

Dy³⁺/Er³⁺ co-doped SrMoO₄ phosphors for wLED application

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1. Introduction

Rare-earth-doped phosphors like SrMoO₄ offer tunable emission colors due to the distinct energy levels arising from 4 f electron arrangements. This property enables a range of fluorescence spectra through transitions among these levels. Consequently, these phosphors find extensive use in diverse applications, leveraging their ability to emit different colors based on specific rare-earth dopants.

2. Synthesis Process

Phosphors were synthesized using a urea-assisted auto-combustion method: strontium oxide and rare-earth (RE) nitrates were mixed with HNO₃, stirred for 1 hour, and combined with a molybdate precursor in water with urea (metal nitrate to urea ratio of 2:1). The resulting solution was heated to evaporate water, then calcined at 1000 °C for 4 hours. Phosphors with different doping levels were produced: Dy³⁺-doped SrMoO₄ (D0 to D5), Er³⁺-doped SrMoO₄ (E1 to E4), and co-doped SrMoO₄:4Dy³⁺,Er³⁺ (D4E1 to D4E4).

3. Result & Discussion

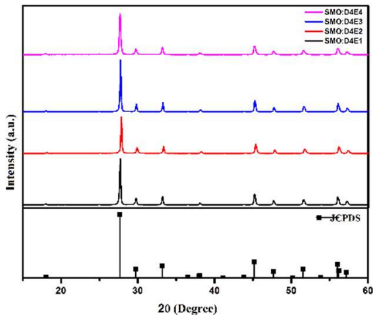


Fig.1 XRD pattern of D4Ex (x = 1, 2, 3, 4)

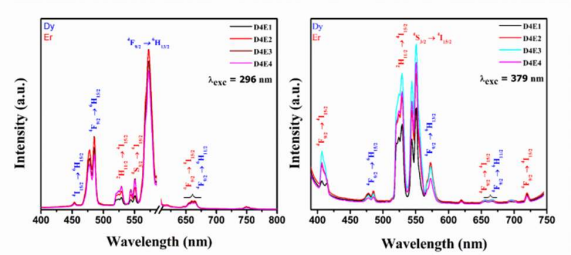


Fig. 2 PL spectrum of D4Ex (x = 1, 2, 3, 4) phosphors with excitation wavelength of (a) Host Excitation (b) Dopant Excitation

Emission spectra of samples with fixed Dy³⁺ and varying Er³⁺ contents, The highlights here are the decrement in the intensity of the 573 nm band and increment in Er³⁺ due to energy transfer in host excitation from host to Dy and Er.

Table I Colour purity and CIE co-ordinates of D4Ex (x = 1, 2, 3, & 4)

Sample Code	CIE (x, y)	CCT (K)	Purity (%)
D4E1	0.3770, 0.4282	4388	41.7
D4E2	0.3726, 0.4340	4515	42.2
D4E3	0.3690, 0.4474	4647	45.1
D4E4	0.3694, 0.4492	4644	45.8

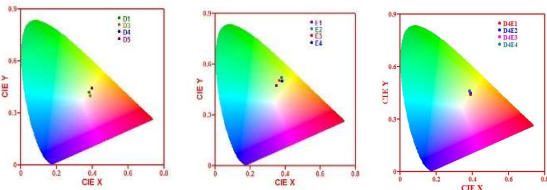


Fig. 3 CIE coordinates of Dx (x = 1, 3, 4, 5); Ex (1, 2, 3, 4) & D4Ex (x = 1, 2, 3, 4) phosphors.

4. Conclusions

Dy³⁺/Er³⁺ co-doped SrMoO₄ phosphors were prepared via a simple urea-assisted auto-combustion process. The creation of the phosphors' tetragonal crystal structure is confirmed by the structural investigation. The energy levels produced within the bandgap of SrMoO₄ are responsible for the change in the absorption peak observed following Dy³⁺ and Er³⁺ doping, as determined by the absorption spectra. The synthesized phosphors' photoluminescence (PL) was seen at an excitation wavelength of 296 nm. In the PL spectra, all emission peaks that correspond to the Dy³⁺ and Er³⁺ ions are visible.

Acknowledgements

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References

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