



Synthesis and luminescence properties of oxyapatite-type $\text{ZnLa}_4(\text{SiO}_4)_3\text{O}:\text{Eu}^{3+}$ phosphor for high CRI w-LEDs

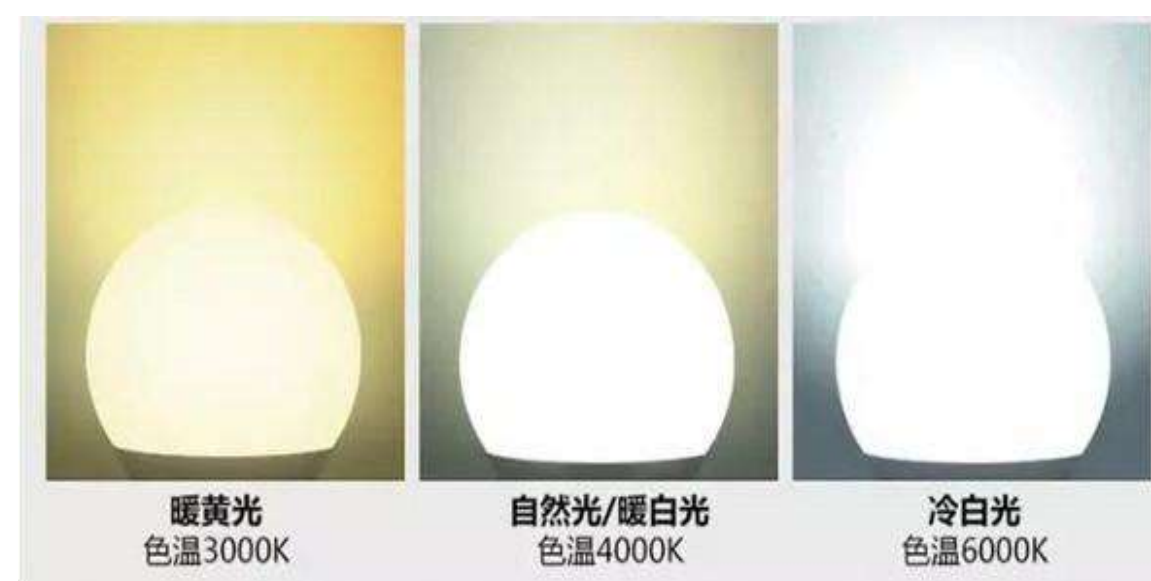
氧化磷灰石型 $\text{ZnLa}_4(\text{SiO}_4)_3\text{O}:\text{Eu}^{3+}$ 荧光粉的合成及发光性能的研究及其用于高显色指数白光LED的应用

Siyu Cheng (程思语), Ruiqi Liu (刘睿琦), Wenhao Li (李文浩), Hanxin He (何晗鑫), Ruijin Yu (余瑞金)

College of Chemistry & Pharmacy, Northwest A&F University, Yangling, Shaanxi 712100, PR China

