Electronic Supplementary Information (ESI)

Cation Vacancy Repair for Enhancement of Orange-Yellow Luminescence in the $Sr_9Mg_{1.5-x}K_x(PO_4)_7$: Eu^{2+} Phosphors

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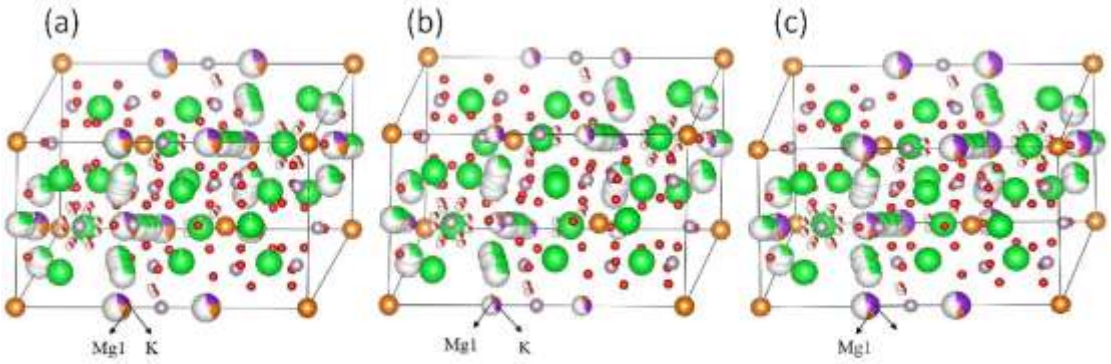

Figure S1. Crystal structures of (a) SMK025, (b) SMK050 and (c) SMK075 samples.

Table S1. Crystallographic parameters and Rietveld Refinement for SMK025, SMK050 and SMK075 samples.

Formula	**SMK025**	**SMK050**	**SMK075**
Sp.Gr.	R-3m	R-3m	R-3m
a, Å	10.6025	10.6201	10.6294
c, Å	19.6958	19.6855	19.6730
V, Å^3	1917.43	1922.81	1924.95
R_{exp}, %	6.4412	6.57820	6.1515
R_{wp}, %	11.0625	10.1983	11.1854
GOF	1.7175	1.55031	1.8183

Table S2. Lattice Parameters and Atom Positions for SMK000 sample.

Atom	Site	*x*	*y*	*z*	Occup.	Biso
Sr1	18h	0.18942	0.81058	0.53786	1	0.76897
Sr2	18h	0.49061	0.50939	0.00600	0.25	0.76890
Sr3	18h	0.46895	0.53105	0.01374	0.25	0.7690
Mg1	6c	0	0	0.36601	0.25	0.3565
Mg2	3a	0	0	0	1	0.3565
P1	3b	0	0	0.5	1	1.0275
P2	18h	0.49161	0.50839	0.39787	1	1.0275
O1	36i	0.89790	0.03787	0.53982	0.3333	1.2527
O2	18h	0.53892	0.46108	0.67634	1	1.2527
O3	36i	0.26371	0.00885	0.23418	1	1.2527
O4	18h	0.91007	0.08993	0.06509	1	1.2527

Table S3. Lattice Parameters and Atom Positions for SMK100 sample.

Atom	Site	*x*	*y*	*z*	Occup.	Biso
Sr1	18h	0.18993	0.81007	0.53705	0.9895	0.9729
Sr2	18h	0.48964	0.51036	0.00602	0.25	0.6091
Sr3	18h	0.46181	0.53819	0.01363	0.2454	0.6091
K	6c	0	0	0.34658	0.4408	1.2455
Mg2	3a	0	0	0	1	1.2455
P1	3b	0	0	0.5	1	1.4456
P2	18h	0.49154	0.50846	0.39796	1	1.4456
O1	36i	0.89226	0.02760	0.54030	0.3333	1.3558
O2	18h	0.53994	0.46006	0.67593	1	1.3558
O3	36i	0.26314	0.00921	0.23511	1	1.3558
O4	18h	0.90939	0.09061	0.06626	1	1.3558

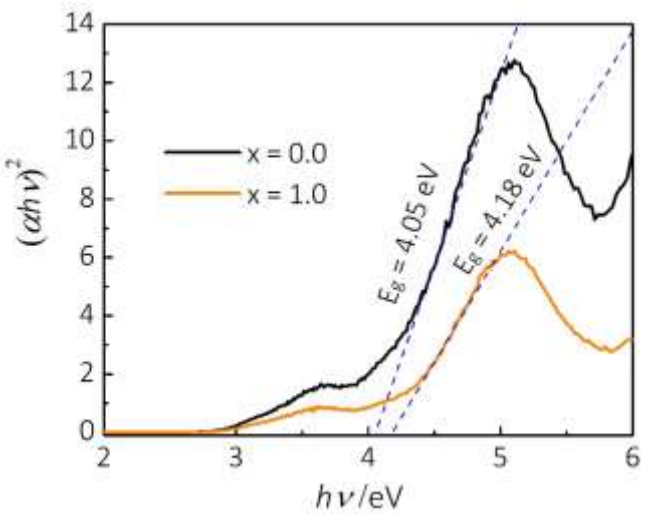

Figure S2. Energy band gaps of SMK000 and SMK100 samples evaluated by their diffuse reflection spectra.

