Electronic Supplementary Material (ESI) for Journal of Materials Chemistry C.

SUPPORTING INFORMATION

Thermal Stabilization and Energy Transfer in Narrow-band Red-emitting $Sr[(Mg_2Al_2)_{1-y}(Li_2Si_2)_yN_4]:Eu^{2+}$ Phosphors

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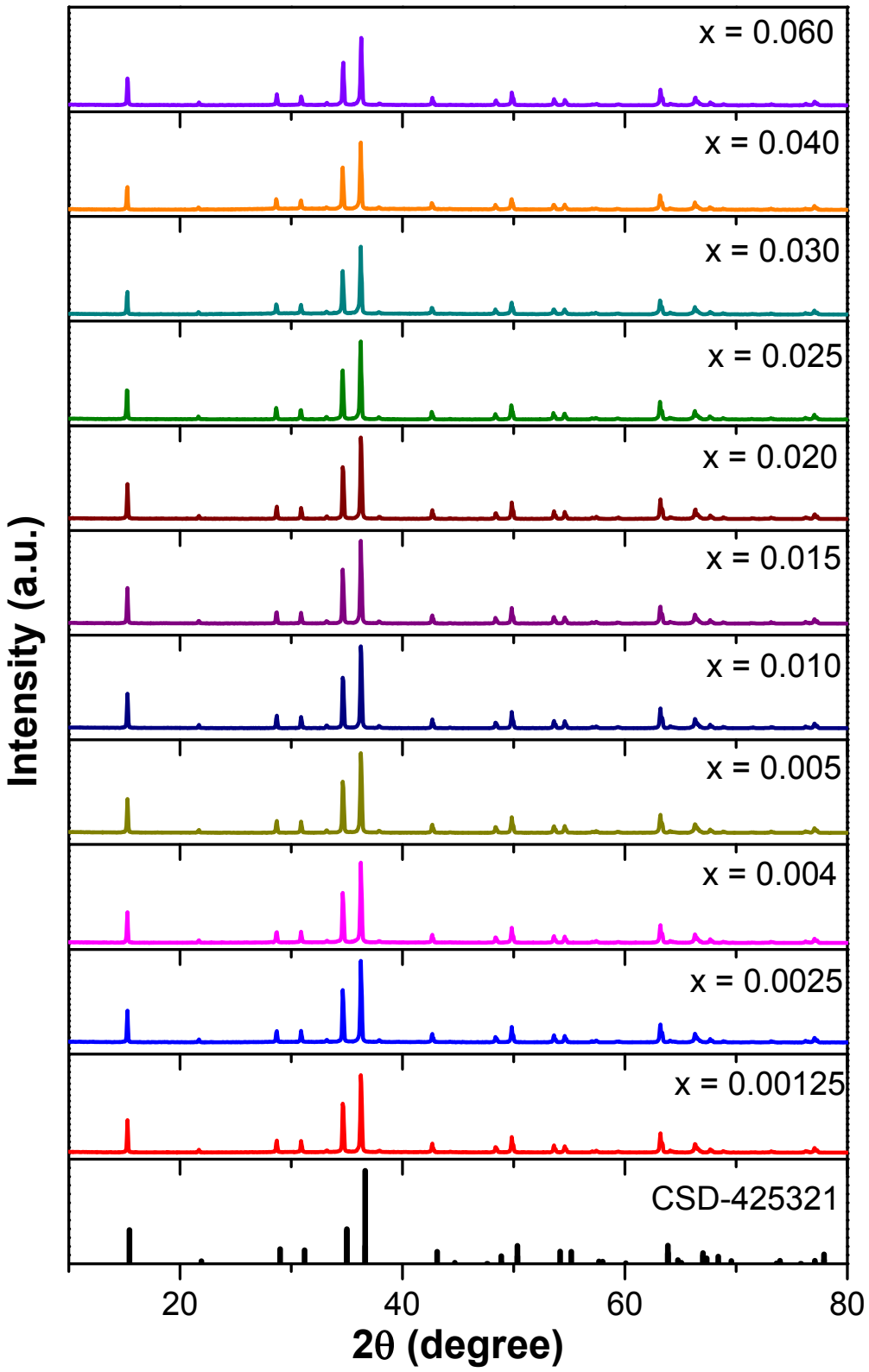

Fig. S1 Powder X-ray diffraction (XRD) patterns of $Sr_{1-x}[(Mg_2Al_2)_{1-y}(Li_2Si_2)_yN_4]:Eu_x^{2+}$ (x = 0.00125–0.06; y = 0).

