

Rapid Aqueous-phase Synthesis and Photoluminescence Properties of $K_{0.3}Bi_{0.7}F_{2.4}:Ln^{3+}$ ($Ln = Eu, Tb, Pr, Nd, Sm, Dy$) Nanocrystalline Particles

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1. Materials synthesis

Typically, solution A was prepared by dissolving $BiCl_3$ and $LnCl_3 \cdot 6H_2O$ in 6 mL of HCl solution (≥ 1.5 M). Note that high concentration HCl solution was used here in order to prevent the hydrolysis of Bi^{3+} . Meanwhile, solution B was prepared by dissolving KF in 2.5 mL of deionized water in another Teflon beaker. Subsequently, the solution A was added into the solution B. The resultant mixture was stirred for 1 min at room temperature ~ 80 °C. After the reaction, the obtained product was centrifuged, washed several times with deionized water and ethanol, and dried at 50 °C for 12 h to obtain the final products.

2. Characterization

The crystal structure and phase composition were measured by powder X-ray diffraction (XRD, DMAX-2500PC, Rigaku) with a scanning speed of $10^\circ \text{ min}^{-1}$. The morphology of the as-prepared nanophosphors was analyzed using a field-emission scanning electron microscope (SEM, JSM-7800F, JEOL). The photoluminescence properties were studied by using an Edinburgh FLS1000 fluorescence spectrophotometer equipped with the 450 W Xe lamp and a photomultiplier tube (measurement range, 200–900 nm). The decay curves were also performed on the same fluorescence spectrophotometer by using a 60 W μs flash lamp as an excitation source.

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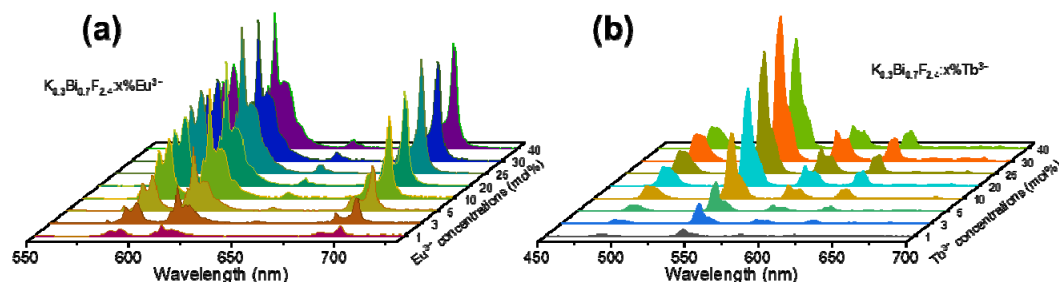


Figure S1. Emission spectra of the KBF:Ln (Ln = Eu, Tb) samples doped with different Ln³⁺ concentration.

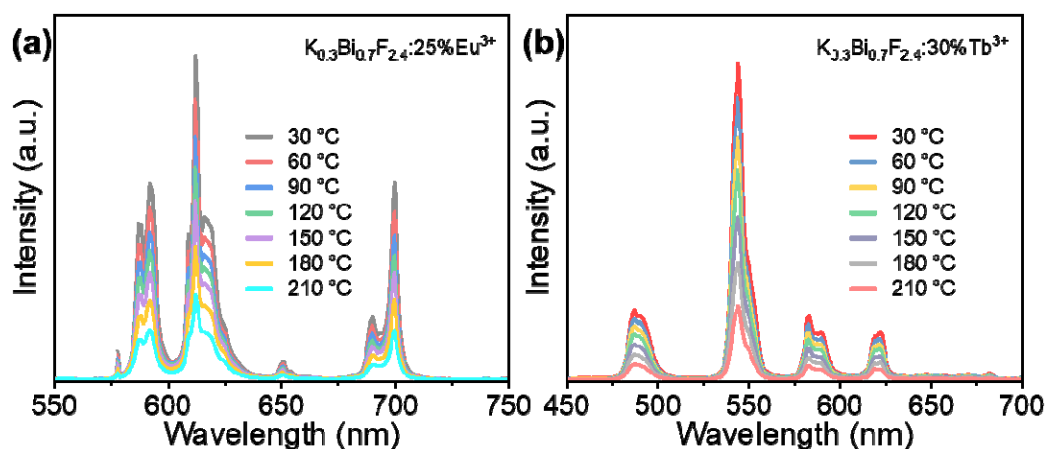


Figure S2. Temperature-dependent emission spectra of the KBF:25%Eu (a) and KBF:30%Tb (b) samples.

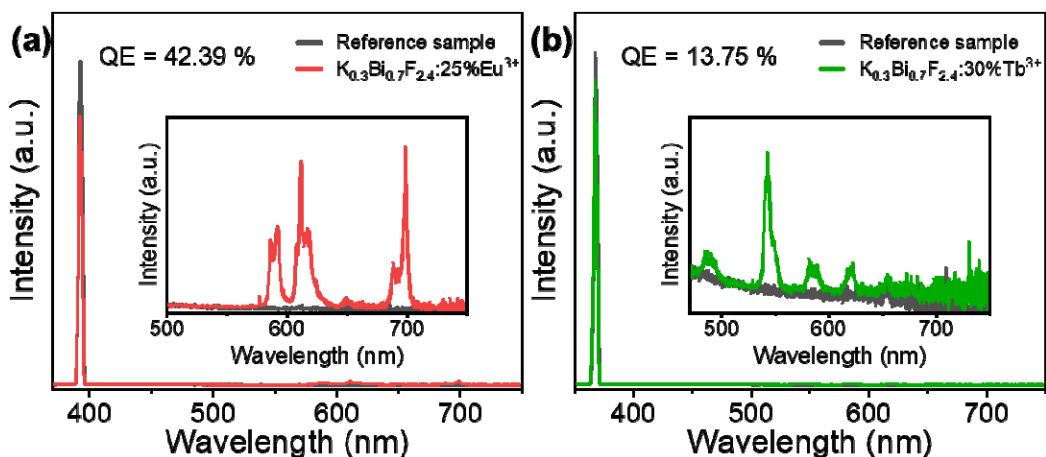


Figure S3. Excitation line of BaSO₄ and emission spectrum of KBF:25%Eu (a) and KBF:30%Tb (b) samples. Inset shows the magnification of the emission spectrum.

Table S1. The crystallite size of pure KBF synthesized at different reaction temperatures.

Samples	K	λ /nm	(h k l)	2-Theta/°	FWHM/°	D/nm
KBF (RT)				26.180	0.164	52.11
KBF (50 °C)	0.943	0.15406	(1 1 1)	26.201	0.155	55.14
KBF (80 °C)				26.161	0.141	60.61

Table S2. The crystallite size of the lanthanide doped KBF nanocrystalline particles.

Samples	K	λ/nm	(h k l)	2-Theta/ $^{\circ}$	FWHM/ $^{\circ}$	D/nm
KBF:5%Pr ³⁺	0.943	0.15406	(1 1 1)	26.160	0.190	44.98
KBF:2%Nd ³⁺				26.241	0.168	50.87
KBF:5%Sm ³⁺				26.119	0.186	45.94
KBF:5%Dy ³⁺				26.142	0.215	39.75
KBF:25%Eu ³⁺				26.339	0.302	28.31
KBF:30%Tb ³⁺				26.42	0.419	20.41