

Supporting information

Spectral Tuning of the n-UV convertible Oxynitride Phosphor: Orange Color Emitting

Realization via energy transfer mechanism

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Experimental Section

Synthesis and Characterization

Powder samples of YASON:Ce³⁺,Tb³⁺,Eu³⁺ were prepared by solid-state reaction starting from high purity Y₂O₃, Eu₂O₃, Tb₄O₇, CeO₂, Al₂O₃, and α -Si₃N₄. The powder reagents were intimately ground together with ethanol in an agate mortar, placed in high purity Al₂O₃ crucibles, and heated at 1550 ~ 1650°C in a 10%/H₂-/90%N₂ atmosphere for 6h. Finally, the obtained samples were cooled to room temperature and ground again in an agate mortar. Powder XRD data were obtained using Cu-K radiation (Bruker D8) over the angular range 10°≤2θ≤80° with a step size 0.02°. Photoluminescence (PL) spectra were measured on a Hitachi F-4500 luminescence spectrophotometer scanning the wavelength range of 200-700nm. The diffuse-reflectance spectra were obtained by a SHIMADZU UV-vis-NIR spectrophotometer with the reflection of black felt (reflection 3%) and white BaSO₄ (reflection 100%) in the wavelength region of 300-800 nm. The luminescent decay curve was obtained from a Lecroy Wave Runner 6100 Digital Oscilloscope (1GHz) using a tunable laser (pulse width = 4ns, gate = 50ns) as the excitation source (Continuum Sunlite OPO). The temperature-dependence properties of the phosphors were measured by an FLS-920 combined fluorescence lifetime and steady state spectrometer (Edinburgh Instruments), and the excitation sources used include a 450W xenon lamp.

Results and Discussion

Phase formation

Figure S1 shows the X-ray diffraction pattern of the synthesized sample YASON:Ce³⁺,Tb³⁺,Eu³⁺.

All the diffraction peaks of obtained samples can be indexed to the standard data of Y₁₀Al₂Si₃O₁₈N₄ with JCPDS file no 32-1426 except for some shift toward smaller angle, indicating that the obtained samples are single phase and doped activators, (Ce³⁺, Tb³⁺, Eu³⁺ ions) have been incorporated in the host lattice by replacing the Y³⁺ crystallographic sites due to their similar physical character.¹

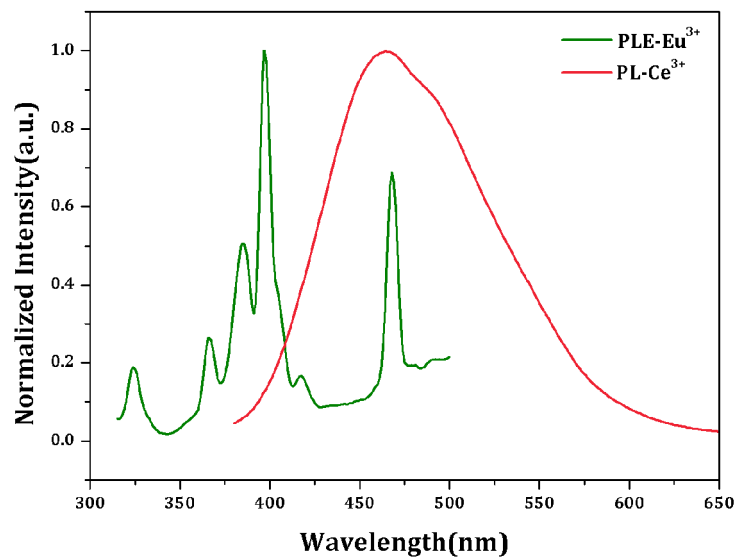


Figure S1. The overlap spectra between the PLE-YASON:0.05Eu³⁺ and PL- YASON:0.05Ce³⁺ samples.

