Electronic Supplementary Information

RSC Advances

Combinatorial optimization of the atomic compositions for green-emitting YBO_3:Ce^{3+},Tb^{3+} and red-emitting YBO_3:Ce^{3+},Tb^{3+},Eu^{3+} phosphors using a microplate reader

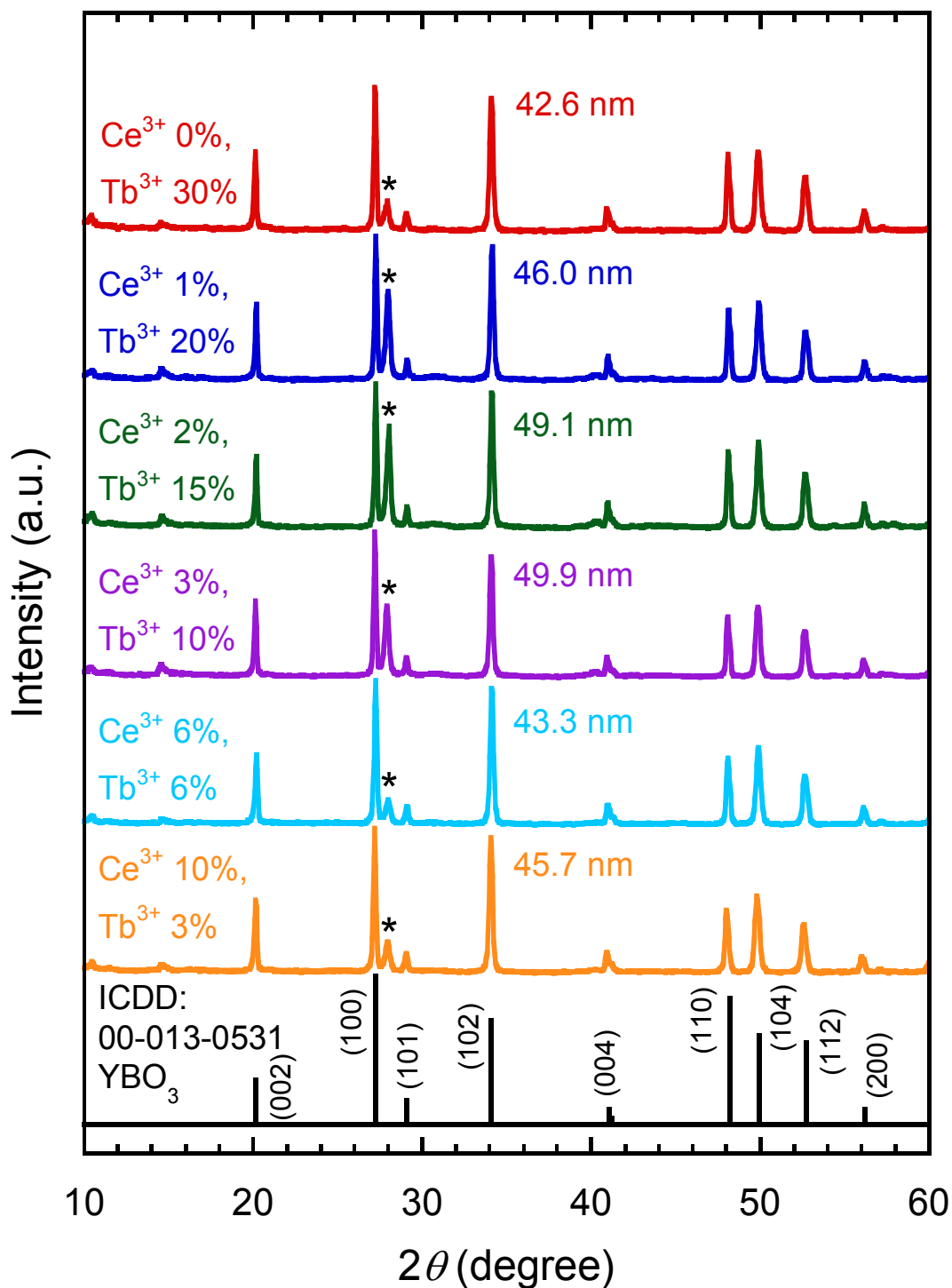Kohei Yano, Satoru Takeshita,[†] Yoshiki Iso,* and Tetsuhiko Isobe*

