

Electronic Supplementary Information

Table S1. Rietveld refined crystallographic parameters of $\text{Na}_3\text{CsMg}_7(\text{PO}_4)_6:x\text{Eu}^{2+}$ ($x = 0, 0.06, 0.10, 0.14, 0.18, 0.20$ and 0.25) samples.

Samples	$x = 0$	$x = 0.06$	$x = 0.10$	$x = 0.14$	$x = 0.18$	$x = 0.20$	$x = 0.25$
Crystal system	Monoclinic						
Space group	$C12/c1$ (15)						
a (Å)	12.762506 (187)	12.762642 (144)	12.763464 (181)	12.763513 (143)	12.763892 (172)	12.765026 (160)	12.765918 (148)
b (Å)	10.720152 (105)	10.721246 (107)	10.722427 (110)	10.723418 (140)	10.723445 (135)	10.724007 (119)	10.725558 (145)
c (Å)	15.545872 (194)	15.546492 (191)	15.547940 (200)	15.549800 (236)	15.550003 (216)	15.551211 (246)	15.556384 (249)
$\alpha = \gamma$ (°)	90	90	90	90	90	90	90
β (°)	113	113	113	113	113	113	113
V (Å ³)	1957.613	1958.598	1958.757	1958.804	1958.840	1959.178	1959.789
2θ -interval	6-75°	6-75°	6-75°	6-75°	6-75°	6-75°	6-75°
Z	16	16	16	16	16	16	16
R_{wp} (%)	6.71 %	6.02 %	6.42 %	6.57 %	6.38 %	6.19 %	6.88 %
R_{p} (%)	4.45 %	4.06 %	4.23 %	4.17 %	4.11 %	4.06 %	4.15 %
χ^2	1.309	1.059	1.205	1.264	1.181	1.118	1.406

Table S2. Rietveld refined crystallographic parameters of $\text{Na}_3\text{CsMg}_{7-y}(\text{PO}_4)_6: y\text{Mn}^{2+}$ ($y = 0, 0.2, 0.4, 0.6, 0.8, 1.0$) and $\text{Na}_3\text{CsMg}_{6.6}(\text{PO}_4)_6: 0.18\text{Eu}^{2+}/0.4\text{Mn}^{2+}$ series samples.

Samples	$y = 0$	$y = 0.2$	$y = 0.4$	$y = 0.6$	$y = 0.8$	$y = 1.0$	$x = 0.18,$ $y = 0.4$
Crystal system	Monoclinic						
Space group	$C12/c1$ (15)						
a (Å)	12.762506 (187)	12.770974 (147)	12.774812 (149)	12.784986 (142)	12.790604 (157)	12.804872 (138)	12.773269 (161)
b (Å)	10.720152 (105)	10.725223 (113)	10.725857 (109)	10.733162 (102)	10.734987 (113)	10.739982 (99)	10.729808 (117)
c (Å)	15.545872 (194)	15.556590 (203)	15.558581 (207)	15.576183 (193)	15.584209 (212)	15.602550 (183)	15.568131 (131)
$\alpha = \gamma$ (°)	90	90	90	90	90	90	90
β (°)	113	113	113	113	113	113	113
V (Å ³)	1957.613	1961.356	1962.185	1967.493	1969.792	1975.278	1963.588
2θ -interval	6-75°	6-75°	6-75°	6-75°	6-75°	6-75°	6-75°
Z	16	16	16	16	16	16	16
R_{wp} (%)	6.71 %	6.49 %	7.07 %	6.66 %	6.17 %	5.12 %	5.46 %
R_{p} (%)	4.45 %	4.40 %	4.86 %	4.60 %	4.16 %	3.41 %	3.79 %
χ^2	1.309	1.225	1.501	1.329	1.185	0.825	0.8206

