Electronic Supplementary Information

Crystal-phase Transition and Polyhedron Transformation towards Evolution of Photoluminescence and Improvement of Thermal Stability in Efficient Blue-emitting $Ba_{0.47-x}Sr_{0.50+x}Al_2Si_2O_8:Eu^{2+}$

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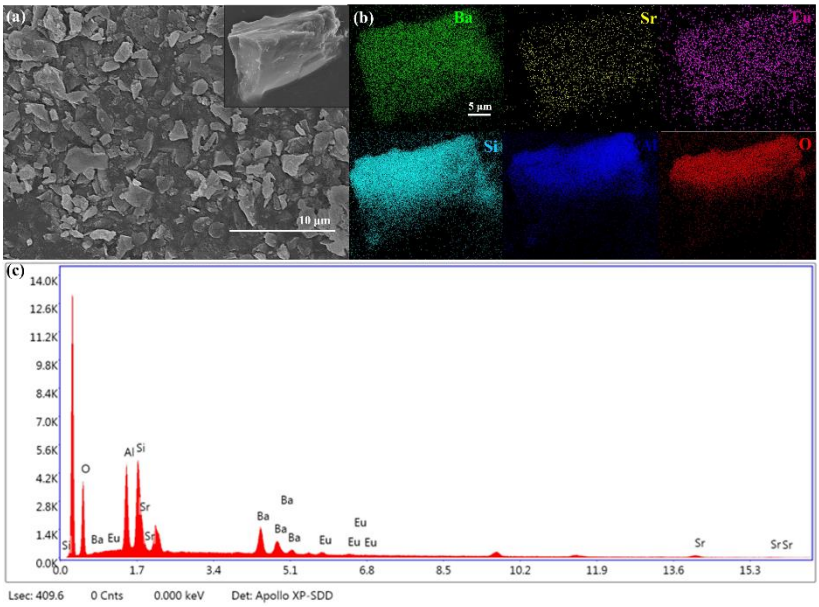

Fig. S1 (a) SEM images, (b) corresponding elemental mapping of Ba, Sr, Eu, Si, Al and O, respectively, and (c) EDS spectra of $Ba_{0.47}Sr_{0.50}Al_2Si_2O_8:0.03Eu^{2+}$ sample.

Table S1 The average EDS results of $Ba_{0.47}Sr_{0.50}Al_2Si_2O_8:0.03Eu^{2+}$ sample.

Element	Weight %	Atomic %	Net Int.	Error %	Kratio	Z
O K	33.22	59.34	54.20	9.23	0.1015	1.1560
AlK	15.75	16.68	87.80	7.02	0.0751	1.0443
SiK	14.26	14.51	83.00	7.08	0.0716	1.0698
BaL	19.67	4.09	38.90	5.09	0.1565	0.7557
EuL	1.45	0.27	2.40	28.36	0.0112	0.7533
SrK	15.65	5.10	4.40	13.88	0.1425	0.7931

Table S2 Crystallographic parameters gained from Rietveld refinements for $Ba_{0.47-x}Sr_{0.5+x}Al_2Si_2O_8$: 0.03Eu ($x$ = -50.0%-47.0%)

Samples	a	b	c	V	β	γ	R_p	R_{wp}	R_{exp}	χ^2
BASOE	5.2943	5.2943	7.7822	188.906	90.0000	120	4.48	6.25	3.32	3.55
x = -45%	5.2938	5.2938	7.7823	188.876	90.0000	120	6.74	8.77	3.62	5.86
x = -35%	5.2893	5.2893	7.7796	188.488	90.0000	120	8.07	10.70	3.51	9.35
x = -25%	5.2857	5.2857	7.7747	188.111	90.0000	120	6.46	8.90	3.42	6.76
x = -15%	8.5492	13.0277	14.3608	1448.568	115.0872	90	6.42	10.30	3.32	9.65
x = -10%	8.5351	13.0249	14.3542	1445.604	115.0529	90	5.41	7.28	3.22	5.12
x = -5%	8.5215	13.0186	14.3449	1441.630	115.0556	90	5.60	7.38	3.21	5.29
BSASOE	8.5094	13.0174	14.3401	1438.683	115.0800	90	4.09	5.54	3.00	3.41
x = 10%	8.4850	13.0031	14.3183	1429.965	115.1532	90	8.56	10.90	4.66	5.51
x = 25%	8.4360	12.9904	14.2953	1417.060	115.2364	90	3.98	5.40	2.91	3.43
x = 40%	8.3970	12.9751	14.2691	1405.413	115.3093	90	8.53	11.10	4.26	6.75
SASOE	8.3831	12.9729	14.2635	1402.086	115.3285	90	4.47	6.37	2.57	6.13

