

Electronic Supplementary Information (ESI)

Crystal field optimization and fluorescence enhancement of Mn⁴⁺-doped fluoride red phosphor with excellent stability induced by double-site metal ion replacement for warm WLED

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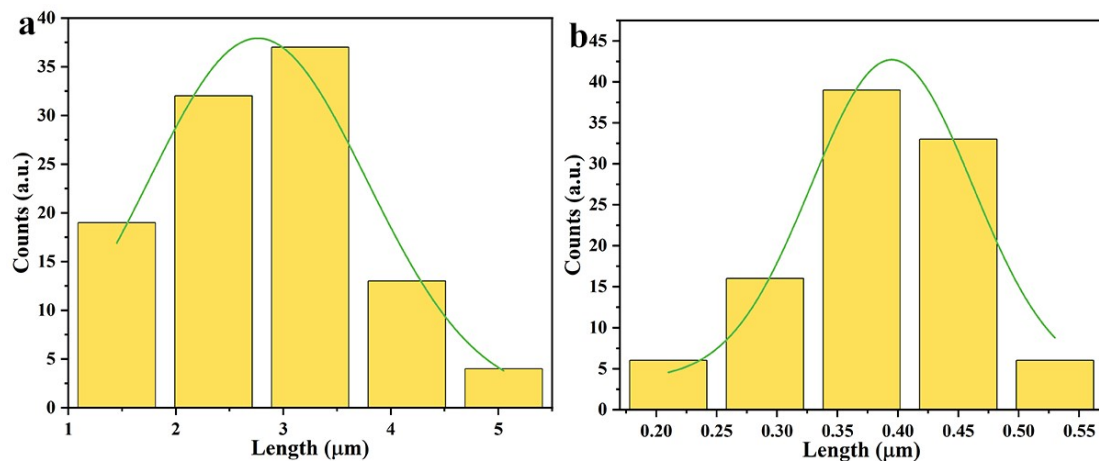


Fig. S1 Histogram of length (a) and diameter (b) of as-prepared BaSiF₆:Mn⁴⁺ red phosphor.

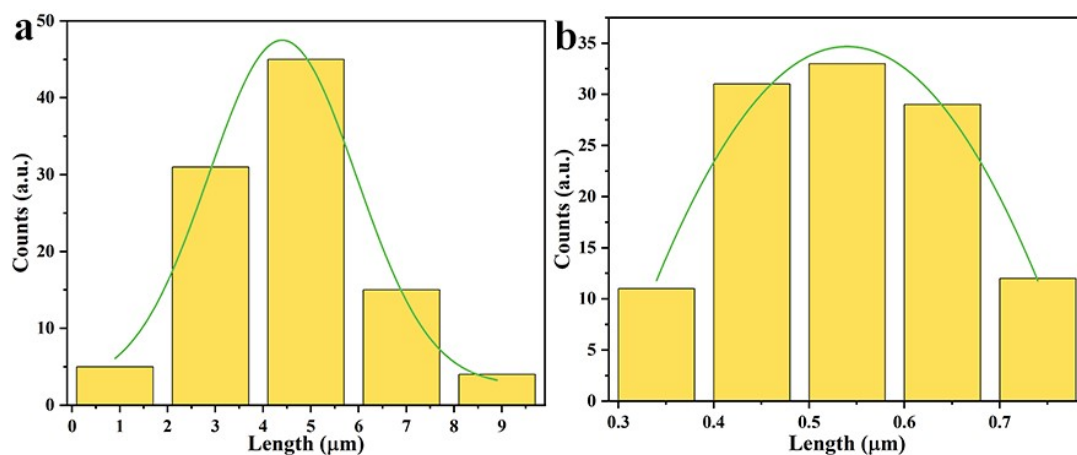


Fig. S2 Histogram of length (a) and diameter (b) of as-prepared BaSi_{0.5}Ge_{0.5}F₆:Mn⁴⁺ red phosphor.

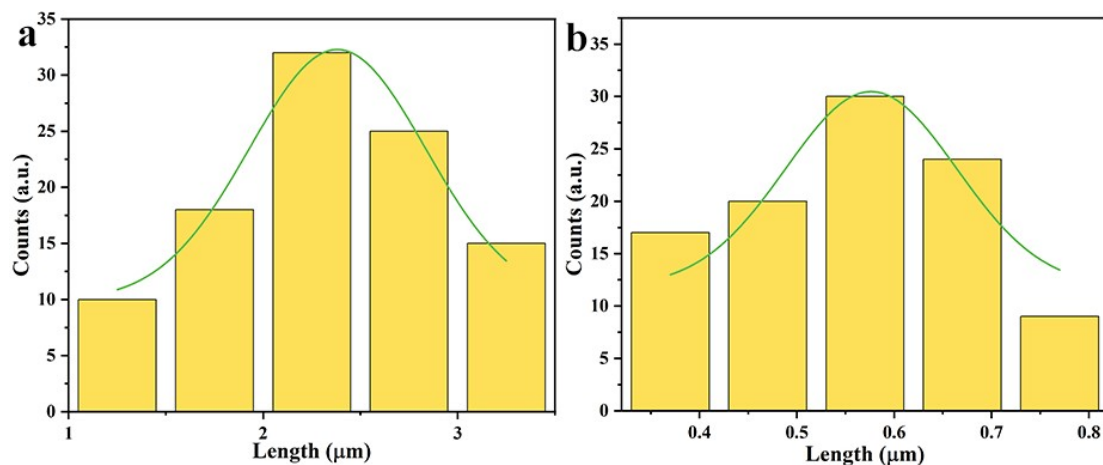


Fig. S3 Histogram of length (a) and diameter (b) of as-prepared K_{0.6}Ba_{0.7}Si_{0.5}Ge_{0.5}F₆:Mn⁴⁺ red phosphor

Table 1 Spectroscopic parameters and β_1 values of Mn^{4+} ions for as-reported Mn^{4+} -activated fluorides and oxides phosphor reported by other literature

Host	D_q/cm^{-1}	B/cm^{-1}	C/cm^{-1}	β_1	$E(^2E_g)/cm^{-1}$	Ref.
Na_2TiF_6	2100	504	4052	1.037	16129	1
$K_2XF_7(X = Ta, Nb)$	2166	511	3955	1.03	15948	2
$(NH_4)_2NaAlF_6$	2144	531	3850	1.004	15698	3
$(NH_4)_2NaGaF_6$	2144	531	3858	1.006	15723	3
$(NH_4)_2NaInF_6$	2144	531	3874	1.01	15772	3
$KZnF_3$	2105	607	3785	1.0235	15797	4
$KGaP_2O_7$	2204	782	2804	0.9385	14245	5
$SrGd_2Al_2O_7$	2053	767	2762	0.921	13793	6
Gd_2ZnTiO_6	1980	639	3132	0.913	14184	7
$Li_3Mg_2SbO_6$	2096	812	2634	0.9299	15015	8
$La(MgTi)_{1/2}O_3$	2053	700	2959	0.915	14124	9
Sr_2LaNbO_6	2101	722	3001	0.9348	14409	10
$K_{0.6}Ba_{0.7}Si_{0.5}Ge_{0.5}F_6$	2173	556	3795	1.004	15773	This work

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