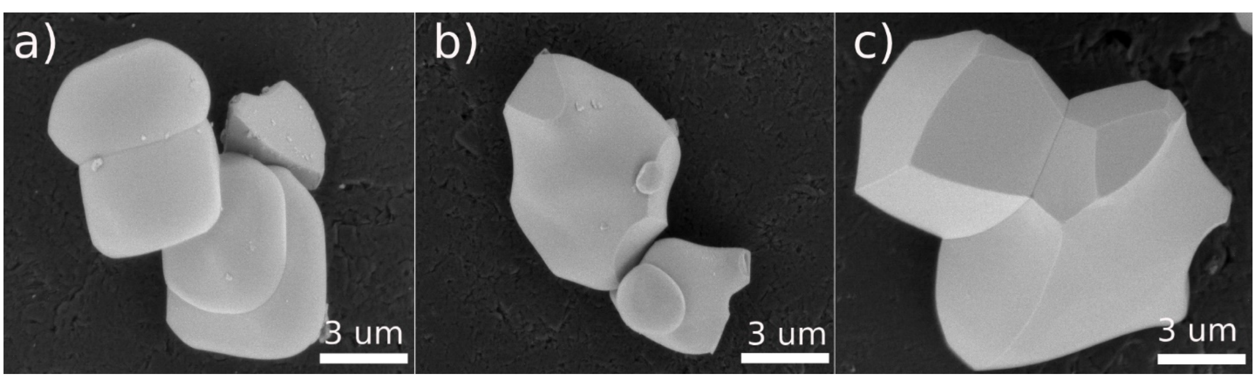

Figure S3. SEM images of NGYW:Pr (a), NGW:Pr (b) and NYW:Pr (c) samples.

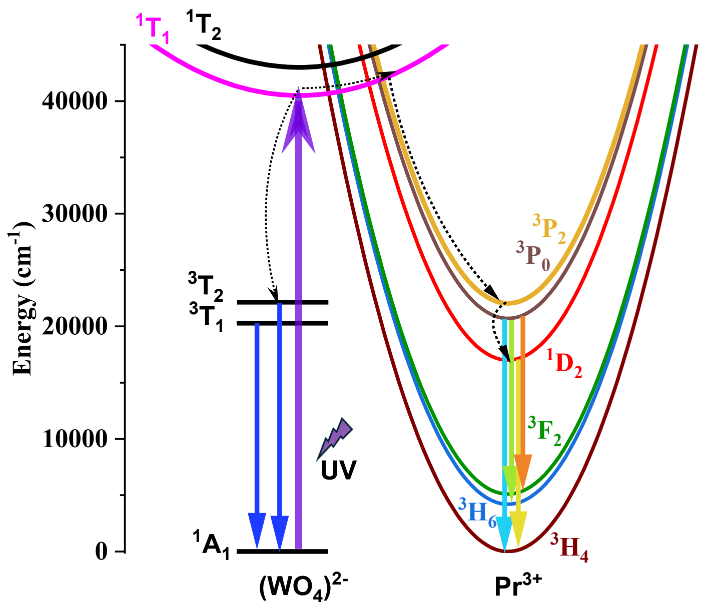

Figure S4 Schematic illustration of energy transfer from the scheelite $[WO_4]^{2-}$ structure to the praseodymium ion in NGYW:Pr, NGW:Pr, and NYW:Pr crystallites under ultraviolet (UV) excitation.