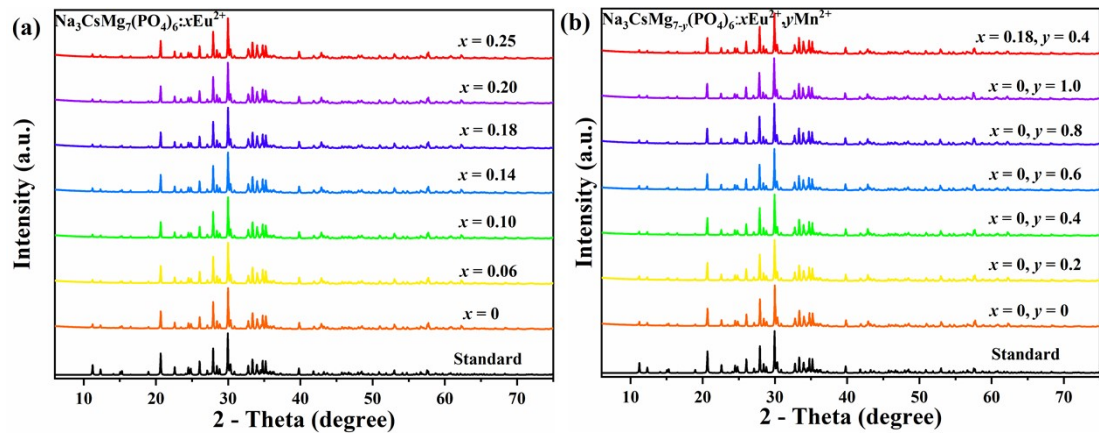


Figure S1. (a) XRD patterns of the $\text{Na}_3\text{CsMg}_7(\text{PO}_4)_6:\text{xEu}^{2+}$ ($x = 0, 0.06, 0.10, 0.14, 0.18, 0.20$ and 0.25); (b) XRD patterns of the the $\text{Na}_3\text{CsMg}_{7-y}(\text{PO}_4)_6:y\text{Mn}^{2+}$ ($y = 0, 0.2, 0.4, 0.6, 0.8, 1.0$) and $\text{Na}_3\text{CsMg}_{6.6}(\text{PO}_4)_6: 0.18\text{Eu}^{2+}, 0.4\text{Mn}^{2+}$ series samples.

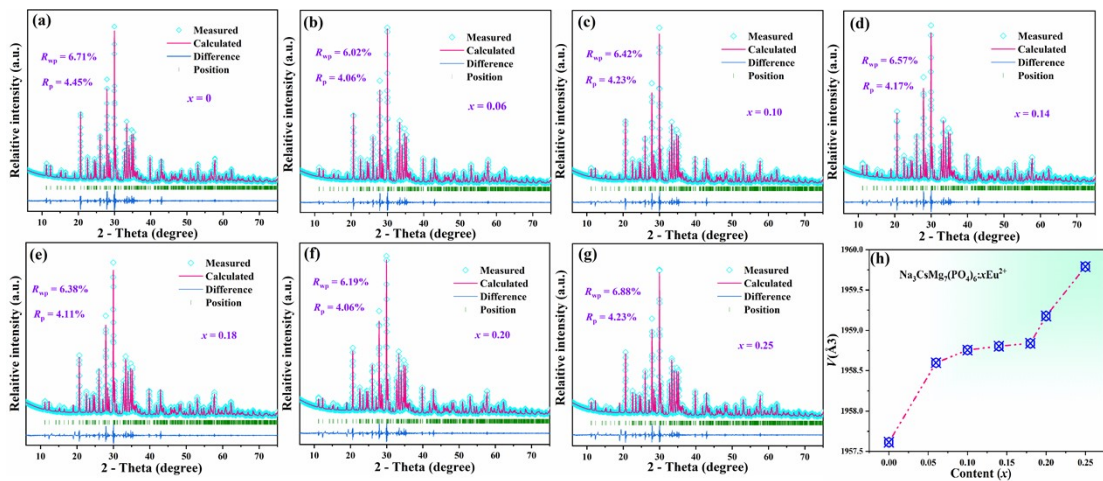


Figure S2. (a), (b) (c) (d) (e) (f) and (g) Rietveld refinements of the XRD files for $\text{Na}_3\text{CsMg}_7(\text{PO}_4)_6:\text{xEu}^{2+}$ ($x = 0, 0.06, 0.10, 0.14, 0.18, 0.20$ and 0.25), respectively; (h) The unit cell volume V for $\text{Na}_3\text{CsMg}_7(\text{PO}_4)_6:\text{xEu}^{2+}$ ($x = 0, 0.06, 0.10, 0.14, 0.18, 0.20$ and 0.25) samples.

