Supporting Information
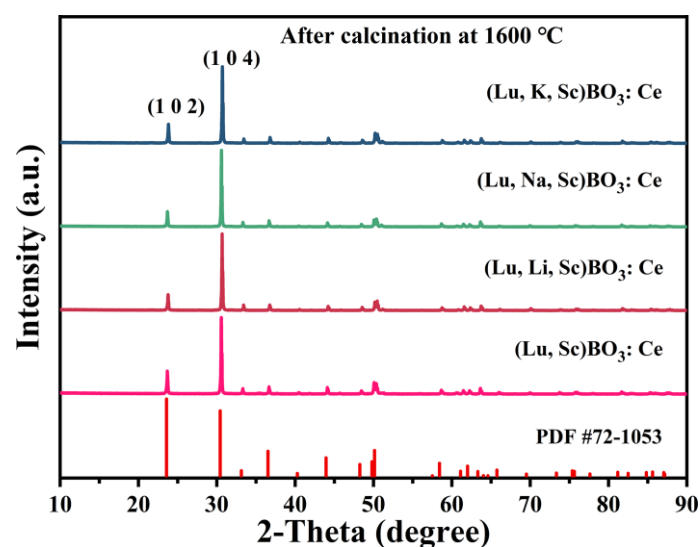
Significant enhancement of scintillation performance by inducing oxygen vacancy in alkali metal ions (A^+ = Li$^+$, Na$^+$, K$^+$) incorporated (Lu, Sc)BO$_3$: Ce
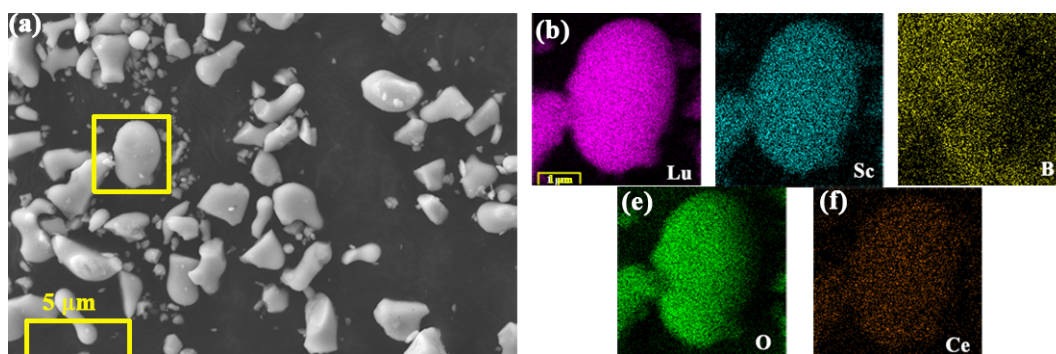
Yun-Ling Yang, [a] Jia-Xuan Chen, [a] Fan Guo, [a] Meng Huang, [a] Shan-Shan Liang, [a]

Qian-Li Li, [a] Jian-Feng Hu, [a] Jing-Tai Zhao, [b] Xing-Yu Gao, [c] Ya-Nan Fu, [c] Hui Lin [d]
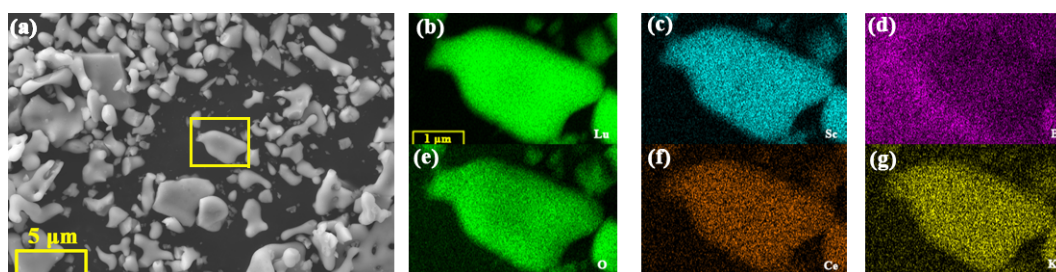
and Zhi-Jun Zhang*[a]