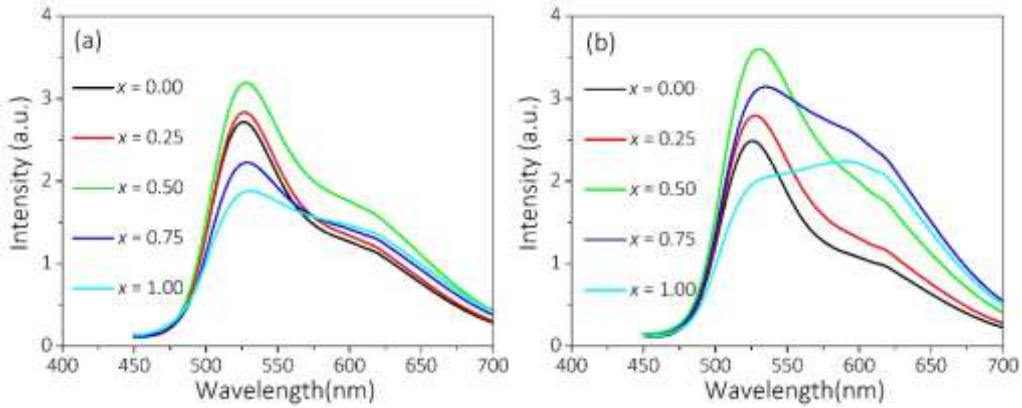

Figure S3. Emission spectra of $Sr_9Mg_{1.5-x}Na_x(PO_4)_7:Eu^{2+}$ (a) and $Sr_9Mg_{1.5-x}Li_x(PO_4)_7:Eu^{2+}$ (b) phosphors.

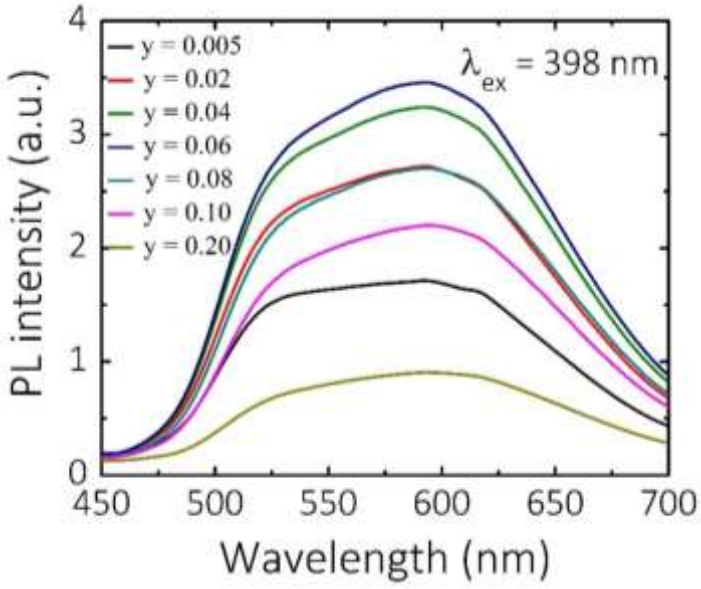

Figure S4. PL spectra as a function of Eu^{2+} concentration (*y*) of SMK.

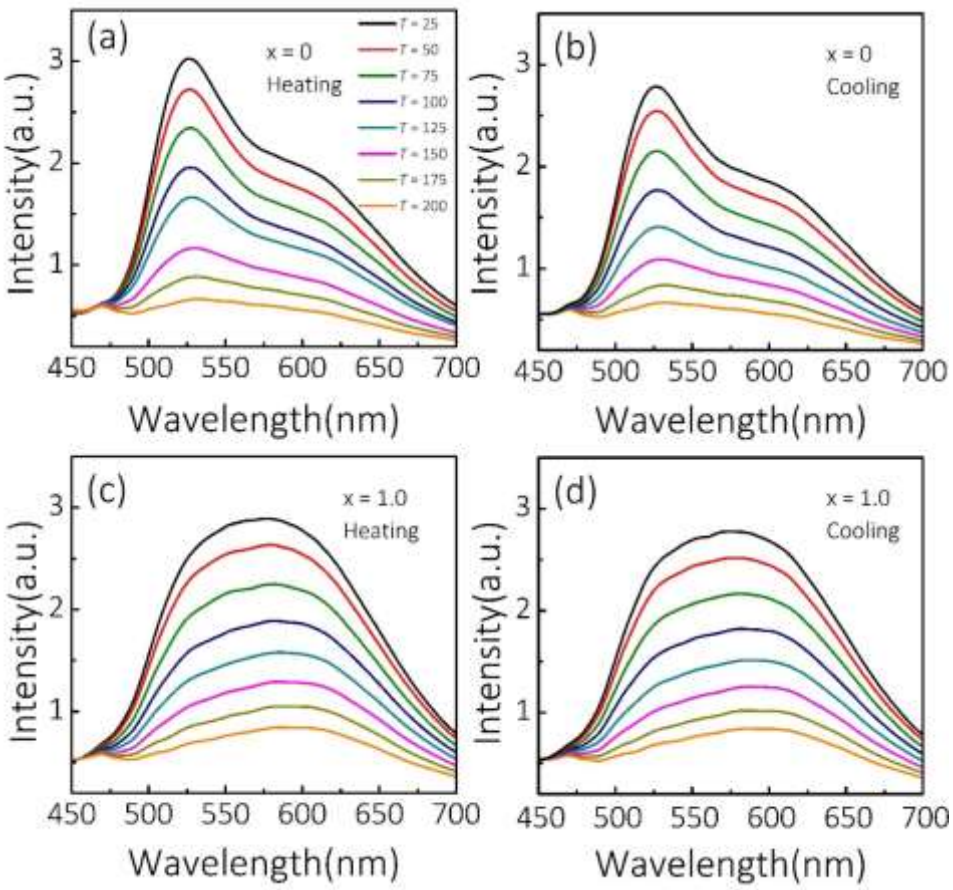

Figure S5. Temperature-dependent emission spectra for SMPK: Eu (a) and (b) Heating/cooling cycles of emission spectra for the SMK000, (c) and (d) Heating/cooling cycles of emission spectra for the SMK100.