

Lanthanide Doped $\text{Na}_2\text{MgScF}_7$ with Downshifting and Upconversion Emissions for Multicolor Anti-Counterfeiting

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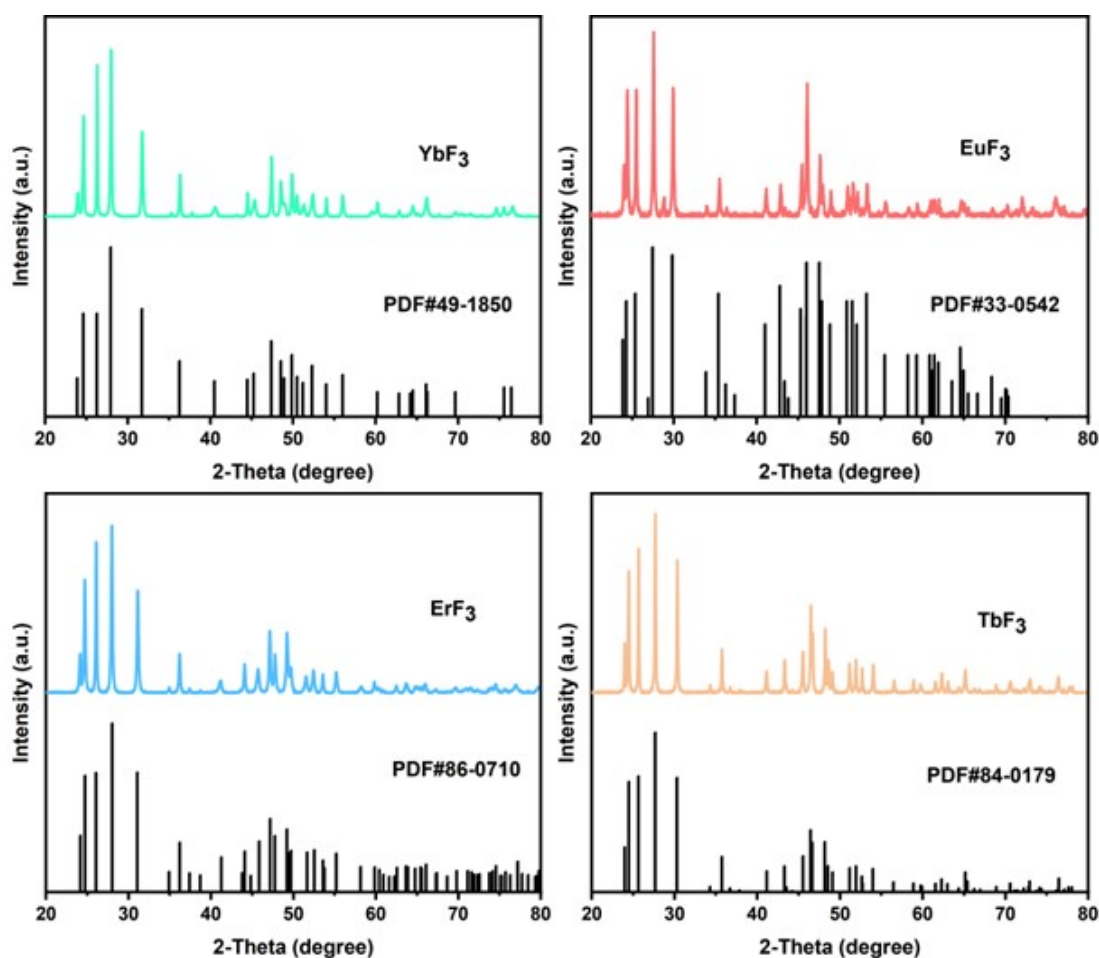


Fig. S1 XRD patterns of the prepared TbF₃, EuF₃, ErF₃ and YbF₃ samples.