Note: α = 90 ° for all the samples

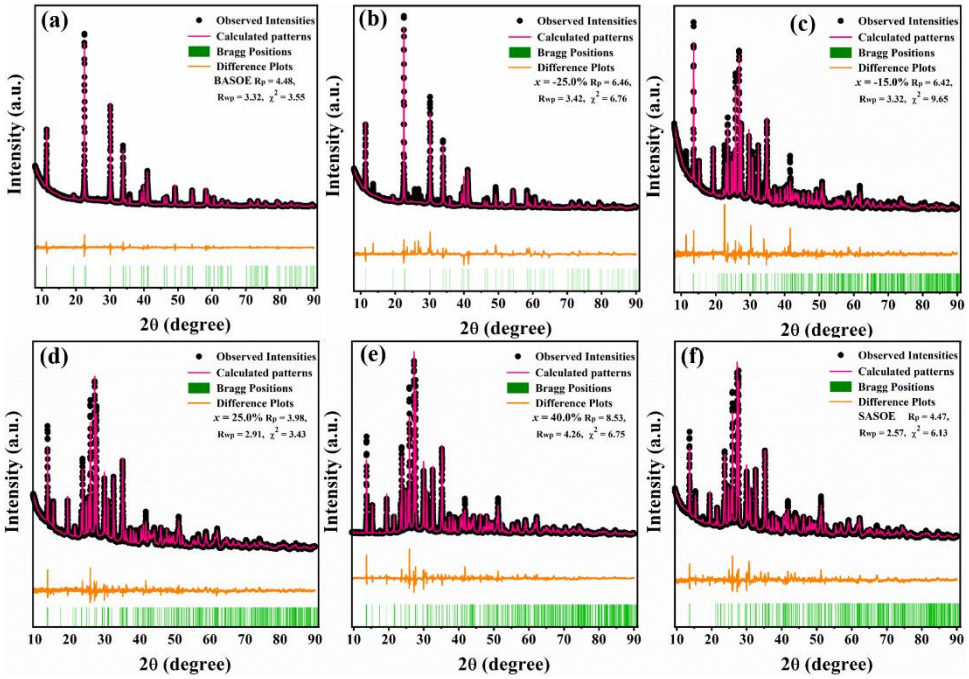

Fig. S2 The Rietveld refinement XRD patterns of BASOE, x = -25.0%, x = -15.0%, x = 25.0%, x = 25.0% and SASOE samples.

Table S3 CIE coordinates for $Ba_{0.47-x}Sr_{0.5+x}Al_2Si_2O_8$: 0.03Eu ($x$ = -50.0%-47.0%)

Samples	CIE Coordinates	
	x	y
BASOE	0.1919	0.2365
x = -45%	0.1816	0.1992
x = -40%	0.1761	0.1827
x = -35%	0.1652	0.1471
x = -30%	0.1543	0.1147
x = -25%	0.1599	0.1317
x = -20%	0.1528	0.1122
x =-15%	0.1523	0.1057
x = -10%	0.1516	0.1021
x = -5%	0.1523	0.1038
BSASOE	0.1520	0.1016
x = 10%	0.1531	0.0922
x = 20%	0.1539	0.0895
x = 25%	0.1541	0.0993
x = 30%	0.1548	0.0884
x = 40%	0.1560	0.0820
x = 47%	0.1572	0.0958