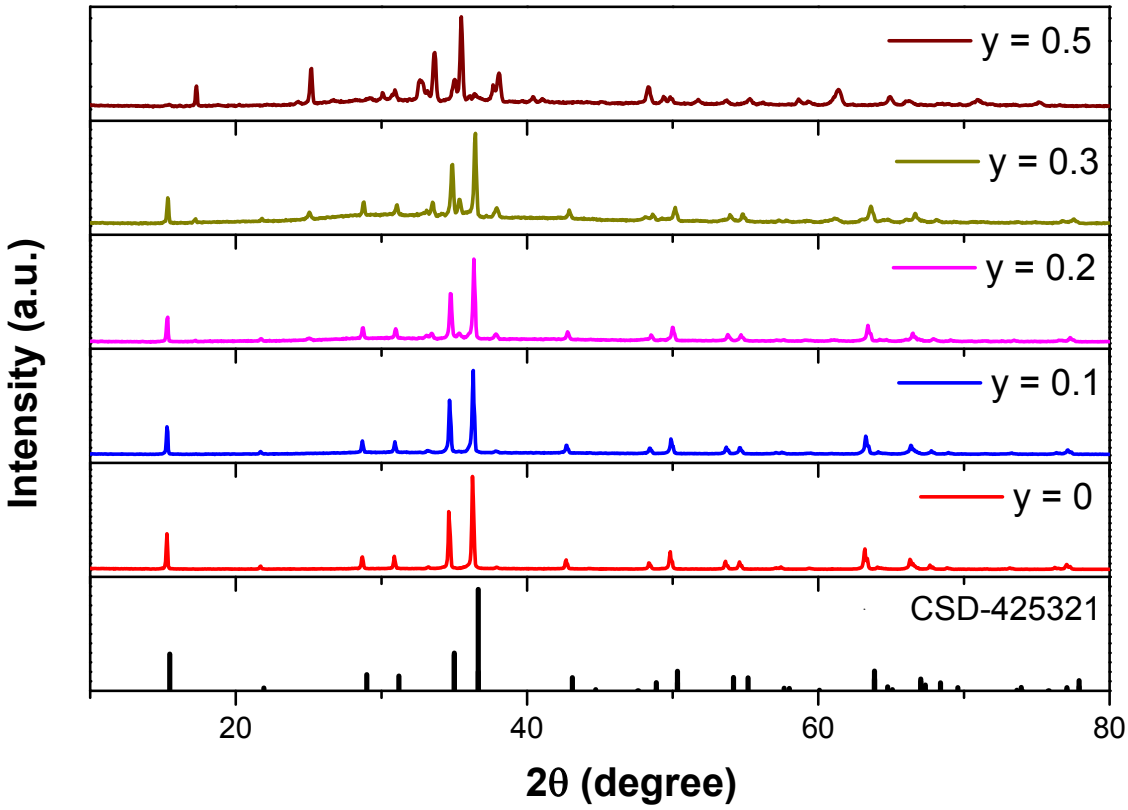

Fig. S2 Powder XRD pattern of $Sr_{1-x}[(Mg_2Al_2)_{1-y}(Li_2Si_2)_yN_4]:Eu_x^{2+}$ (x = 0.004; y = 0–0.5)

