Supplementary Information

Title: Potential color tunable $Sr_3LaNa(PO_4)_3F:Eu^{2+}/Tb^{3+}/Mn^{2+}$ phosphor induced by $Eu^{2+}{\rightarrow}Tb^{3+}$ and $Tb^{3+}{\rightarrow}Mn^{2+}$ energy transfer for WLEDs

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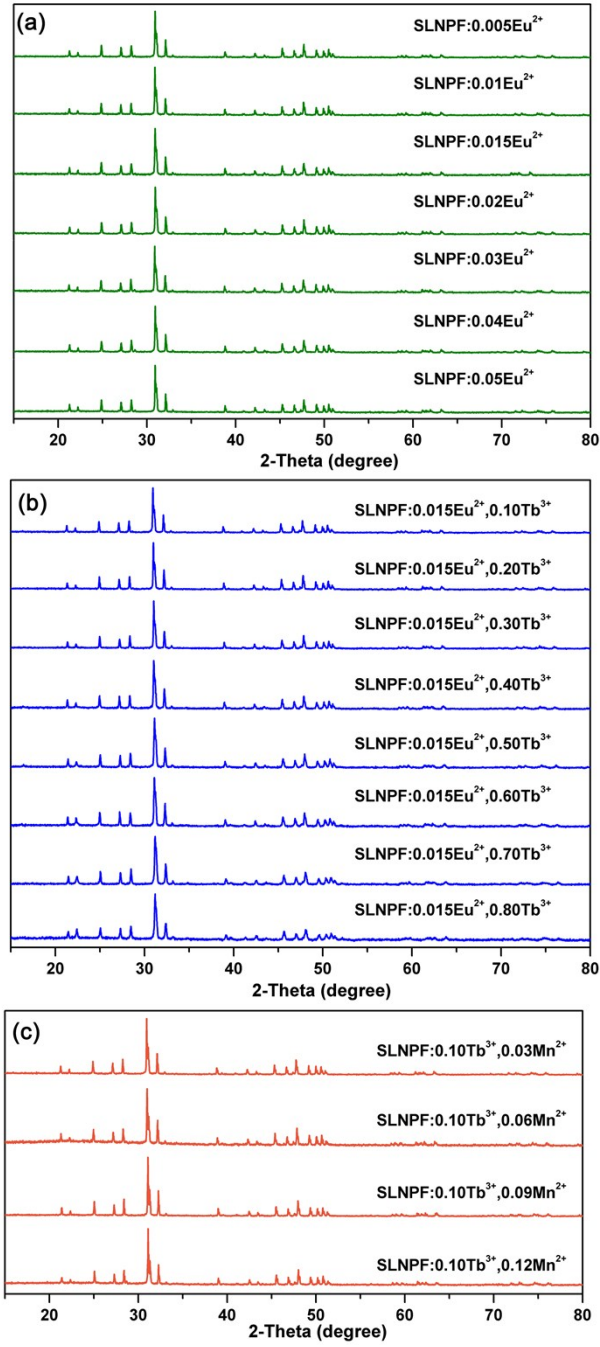
Fig. S1. XRD patterns of the prepared (a) SLNPF:xEu^{2+} (x = 0.005-0.05), (b) SLNPF:0.015Eu^{2+},yTb^{3+} (y = 0.10-0.80), and (c) SLNPF: 0.10Tb^{3+},zMn^{2+} (z = 0.03-0.12) phosphors.
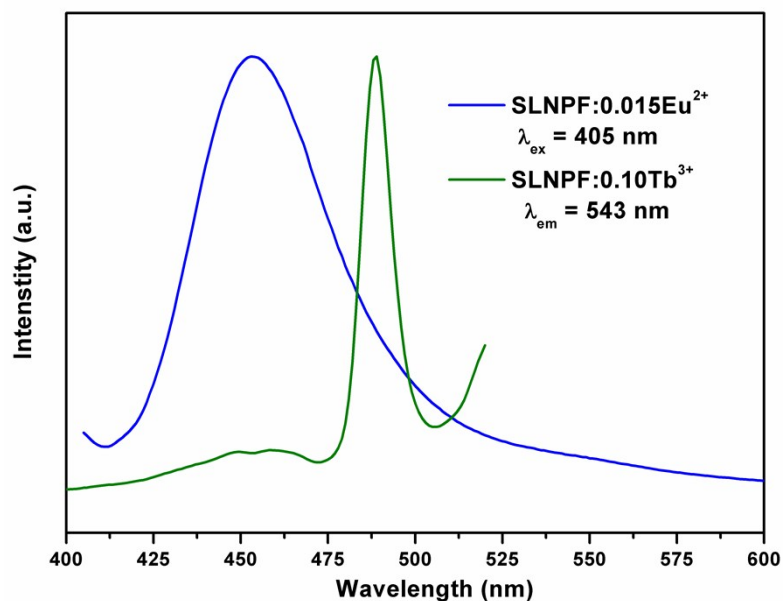
Fig. S2. Spectra overlap between the PL of SLNPF:0.015Eu^{2+} and PLE of SLNPF:0.10Tb^{3+} phosphors.
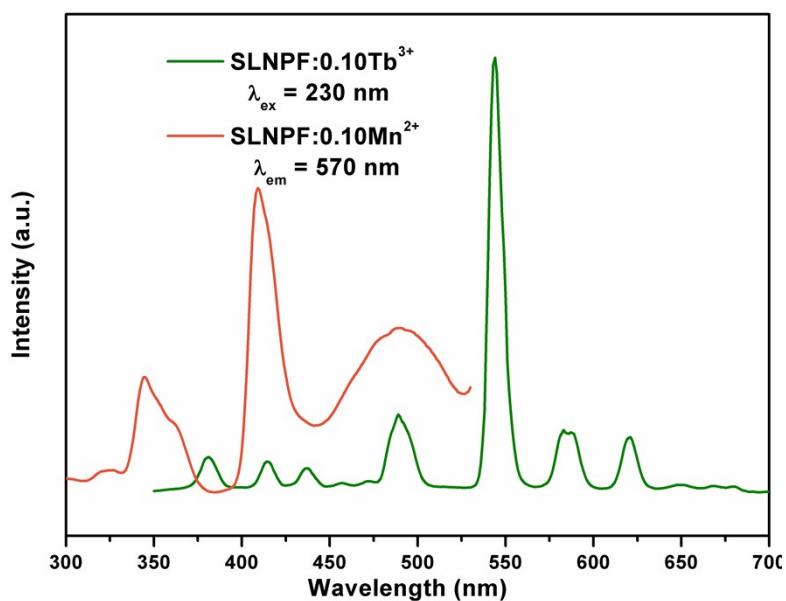