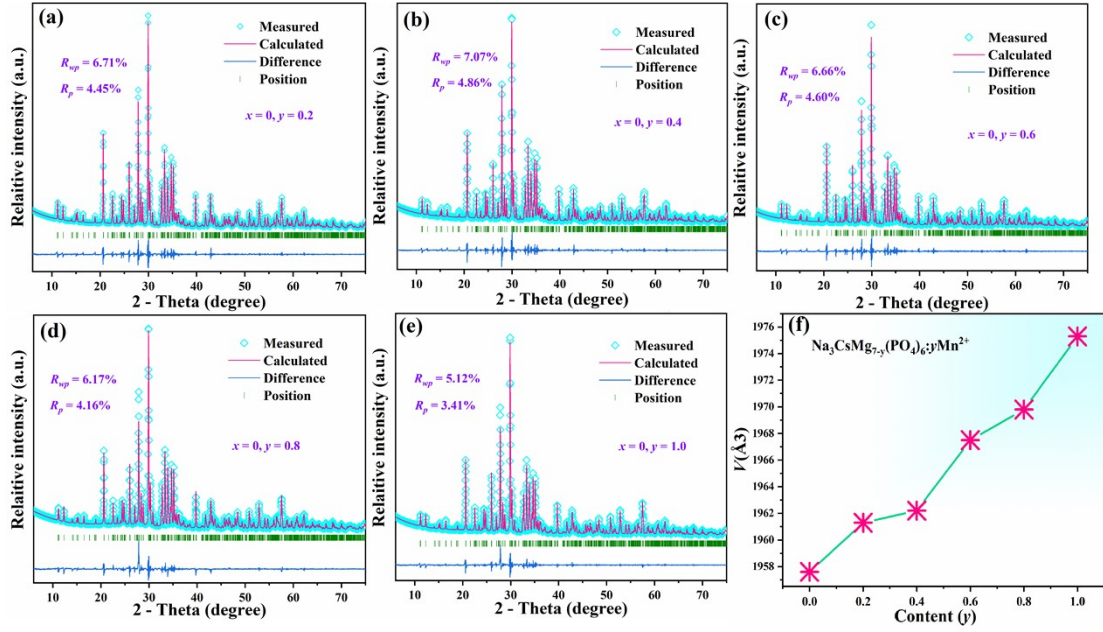


Figure S3. (a), (b) (c) (d) and (e) Rietveld refinements of the XRD files for $\text{Na}_3\text{CsMg}_{7-y}(\text{PO}_4)_6:y\text{Mn}^{2+}$ ($y = 0, 0.2, 0.4, 0.6, 0.8, 1.0$), respectively; (f) The unit cell volume V for $\text{Na}_3\text{CsMg}_{7-y}(\text{PO}_4)_6:y\text{Mn}^{2+}$ ($y = 0, 0.2, 0.4, 0.6, 0.8, 1.0$) samples.

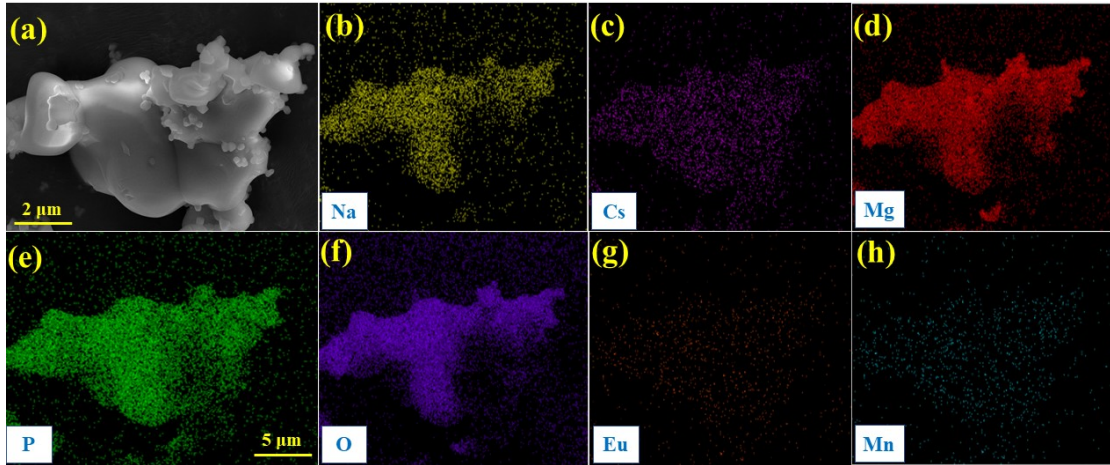


Figure S4. SEM images of $\text{Na}_3\text{CsMg}_7(\text{PO}_4)_6:0.18\text{Eu}^{2+},0.4\text{Mn}^{2+}$ at different magnifications (a) and elemental mappings of (b) Na, (c) Cs, (d) Mg, (e) P, (f) O, (g) Eu and (h) Mn.

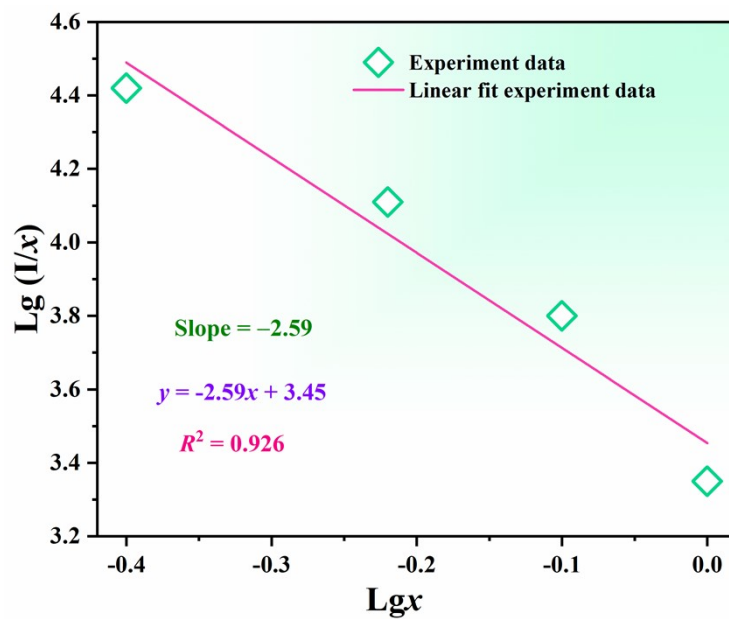


Figure S5. Fitting line of $\log(I/x)$ versus $\log(x)$ in $\text{Na}_3\text{CsMg}_{7-y}(\text{PO}_4)_6: y\text{Mn}^{2+}$ ($y = 0, 0.2, 0.4, 0.6, 0.8, 1.0$) phosphors.