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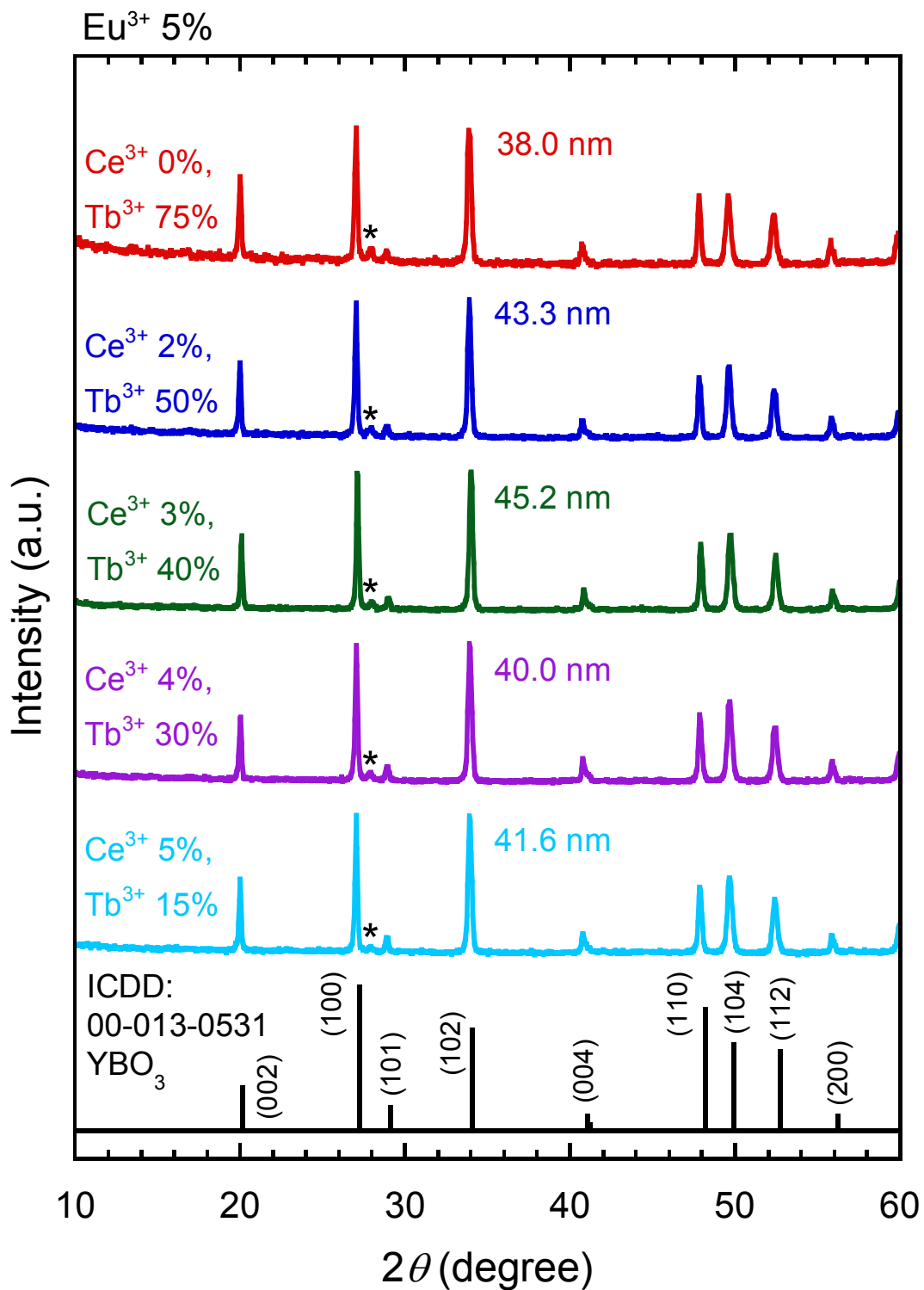
Corresponding Authors