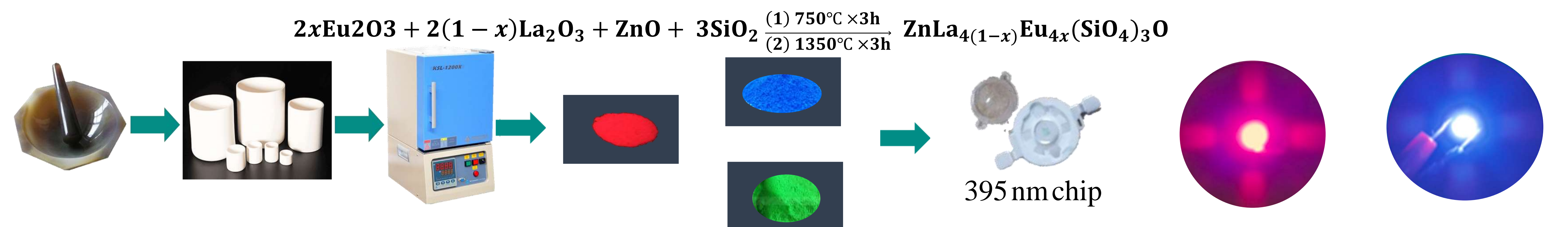


Introduction

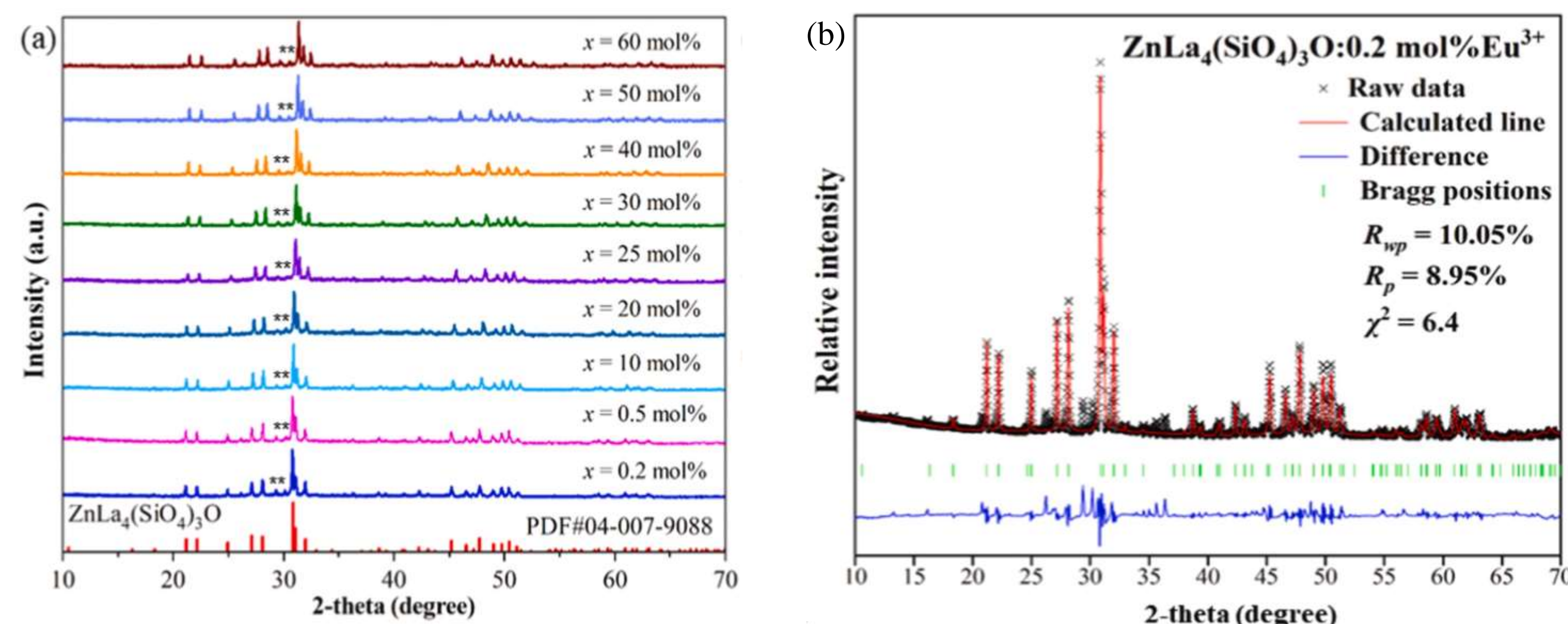


The w-LEDs lack red spectral region and appear as cold white lights.
W-LEDs usually have a low color rendering index and a high color coordinate temperature (CCT).

