Electronic Supplementary Information

Upconversion luminescence and temperature measurement performance of Ho³⁺/Yb³⁺ and Tm³⁺/ Yb³⁺ codoped Na₅Rb₇Sc₂(WO₄)₉ phosphors

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Fig. S1 Fragments of XRD patterns of undoped Na₅Rb₇Sc₂(WO₄)₉ tungstate and Na₅Rb₇Sc_{1.95}Yb_{0.05-x}Tm_x(WO₄)₉ (x = 0.0025-0.01) (a) as well as Na₅Rb₇Sc_{2-10z}Yb_{9z}Tm_z(WO₄)₉ (z = 0.0025-0.01) (b).

Table	S1	The	results ^a	of	quantitative	energy-dispersive	X-ray	analyses	for	
$Na_5Rb_7Sc_{1.95}Yb_{0.03}Ho_{0.02}(WO_4)_9$ and $Na_5Rb_7Sc_{1.9}Yb_{0.09}Tm_{0.01}(WO_4)_9$ phosphors.										

		$Na_5Rb_7Sc_{1.95}Yb_{0.03}Ho_{0.02}(WO_4)_9$	$Na_5Rb_7Sc_{1.9}Yb_{0.09}Tm_{0.01}(WO_4)_9$	
at % of Na	Calculated	21.8	21.8	
at. 70 01 Ma	Experimental	20.2±1.7	20.3±1.5	
at % of Sc	Calculated	8.5	8.3	
at. 70 01 Se	Experimental	7.8±0.7	7.1±0.7	
at. % of Rb	Calculated	30.5	30.6	
	Experimental	31.9±1.3	33.0±1.2	
at % of W	Calculated	39.2	39.3	
at. 70 01 W	Experimental	40.1±1.7	39.6±1.9	

^a Random errors of direct measurements shown in the table were determined according to the formulas: $\Delta a_r = t_{St} \cdot S(\bar{a})$

and

$$S(\overline{a}) = \sqrt{\frac{\sum_{i=1}^{n} (a_i - \overline{a})^2}{n \cdot (n-1)}},$$

where \bar{a} is an arithmetic mean value of all measurement results,

n = 20 is amount of measurements,

 $t_{\text{St}} = 2.093$ is the Student's coefficient (n = 20 and $\alpha = 0.95$).



Fig. S2 SEM image of the Na₅Rb₇Sc_{1.95}Yb_{0.03}Ho_{0.02}(WO₄)₉ powder (a); EDX spectrum and maps (b-f)



Fig. S3 SEM image of the Na₅Rb₇Sc_{1.9}Yb_{0.09}Tm_{0.01}(WO₄)₉ powder (a); EDX spectrum and maps (b-f)



Fig. S4 Temperature dependence of the relative sensitivity value defined from the upconversion luminescence spectra of the Na₅Rb₇Sc_{1.925}Yb_{0.045}Ho_{0.03}(WO₄)₉ phosphor.