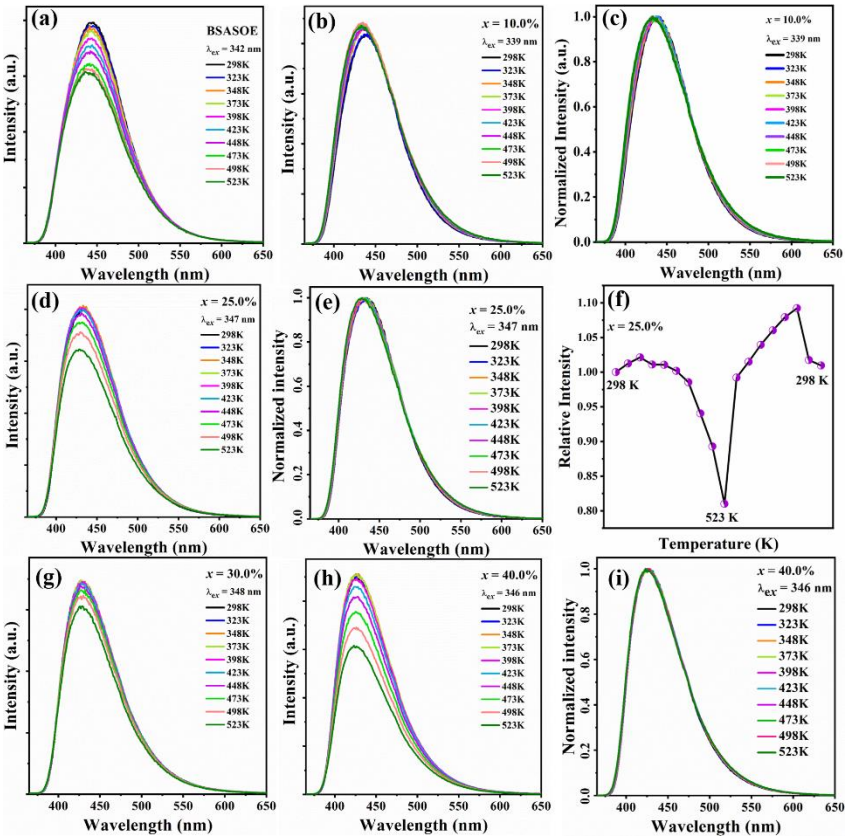

Fig. S3 The PL spectra of (a) BSASOE, (b) x = 10.0% , (d) x = 25.0%, (g) x = 30.0% and (h) x = 40.0% samples, and the normalized PL spectra of (c) x = 10.0%, (e) x = 25.0% and (i) x = 40.0% samples at various temperatures (298-523 K), respectively; (f) The corresponding emission intensity with one heating and cooling cycles of the x = 25.0% sample from 298 to 523 K.

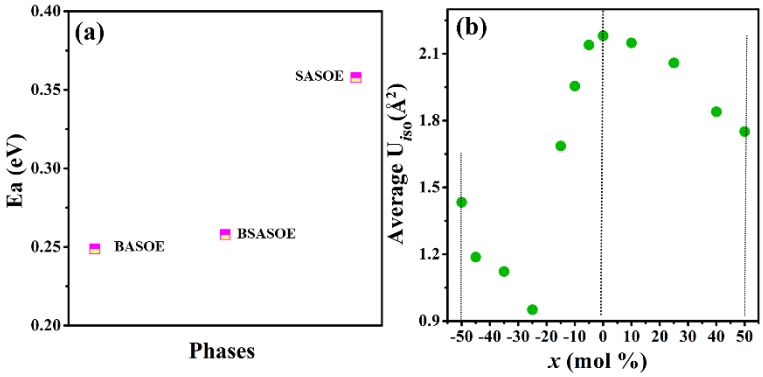

Fig. S4 (a) The activation energy (Ea) values for BASOE, BSASOE and SASOE samples which are obtained from the temperature-dependent PL intensity. (b) The calculated average U_{iso} values from the XRD Rietveld refinement for $Ba_{0.47-x}Sr_{0.50+x}Al_2Si_2O_8$:0.03Eu ($x$ = -50.0%-47.0%).

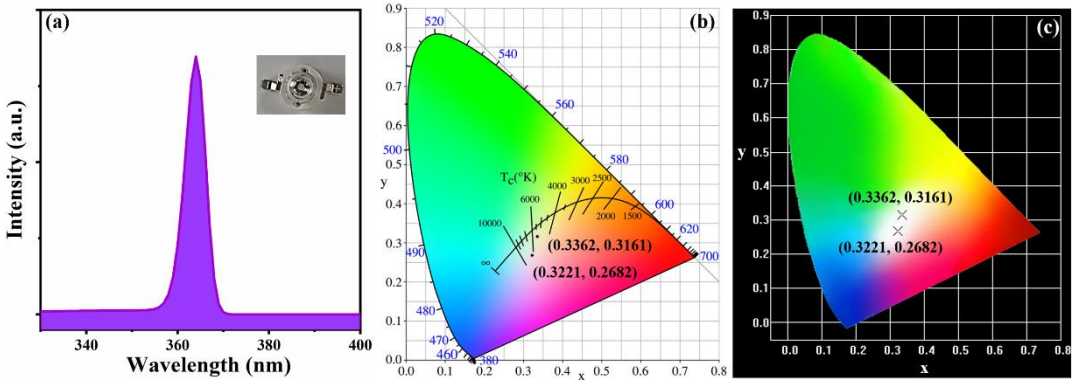

Fig. S5 (a) The emission spectrum of 365 nm LED chip; insert is the photograph of the semi-finished lamp bead. (b) and (c) CIE chromaticity coordinates diagrams for the two fabricated devices in different versions of CIE 1931.