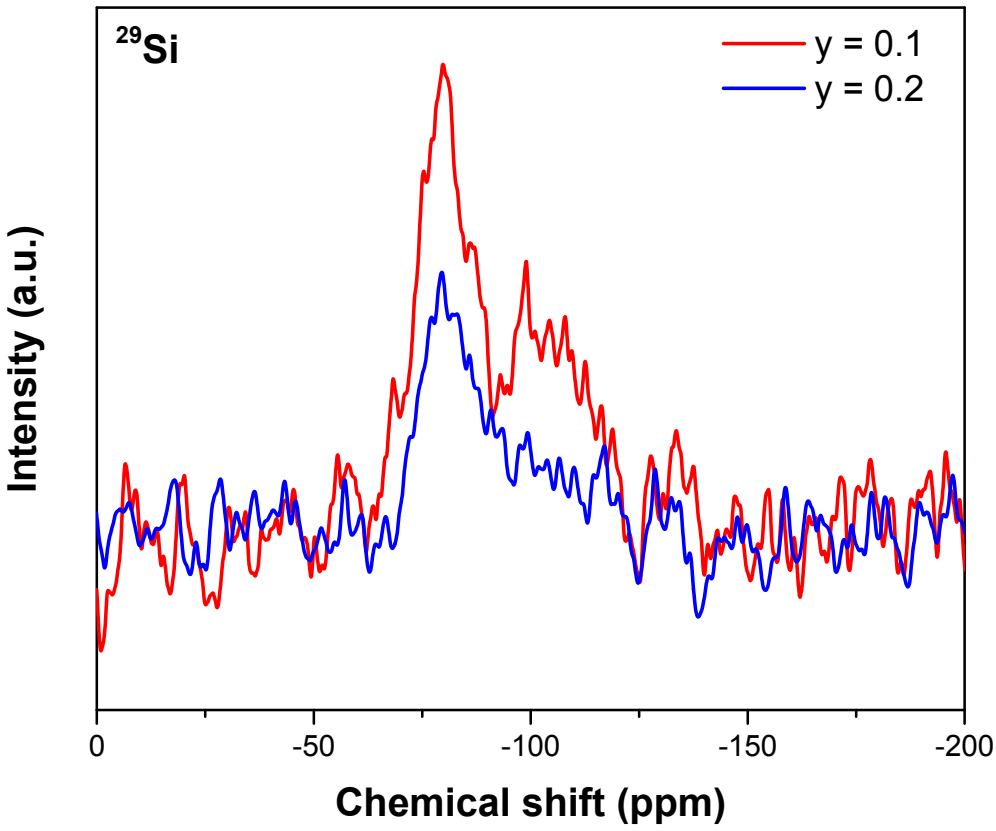

Fig. S3 ^{29}Si Solid state-nuclear magnetic resonance spectra of $Sr_{0.996}[(Mg_2Al_2)_{1-y}(Li_2Si_2)_yN_4]:Eu_{0.004}^{2+}$