Experimental parts



Phase purity



EDS

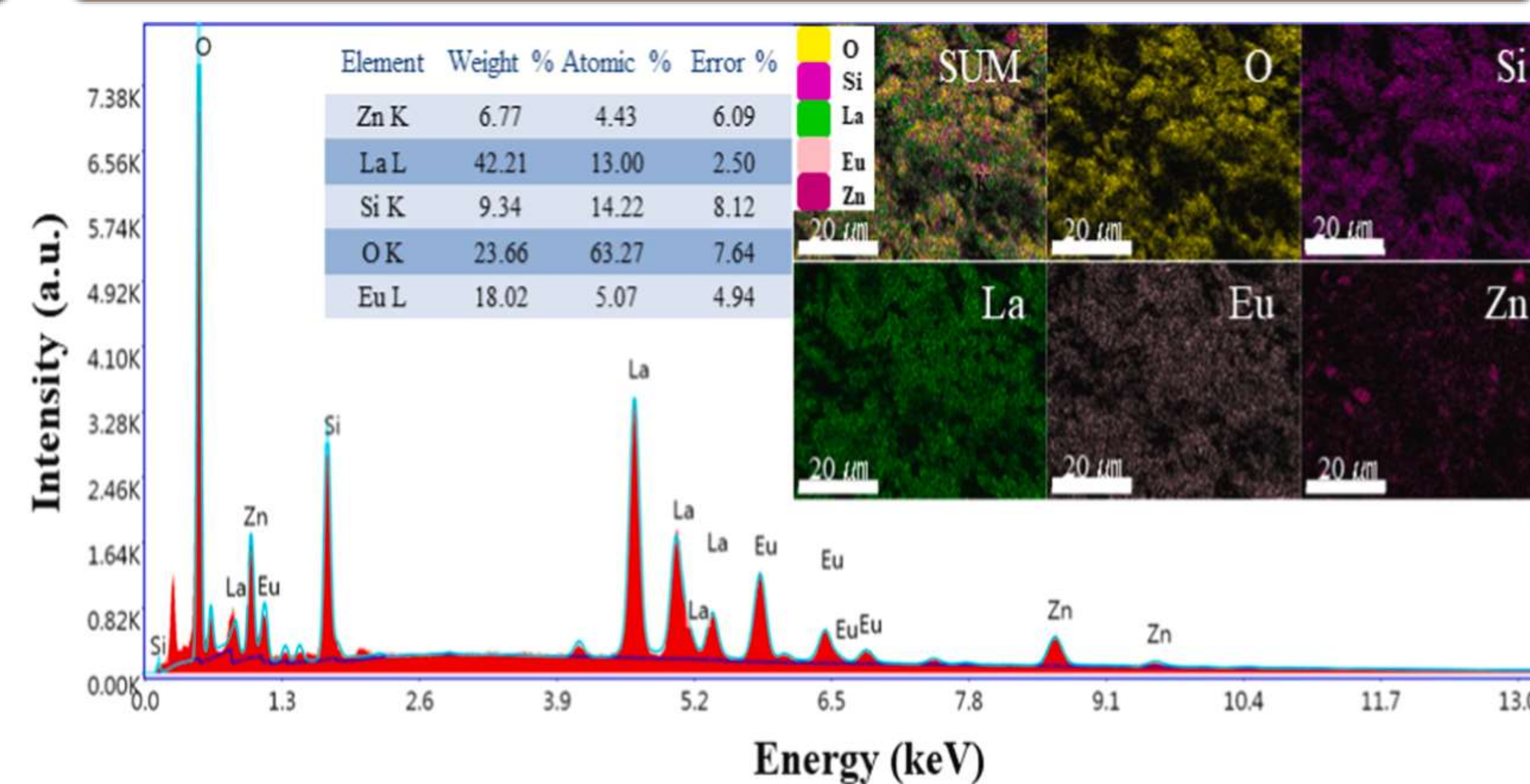


Fig. 2. EDS of ZLSO:25 mol% Eu^{3+} and the elemental mappings.