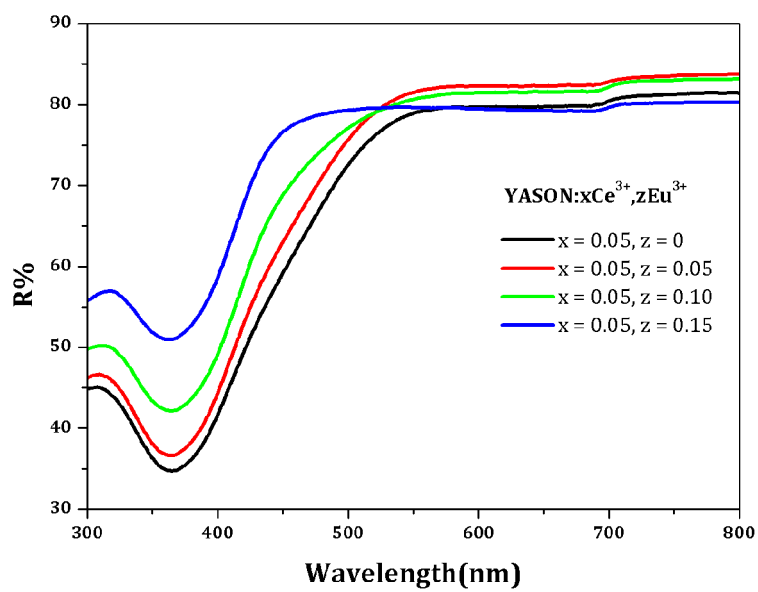


Figure S2. Diffuse reflection spectra of YASON:xCe³⁺,zEu³⁺ (x = 0.05; z = 0, 0.05, 0.10, 0.15).

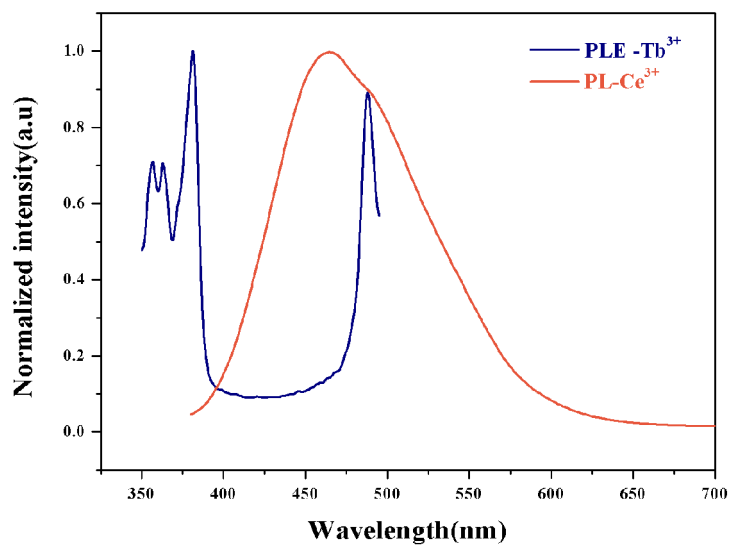


Figure S3. The overlap spectra between the PLE-YASON:0.05Tb³⁺ and PL- YASON:0.05Ce³⁺ samples.

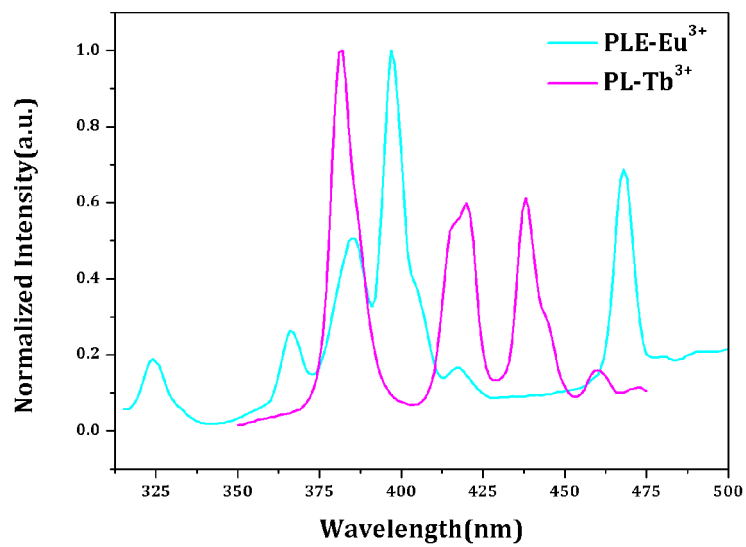


Figure S4. The overlap spectra between the PLE-YASON:0.05Eu³⁺ and PL- YASON:0.05Tb³⁺ samples.