Fig. S3. Spectra overlap between the PL of SLNPF: 0.10Tb^{3+} and PLE of SLNPF:0.10Mn^{2+} phosphors.

Table S1. Final refined structure parameters of SLNPF:0.015Eu^{2+} derived from the Rietveld refinement of X-ray diffraction data

Atom	Wyckoff position	x	Y	z	Frac	Uiso
La1	2d	0.33330(0)	0.66670(0)	0.51470(5)	1.00	0.025
Na1	2d	0.33330(0)	0.66670(0)	0.01900(9)	1.00	0.025
Sr1	6g	0.23666(6)	0.25268(5)	0.26139(0)	0.985	0.025
P1	6g	0.36318(5)	0.39873(5)	0.73642(6)	1.00	0.025
O1	6g	0.48709(0)	0.33111(9)	0.61328(5)	1.00	0.025
O2	6g	0.47189(3)	0.57269(9)	0.67450(6)	1.00	0.025
O3	6g	0.26435(5)	0.34355(2)	0.88723(4)	1.00	0.025
O4	6g	0.26867(5)	0.33649(4)	0.54597(5)	1.00	0.025
F1	2c	0.0000	0.0000	0.16917(2)	1.00	0.025
Eu1	6g	0.23666(6)	0.25268(5)	0.26139(0)	0.015	0.025

Cell parameters: $a = b = 9.6749(0)$ Å, $c = 7.1780(6)$ Å,

$V = 581.877$Å^3; $Z = 2$;

space group: P-3 (no.147);

Reliability factors: $\chi^2 = 8.839$, $R_{wp} = 8.41\%$, $R_p = 5.92\%$

Table S2. CIE coordinates of SLNPF:Eu^{2+}/Mn^{2+}/Tb^{3+} samples

No.	Sample composition	CIE coordinates (x, y)
1	SLNPF:0.015Eu^{2+}	(0.190,0.159)
2	SLNPF:0.10Tb^{3+}	(0.325,0.573)
3	SLNPF:0.10Mn^{2+}	(0.475,0.462)
4	SLNPF:0.015Eu^{2+},0.10Tb^{3+}	(0.212,0.233)
5	SLNPF:0.015Eu^{2+},0.20Tb^{3+}	(0.229,0.293)
6	SLNPF:0.015Eu^{2+},0.30Tb^{3+}	(0.245,0.344)
7	SLNPF:0.015Eu^{2+},0.40Tb^{3+}	(0.259,0.386)
8	SLNPF:0.015Eu^{2+},0.50Tb^{3+}	(0.272,0.418)
9	SLNPF:0.015Eu^{2+},0.60Tb^{3+}	(0.283,0.445)
10	SLNPF:0.015Eu^{2+},0.70Tb^{3+}	(0.292,0.468)
11	SLNPF:0.015Eu^{2+},0.80Tb^{3+}	(0.299,0.479)
12	SLNPF:0.10Tb^{3+},0.03Mn^{2+}	(0.380,0.511)
13	SLNPF:0.10Tb^{3+},0.06Mn^{2+}	(0.427,0.491)
14	SLNPF:0.10Tb^{3+},0.09Mn^{2+}	(0.459,0.475)
15	SLNPF:0.10Tb^{3+},0.12Mn^{2+}	(0.477,0.461)