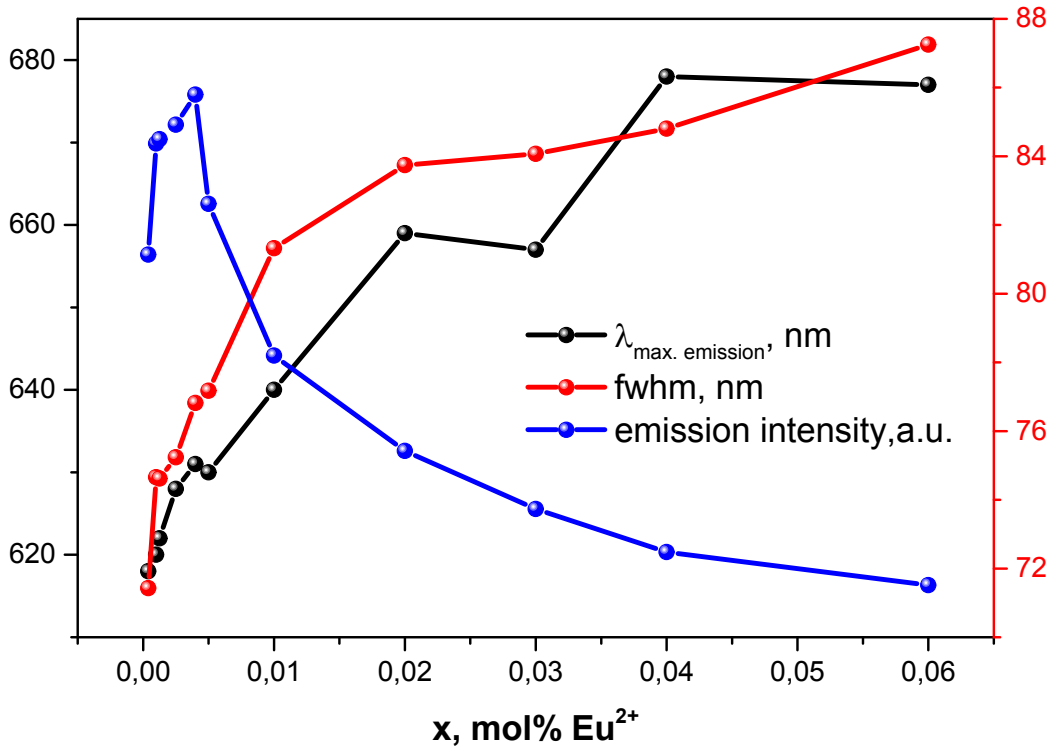

Fig. S4 Emission wavelength, full-width-at-half-maximum (*fwhm*), and photoluminescence emission intensity.

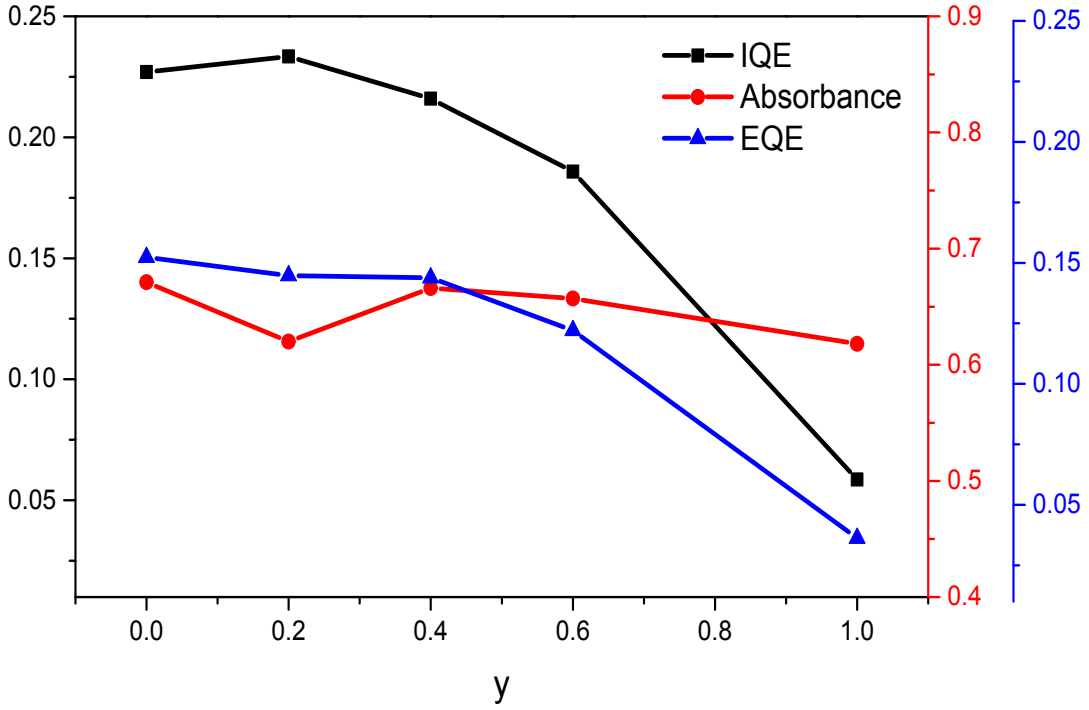

Fig. S5 Quantum efficiency $Sr_{1-x}[(Mg_2Al_2)_{1-y}(Li_2Si_2)_yN_4]:Eu^{2+}$ (x = 0.004; y = 0–1) at 440 nm.