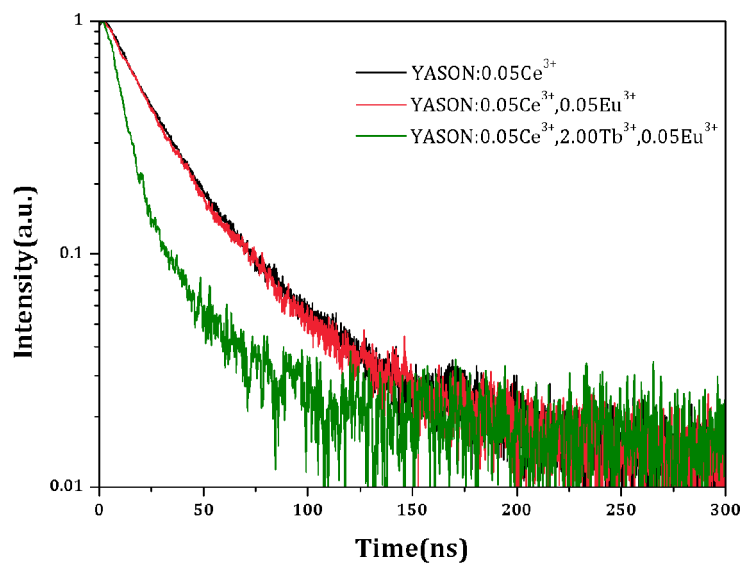


Figure S5. Decay curves of Ce³⁺ ions in YASON:0.05Ce³⁺; YASON:0.05Ce³⁺,0.05Eu³⁺;
YASON:0.05Ce³⁺,2.00Tb³⁺,0.05Eu³⁺ sample. (excited at 355 nm, monitored at 460 nm.)

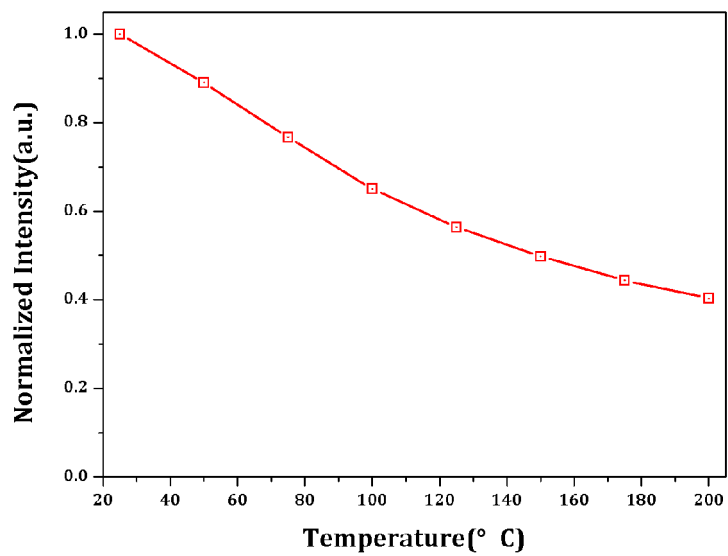


Figure S6. Temperature dependence of the emission intensities of YASON: 0.05Ce³⁺, 2.00Tb³⁺, 0.05Eu³⁺ phosphor between 25°C and 200°C.

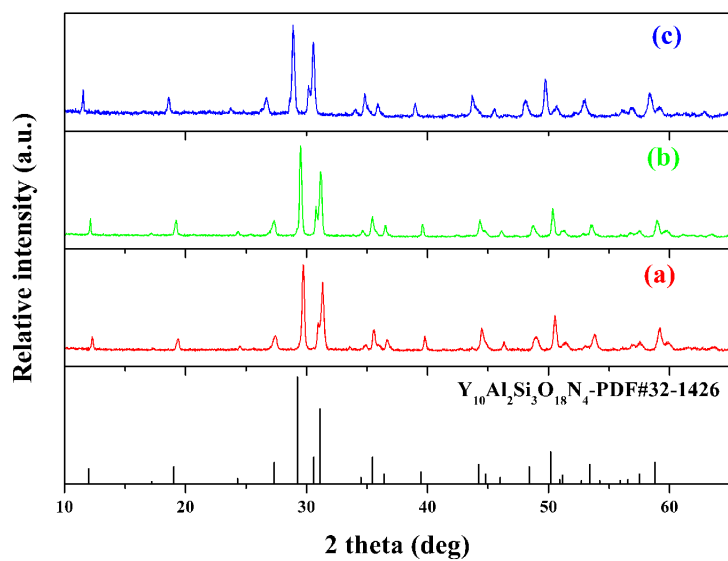


Figure S7. XRD profiles for the typical phosphors in the conditions of (a) YASON:0.05Ce³⁺; (b) YASON:0.05Ce³⁺,0.20Tb³⁺; (c) YASON:0.05Ce³⁺,2.00Tb³⁺,0.05Eu³⁺. The standard data of YASON (JCPDS card No. 32-1426) is shown as reference.

Reference

1. R. D. Shannon, *Acta Crystallogr. Sect. A* 1976, 32, 751.