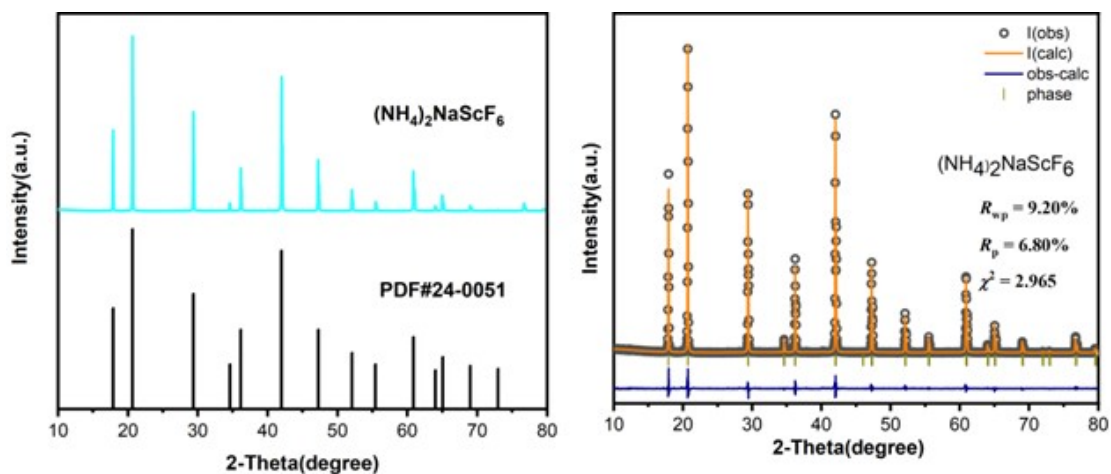


Fig. S2 XRD patterns of the $(\text{NH}_4)_2\text{NaScF}_6$ samples and the Rietveld refinement results of the $(\text{NH}_4)_3\text{NaScF}_6$ samples.