Diffuse reflectance spectra

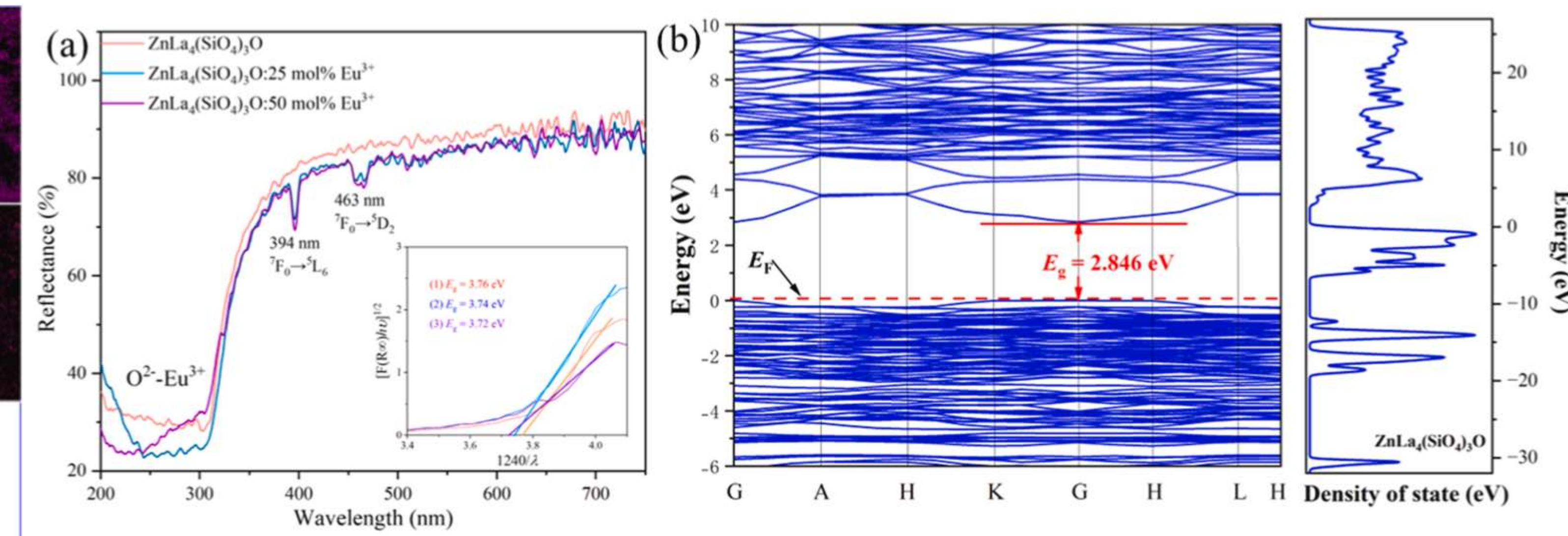


Fig. 3. (a) Diffuse reflectance spectra and Admeasurement of the E_g . **(b)** The calculated E_g and the total DOS of ZLSO by the CASTEP method.

Optical properties

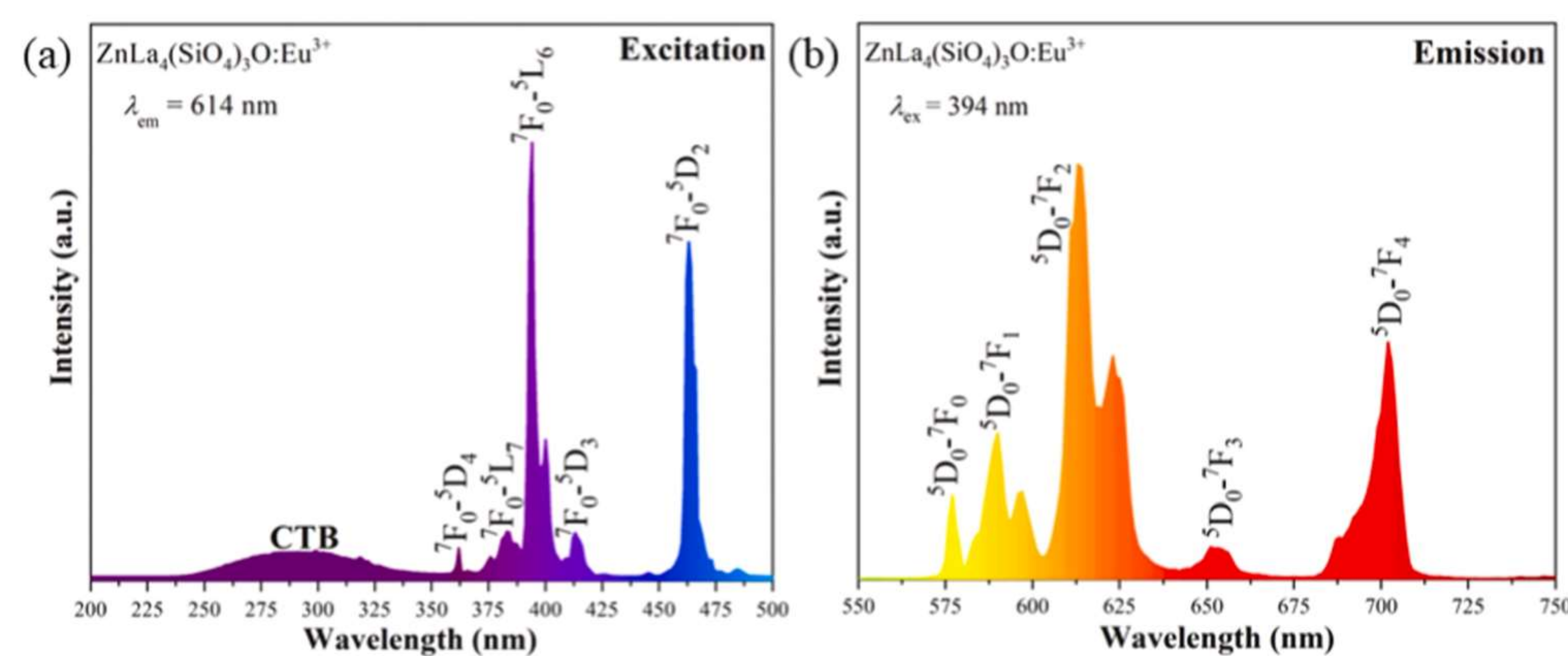


Fig. 3. (a) The excitation spectrum of ZLSO:20 mol% Eu^{3+} ($\lambda_{em} = 614$ nm). **(b)** the emission spectrum of ZLSO:20 mol% Eu^{3+} ($\lambda_{ex} = 394$ nm).