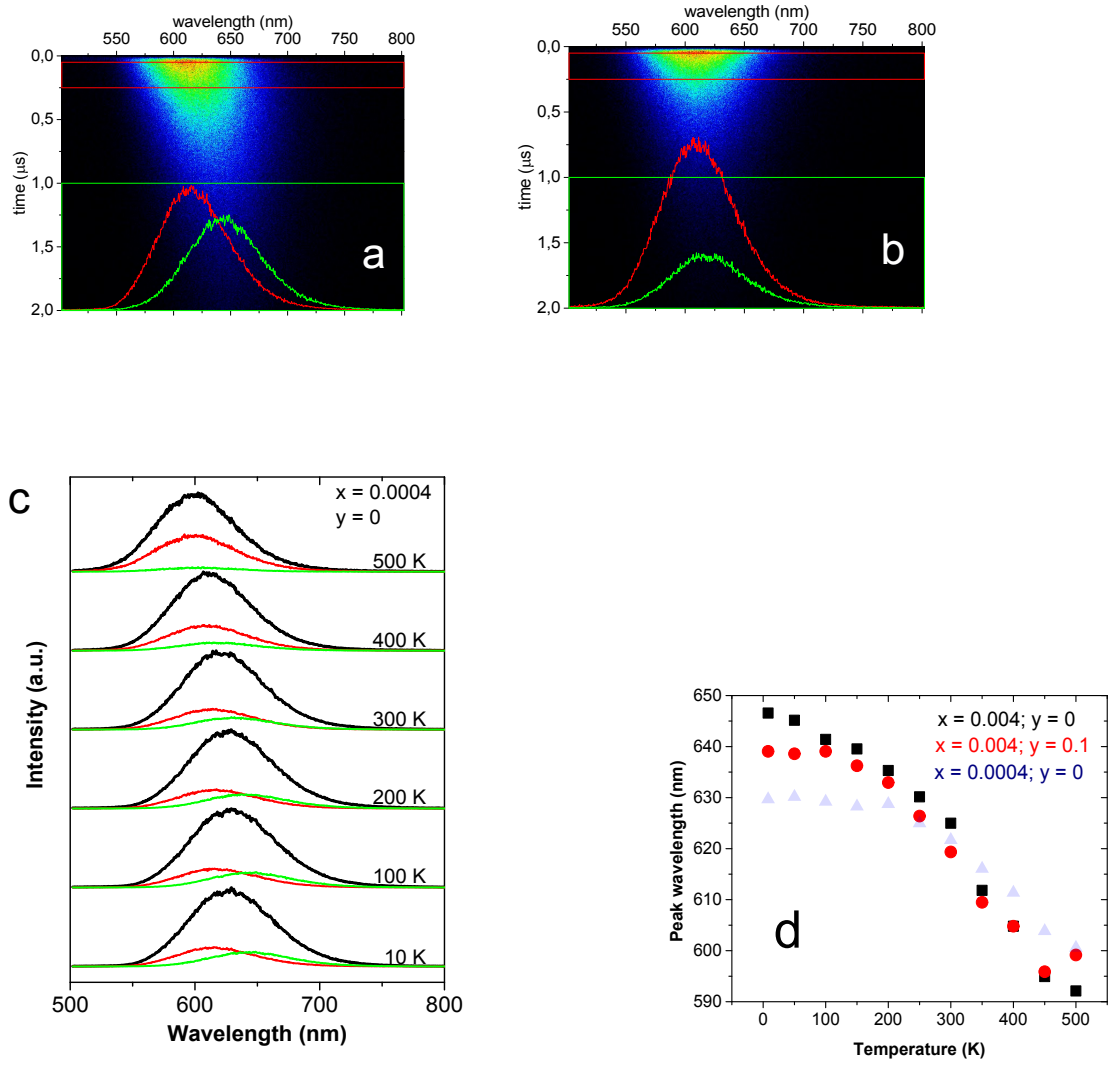

Fig. S6 Streak image of $Sr_{1-x}[(Mg_2Al_2)_{1-y}(Li_2Si_2)_yN_4]:Eu_x^{2+}$ (x = 0.0004, y = 0) at (**a**) 10 and (**b**) 400 K with excitation wavelength of 425 nm. **(c)** Temperature-dependent emission spectra of short-time emission (*red curves*), long-time emission (*green curve*), and total emission (*black curve*) for $Sr_{0.996}[(Mg_2Al_2)_{1-y}(Li_2Si_2)_yN_4]:Eu^{2+}$x = 0.0004, y = 0. Spectra obtained by integrating streak images at areas denoted by respective colors in Figs. S6a and s6b. **(d)** Temperature-dependent emission spectra peak position of total emission spectrum (calculated from the whole streak image) of $Sr_{0.996}[(Mg_2Al_2)_{1-y}(Li_2Si_2)_yN_4]:Eu^{2+}$. (a) x = 0.0004, y = 0; (b)x = 0.004, y = 0; and (c) x = 0.004, y = 0.