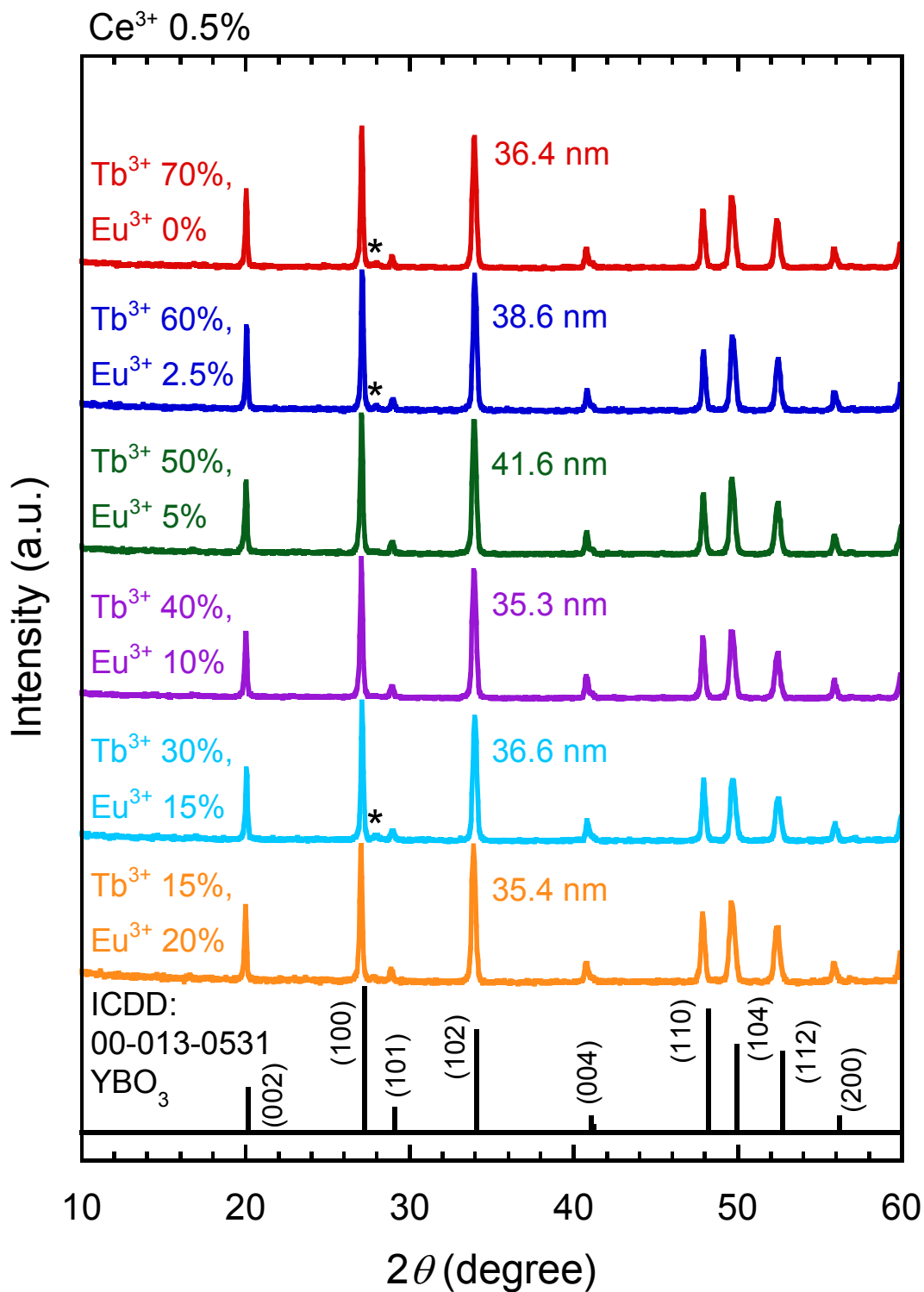*E-mail: iso@applc.keio.ac.jp; Tel: +81 45 566 1558; Fax: +81 45 566 1551 (Y.I.).