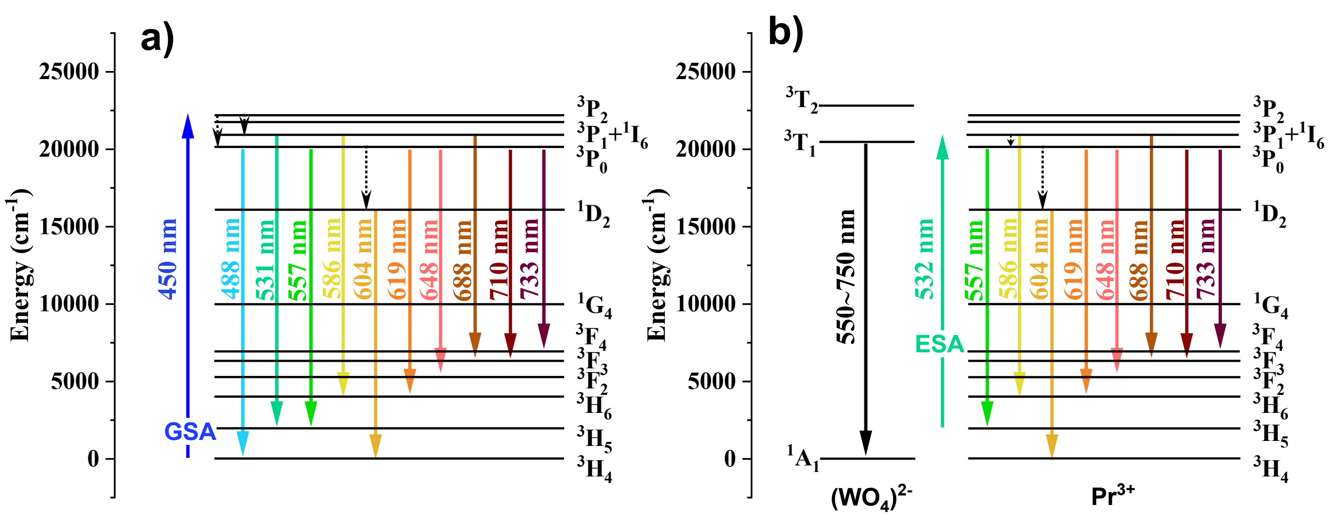

Figure S5. Schematic energy-level diagram of Pr^{3+} in NGYW:Pr, NGW:Pr and NYW:Pr crystallites (a) under 450 nm excitation (GSA) and (b) under 532 nm excitation (ESA).

Table S1. Comparison of the maximum relative temperature sensitivities (Sr) of different Pr^{3+} activated luminescence thermometers.

Host	Dopant	Transitions	T max (K)	Sr (% K^{-1})	Reference
$NaY(WO_4)_2$	Pr^{3+}	$^3P_1\rightarrow{}^3H_5/{}^3P_0\rightarrow{}^3H_5$	300	1.01	This work
$NaGd(WO_4)_2$	Pr^{3+}	$^3P_1\rightarrow{}^3H_5/{}^3P_0\rightarrow{}^3H_5$	300	0.77	This work
$NaGd_{0.5}Y_{0.5}(WO_4)_2$	Pr^{3+}	$^3P_1\rightarrow{}^3H_5/{}^3P_0\rightarrow{}^3H_5$	300	0.77	This work
$NaY(WO_4)_2$	Pr^{3+}	ESA/GSA	350	5.78	This work
$NaGd(WO_4)_2$	Pr^{3+}	ESA/GSA	410	5.06	This work
$NaGd_{0.5}Y_{0.5}(WO_4)_2$	Pr^{3+}	ESA/GSA	375	6.16	This work
$NaYF_4$	Pr^{3+}	$^3P_1\rightarrow{}^3H_5/{}^3P_0\rightarrow{}^3H_5$	300	0.73	[1]
$Li_2Ba_5W_3O_{15}$	Pr^{3+}	$^3P_1\rightarrow{}^3H_5/{}^3P_0\rightarrow{}^3F_2$	300	1.03	[2]
$LiLaMgWO_6$	Pr^{3+}	$^1D_2\rightarrow{}^3H_4/{}^3P_0\rightarrow{}^3F_2$	300	3.2	[3]
$KLaP_4O_{12}$	Pr^{3+}	ESA/GSA	573	1.75	[4]
LaF_3	Pr^{3+}	ESA/GSA	273	5–6	[5]
$LiSrGdW_3O_{12}$	Tb^{3+}	ESA/GSA	290	4.2	[6]