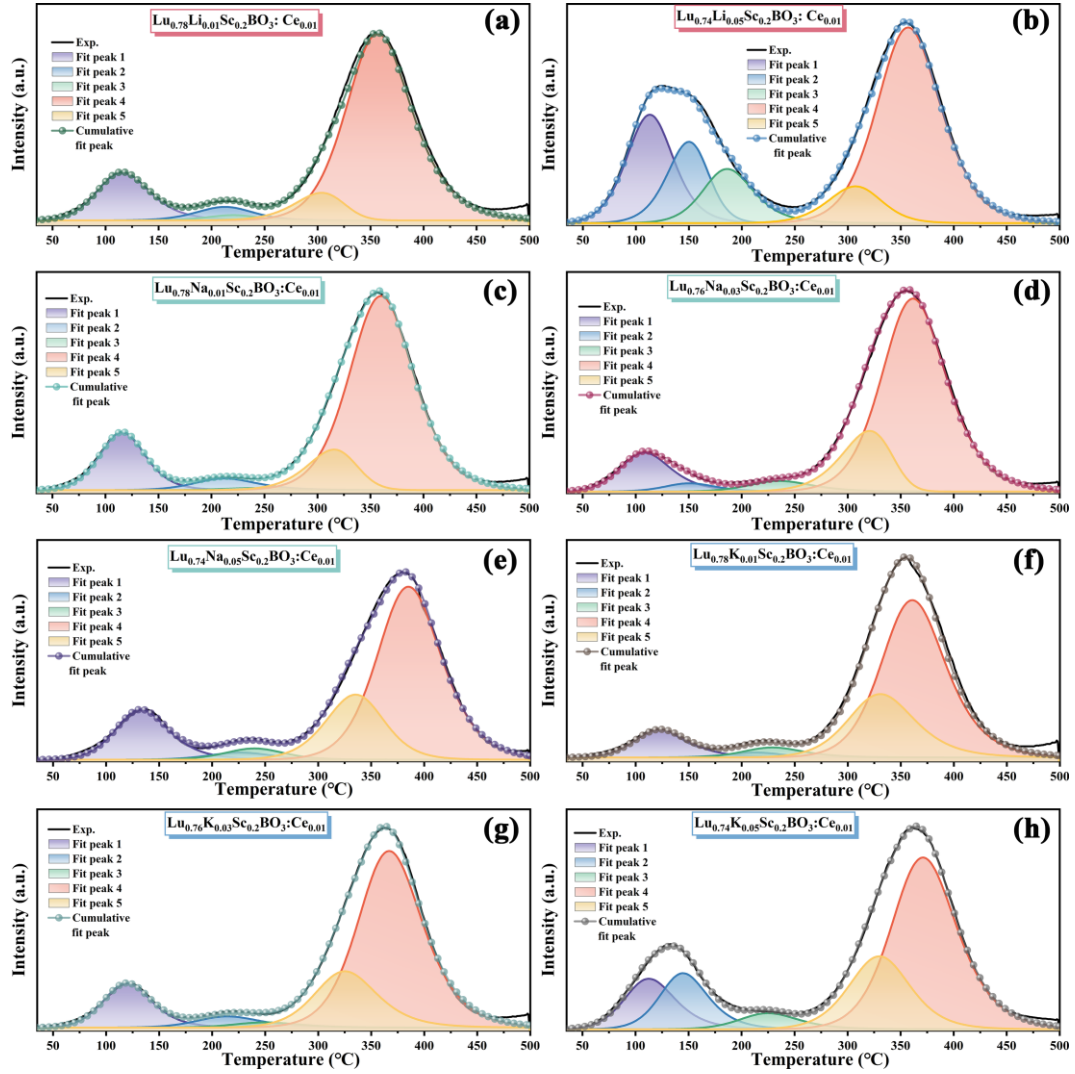**Figure S1.** XRD patterns of LASBO: Ce (x = 0, 0.025) samples after the calcination at

1600 ℃.