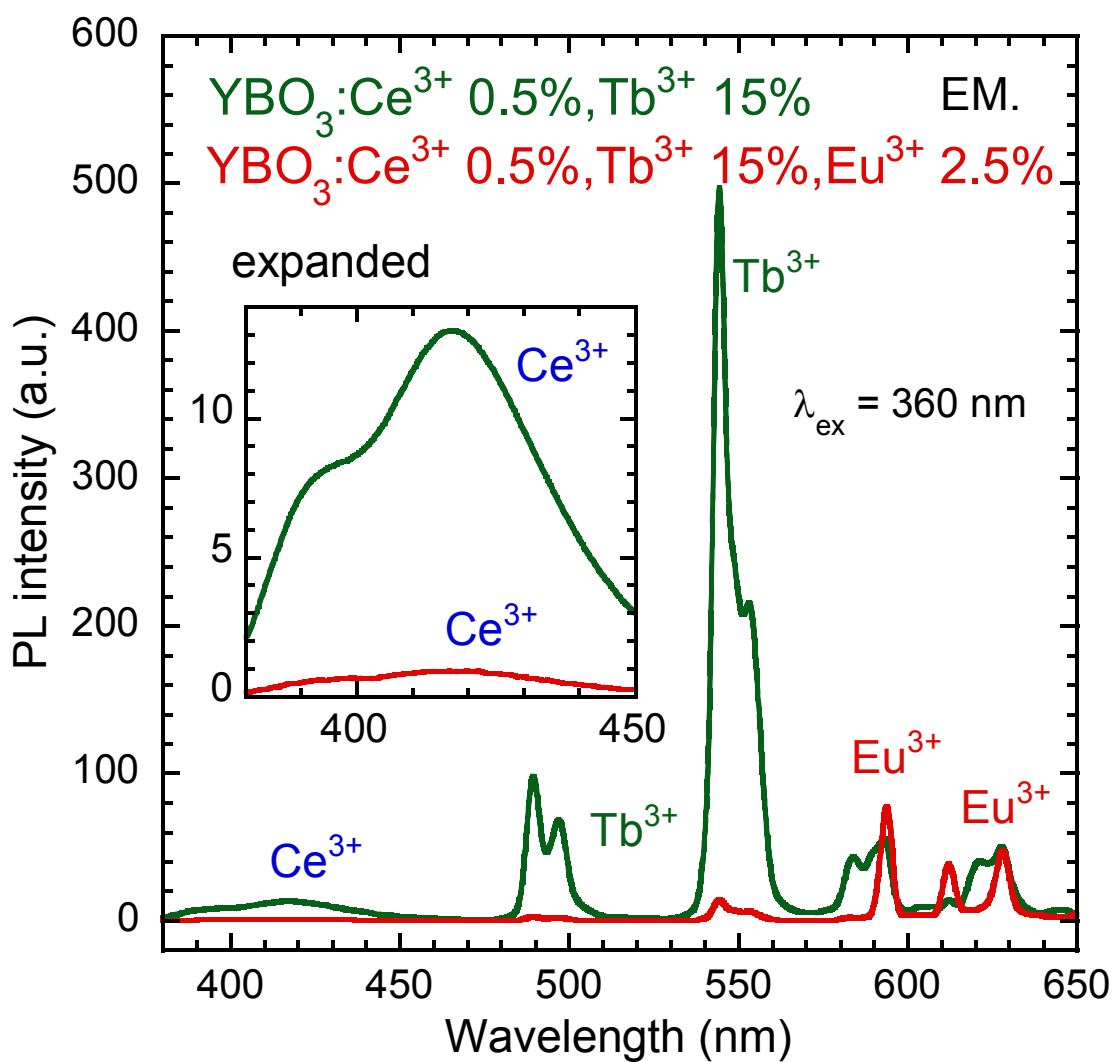*E-mail: isobe@applc.keio.ac.jp; Tel: +81 45 566 1554; Fax: +81 45 566 1551 (T.I.).

Fig. S1 XRD profiles of samples from the $Y_{1-x-y}Ce_xTb_yBO_3$ library ($0 \leq x \leq 0.10$, $0 \leq y \leq 0.40$). The peak indicated by an asterisk possibly originated from the byproduct Y_3BO_6. Each crystallite size of the samples calculated from the width of the (102) reflection peak using the Scherrer equation was also shown.