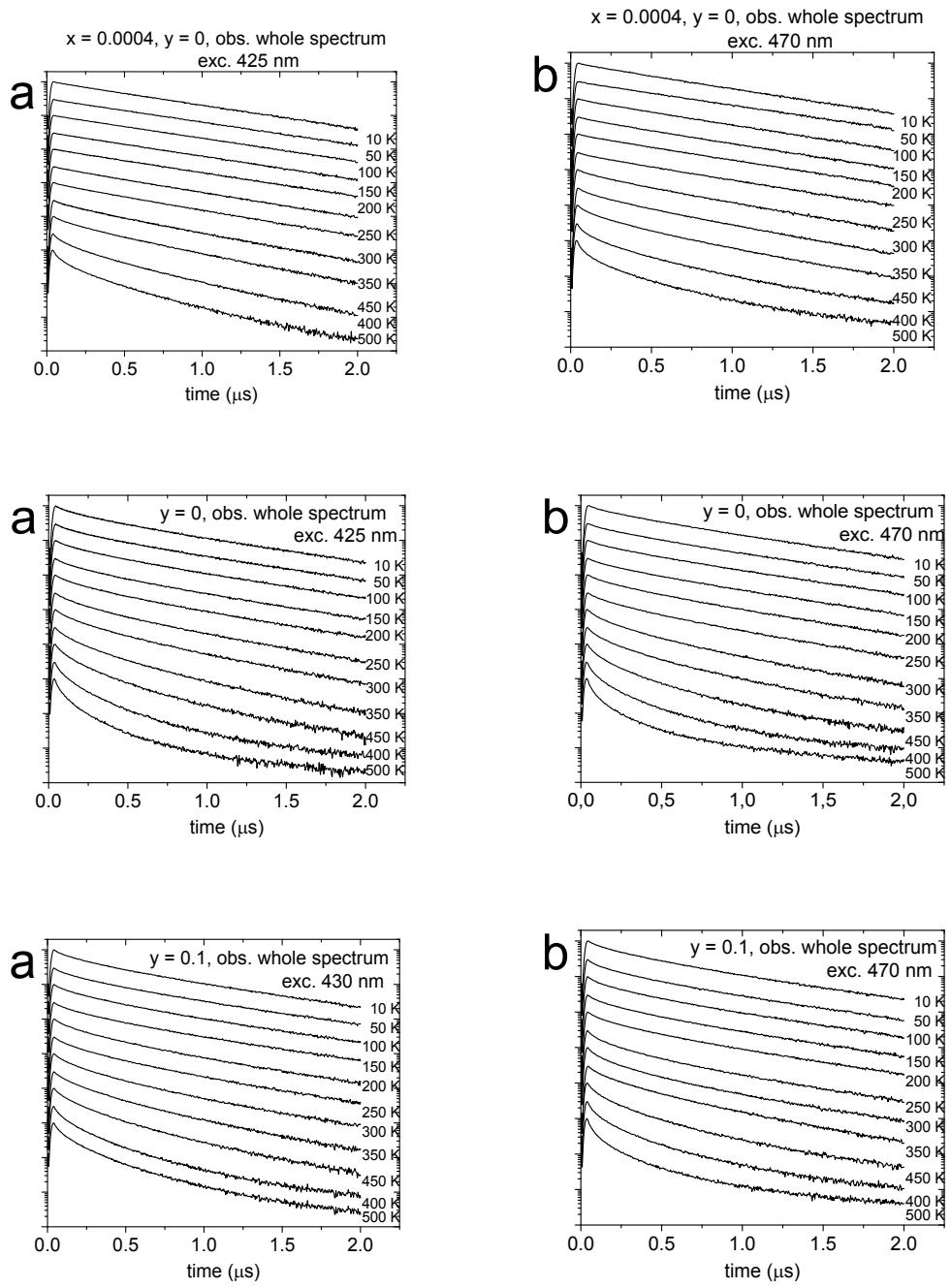

Fig. S7. Temperature-dependent decay profiles of $Sr_{0.996}[(Mg_2Al_2)_{1-y}(Li_2Si_2)_yN_4]:Eu_{0.004}^{2+}$under excitation wavelength (**a**) λ_{exc} = 425 nm and(**b**) λ_{exc} = 470 nm, (Row 1:x = 0.0004, y = 0, Row 2: x = 0.004, y = 0; Row 3: x = 0.004, y = 0.1). The decay profiles have been collected from the whole emission spectrum.