Figure S2. (a) FE-SEM image of $Lu_{0.765}Li_{0.025}Sc_{0.2}BO_3:Ce_{0.01}$. (b - f) Element

mapping of Lu, Sc, B, O and Ce.

Figure S3. (a) FE-SEM image of $Lu_{0.765}K_{0.025}Sc_{0.2}BO_3:Ce_{0.01}$. (b - g) Element

mapping of Lu, Sc, B, O, Ce and K.

Figure S4. (a - h) TL spectra and fitting curves of $Lu_{0.79-x}A_xSc_{0.2}BO_3: Ce_{0.01}$.

Table S1. Calculated trap depths (E_t) and related frequency factor (s) of $Lu_{0.79-x}A_xSc_{0.2}BO_3: Ce_{0.01}$ (x = 0, 0.01, 0.03, 0.05).

Parameter / Compounds		Trap 1 E_{t1} (eV)	Trap 1 s (s⁻¹)	Trap 2 E_{t2} (eV)	Trap 2 s (s⁻¹)	Trap 3 E_{t3} (eV)	Trap 3 s (s⁻¹)	Trap 4 E_{t4} (eV)	Trap 4 s (s⁻¹)	Trap 5 E_{t5} (eV)	Trap 5 s (s⁻¹)
LSBO: Ce (x = 0)		0.75	10^8	0.87	10^9	0.91	10^{10}	1.34	10^{10}	1.59	10^{11}
$A^+ = Li^+$	x = 0.01	0.73	10^8	0.95	10^9	1.05	10^{10}	1.34	10^{10}	1.55	10^{11}
	x = 0.03	0.73	10^9	0.88	10^{10}	1.05	10^{11}	1.35	10^{10}	1.46	10^{10}
	x = 0.05	0.75	10^9	0.92	10^{10}	1.07	10^{10}	1.41	10^{11}	1.55	10^{11}
$A^+ = Na^+$	x = 0.01	0.78	10^9	0.95	10^9	1.05	10^9	1.43	10^{11}	1.54	10^{11}
	x = 0.03	0.75	10^9	0.95	10^8	1.05	10^8	1.34	10^{10}	1.59	10^{11}
	x = 0.05	0.67	10^8	0.95	10^8	1.05	10^9	1.47	10^{11}	1.71	10^{12}

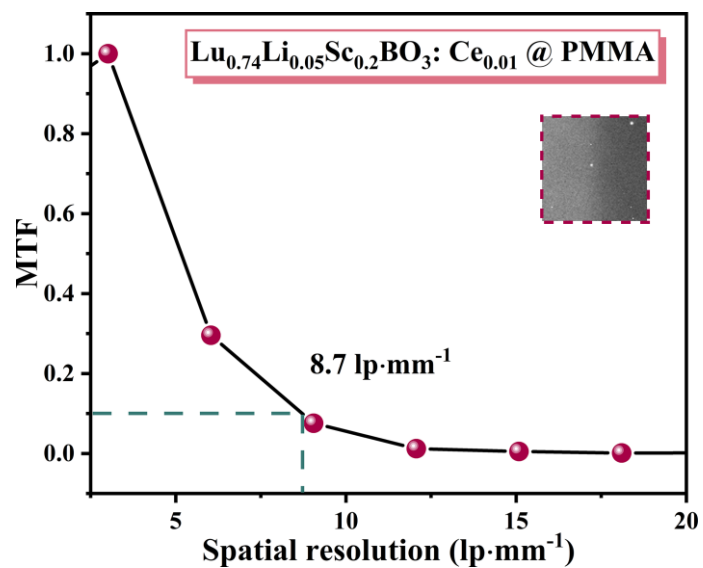| $A^+ = K^+$										
	$x = 0.01$	0.74	10^8	1.03	10^9	1.14	10^{10}	1.47	10^{11}	1.62	10^{11}
	$x = 0.03$	0.78	10^9	0.95	10^8	1.07	10^9	1.48	10^{11}	1.63	10^{12}
	$x = 0.05$	0.74	10^8	0.93	10^{10}	1.07	10^{10}	1.45	10^{11}	1.63	10^{11}

Figure S5. The X-ray imaging corresponding MTF.