Fig. S2 XRD profiles of samples from the $Y_{1-x-y-z}Ce_xTb_yEu_zBO_3$ library ($0 \leq x \leq 0.05$, $0 \leq y \leq 0.90$, $z=0.05$). The peak indicated by an asterisk possibly originated from the byproduct Y_3BO_6. Each crystallite size of the samples calculated from the width of the (102) reflection peak using the Scherrer equation was also shown.

Fig. S3 XRD profiles of samples from the $Y_{1-x-y-z}Ce_xTb_yEu_zBO_3$ library (x=0.005, $0 \leq y \leq 0.795$, $0 \leq z \leq 0.20$). The peak indicated by an asterisk possibly originated from the byproduct Y_3BO_6. Each crystallite size of the samples calculated from the width of the (102) reflection peak using the Scherrer equation was also shown.
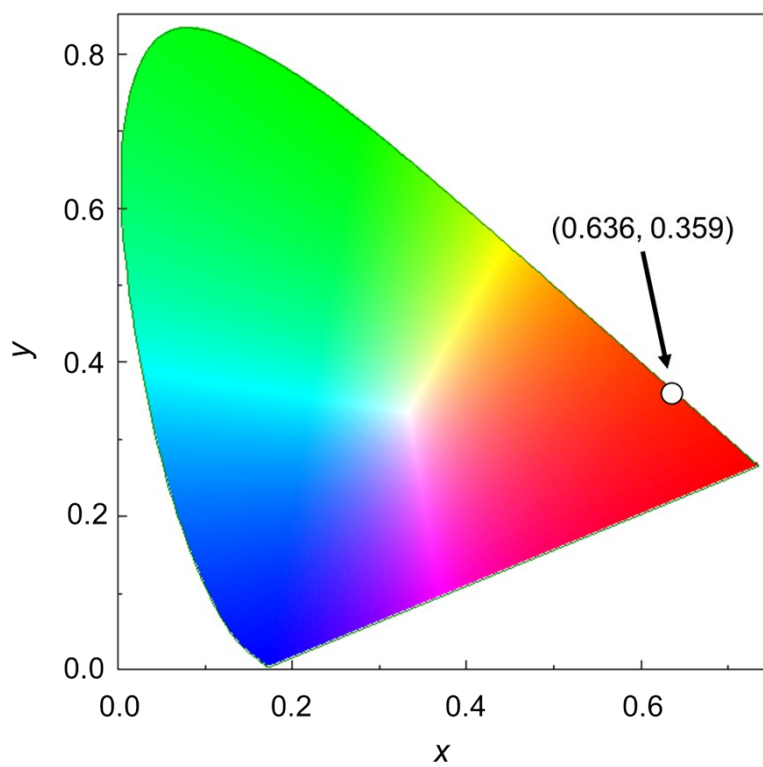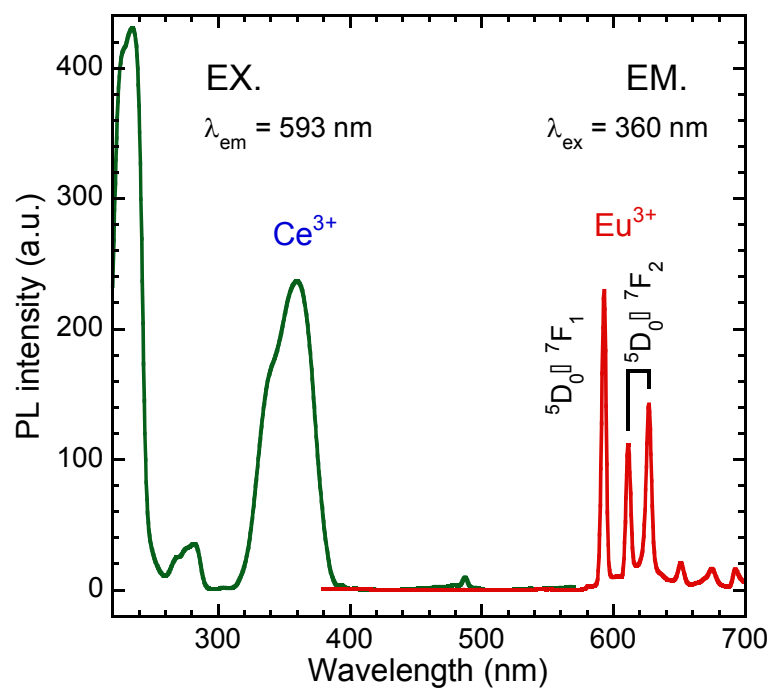
Fig. S4 PL spectra of $Y_{0.845}Ce_{0.005}Tb_{0.15}BO_3$ and $Y_{0.82}Ce_{0.005}Tb_{0.15}Eu_{0.025}BO_3$ synthesized in the wells of a microplate. Inset are expanded spectra in the Ce^{3+} emission region of 380–450 nm.