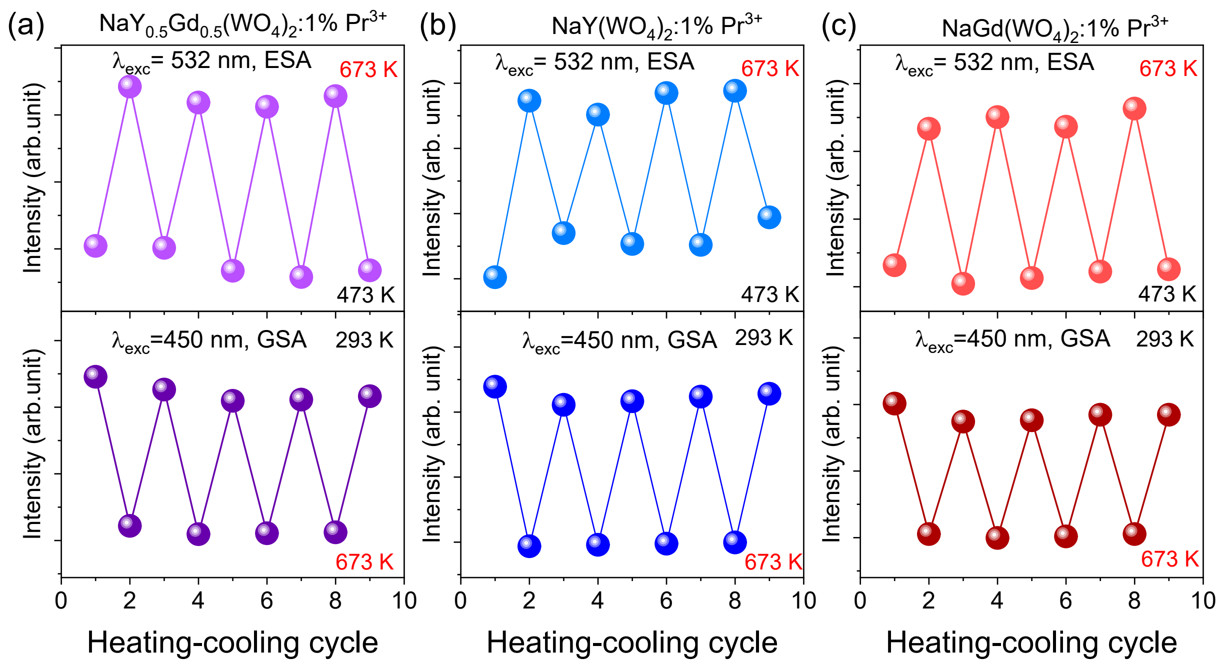

Figure S6. The emission intensities of NGYW:Pr, NYW:Pr, and NGW:Pr measured over several heating-cooling cycles.

Reference

(1) S. Zhou, G. Jiang, X. Wei, C. Duan, Y. Chen, M. Yin, *J. Nanosci. Nanotechnol.* 2014, *14* (5), 3739–3742.

(2) Anu, A.S. Rao, *Opt Mater (Amst)* **2023**, *145*, 114476.

(3) J. Wang, N. Chen, J. Li, Q. Feng, R. Lei, H. Wang, S. Xu, *J Lumin* **2021**, *238*, 118240.

(4) J. Stefanska, L. Marciniak, *Adv Photonics Res* **2021**, *2* (7).

(5) J.Stefanska, K.Maciejewska, L. Marciniak, *New Journal of Chemistry* **2021**, *45* (27), 11898–11904.

(6) F. Ayachi, K. Saidi, M. Dammak, J.J.Carvajal, Pujol, M. *RSC Adv.*, **2024**, 14, 13494.