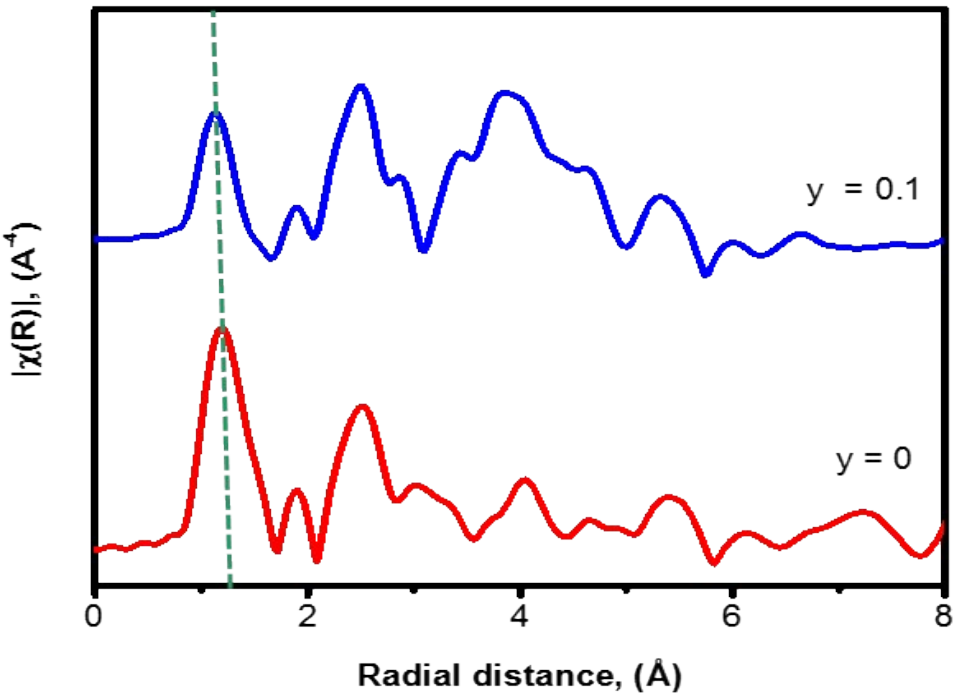

Fig. S8 Extended X-ray fine structure (EXAFS) of $Sr_{1-x}[(Mg_2Al_2)_{1-y}(Li_2Si_2)_yN_4]:Eu_x^{2+}$ (x = 0.004, y = 0, 0.1).

Table S1 Crystallographic data of $Sr[Mg_2Al_2N_4]:Eu^{2+}$.

	$Sr[Mg_2Al_2N_4]$	$Sr[Mg_2Al_2N_4]:Ce^{3+}$	$Sr_{0.996}[(Mg_2Al_2)_{1-y}(Li_2Si_2)_yN_4]:Eu_{0.004}^{2+}$
	Pust, P. et al., *Chem. Mater.* **2014,** *26,* 611-6119.	Leaño, J. Jr., et al., *Chem. Mater.* **2016,** *28*, 6822–6825.	This study
Space group	*I*4/m	*I*4/m	*I*4/m
Crystal system	tetragonal	tetragonal	tetragonal
Lattice parameters			
a, Å	8.1008 (11)	8.17648(8)	8.17164(6)
c, Å	3.3269 (7)	3.35754(4)	3.35780 (3)
Cell volume, $Å^3$	218.32 (6)	224.468 (5)	224.220(4)
Crystallographic Information File	CSD 425321	CSD 431335	

Table S2 Fractional atomic coordinates and isotropic displacement parameters

		x	y	z	Occ.	B_{eq}
Sr	2	0	0	0	1	0.689(2)
Mg	8	0.18232(3)	0.36536(4)	0	0.5	1(21)
Al	8	0.18232(3)	0.36536(4)	0	0.5	1
N	8	0.40296(9)	0.23687(7)	0	1	1.12(8)