Fig. S5 PL and PLE spectra (top), and CIE coordinate with a color diagram (bottom) of $Y_{0.535}Ce_{0.005}Tb_{0.45}Eu_{0.01}BO_3$.

Table S1 Actual metallic compositions of samples from the $Y_{1-x-y}Ce_xTb_yBO_3$ library ($0 \leq x \leq 0.10$, $0 \leq y \leq 0.40$).

	Element	Loading ratio (at%)	Actual composition (at%)
A-7	Y	70.00	79.91
	Tb	30.00	20.09
B-6	Y	79.00	81.44
	Ce	1.00	1.83
	Tb	20.00	16.73
C-5	Y	83.00	83.29
	Ce	2.00	3.78
	Tb	15.00	12.93
D-4	Y	87.00	86.32
	Ce	3.00	5.15
	Tb	10.00	8.53
E-3	Y	88.00	88.21
	Ce	6.00	7.47
	Tb	6.00	4.32
F-2	Y	87.00	85.86
	Ce	10.00	12.04
	Tb	3.00	2.10

Table S2 Actual metallic compositions of samples from the $Y_{1-x-y-z}Ce_xTb_yEu_zBO_3$ library ($0 \leq x \leq 0.05$, $0 \leq y \leq 0.90$, $z=0.05$).

	Element	Loading ratio (at%)	Actual composition (at%)
A-7	Y	24.00	21.94
	Tb	75.00	72.23
	Eu	5.00	5.83
B-6	Y	34.00	31.46
	Ce	1.00	1.47
	Tb	60.00	61.75
	Eu	5.00	5.32
C-5	Y	43.00	40.82
	Ce	2.00	2.57
	Tb	50.00	51.02
	Eu	5.00	5.59
D-4	Y	52.00	45.69
	Ce	3.00	3.73
	Tb	40.00	44.63
	Eu	5.00	5.95
E-3	Y	61.00	54.32
	Ce	4.00	4.40
	Tb	30.00	35.64
	Eu	5.00	5.65
F-2	Y	75.00	63.81
	Ce	5.00	7.34
	Tb	15.00	22.02
	Eu	5.00	6.83

Table S3 Actual metallic compositions of samples from the $Y_{1-x-y-z}Ce_xTb_yEu_zBO_3$ library (x=0.005, 0≤y≤0.795, 0≤z≤0.20).

	Element	Loading ratio (at%)	Actual composition (at%)
A-7	Y	29.50	31.60
	Ce	0.50	0.78
	Tb	70.00	67.61
B-6	Y	37.00	34.47
	Ce	0.50	0.69
	Tb	60.00	61.69
	Eu	2.50	3.15
C-5	Y	44.50	43.94
	Ce	0.50	0.61
	Tb	50.00	49.39
	Eu	5.00	6.07
D-4	Y	49.50	49.17
	Ce	0.50	0.61
	Tb	40.00	39.05
	Eu	10.00	11.17
E-3	Y	54.50	51.41
	Ce	0.50	0.54
	Tb	30.00	31.21
	Eu	15.00	16.84
F-2	Y	64.50	62.43
	Ce	0.50	0.53
	Tb	15.00	15.68
	Eu	20.00	21.36