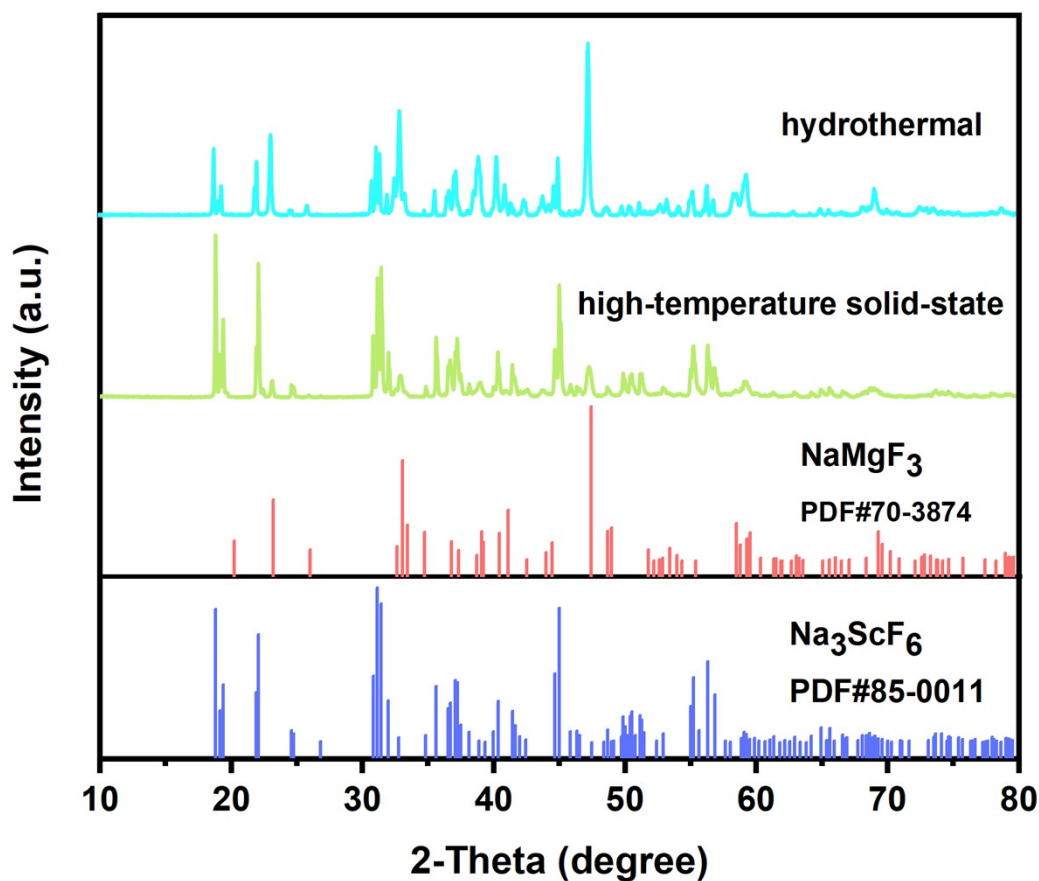


Fig. S3 The products from direct high-temperature solid-state reaction of MgF_2 , NaF , $(\text{NH}_4)\text{ScF}_6$, and hydrothermal reaction of precipitation of Na^+ , Mg^{2+} , Sc^{3+} , and F^- in solution. Noted that both these two reactions cannot obtain the target NMSF.

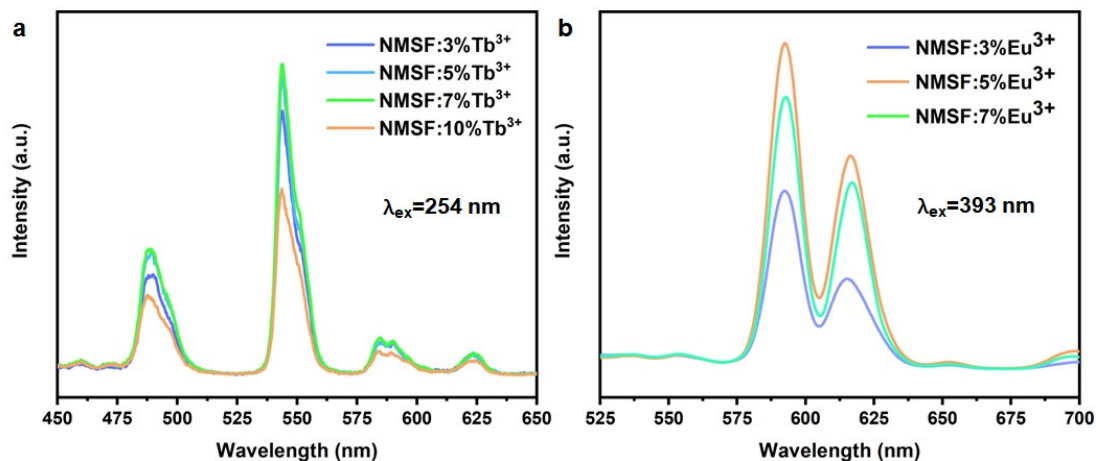


Fig. S4 PL spectra of the NMSF phosphors doped with different concentrations of Tb^{3+} or Eu^{3+} .

Table S1. Rietveld refinement results and crystal data for NMSF and NMSF:5% Tb^{3+}

Sample	NMSF	NMSF:5% Tb^{3+}
Symmetry	Orthorhombic	Orthorhombic
Space group	<i>Imma</i> (no. 74)	<i>Imma</i> (no. 74)
Cell parameters	$a = 10.40860(18) \text{ \AA}$	$a = 10.36956(15) \text{ \AA}$
	$b = 7.32804(12) \text{ \AA}$	$b = 7.30959(9) \text{ \AA}$
	$c = 7.52879(11) \text{ \AA}$	$c = 7.51215(7) \text{ \AA}$
	$\alpha = \beta = \gamma = 90^\circ$	$\alpha = \beta = \gamma = 90^\circ$
	$V = 574.256(24) \text{ \AA}^3$	$V = 569.400(12) \text{ \AA}^3$
	$Z=4$	$Z=4$