Thermal stability

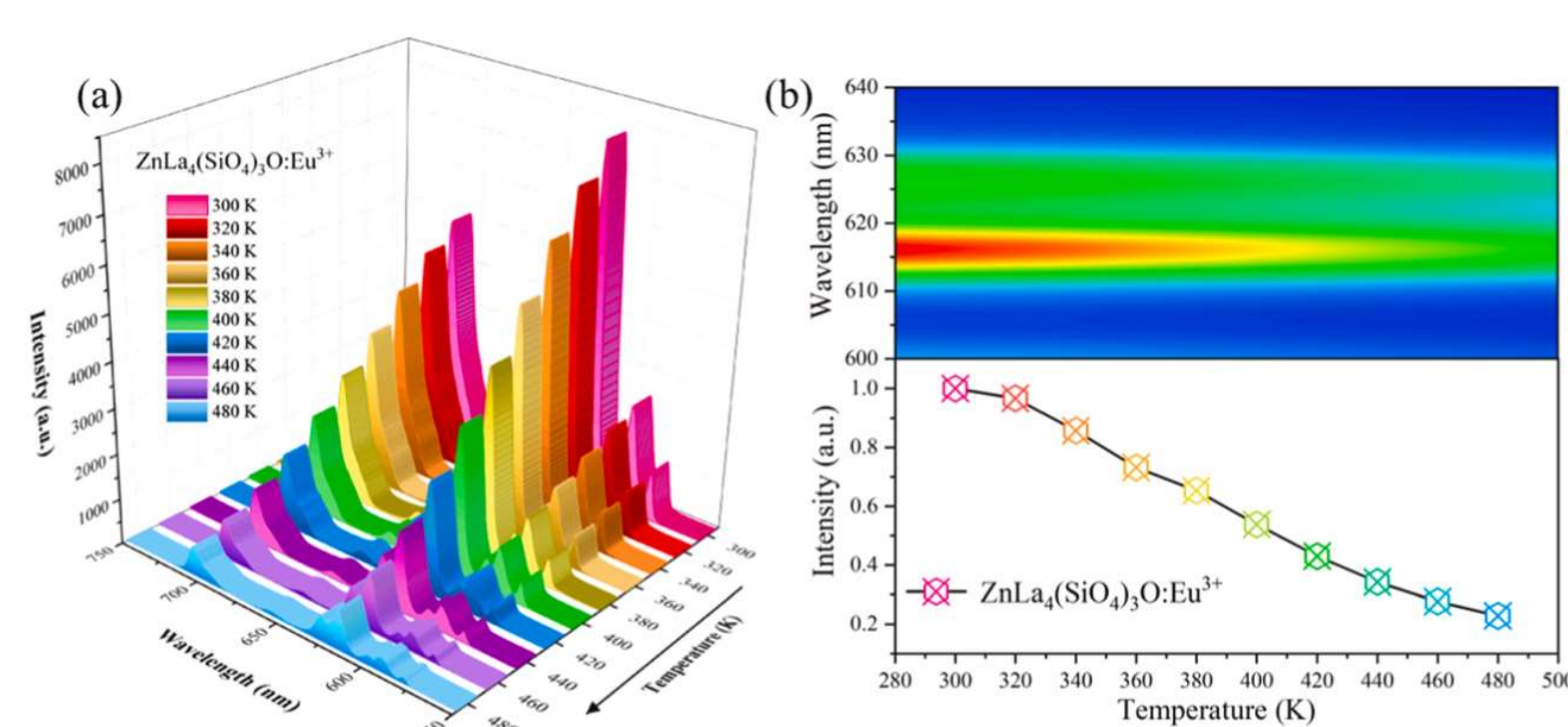


Fig. 5. (a) The temperature-dependent emission spectra. **(b)** The emission intensity at different temperatures.

Application

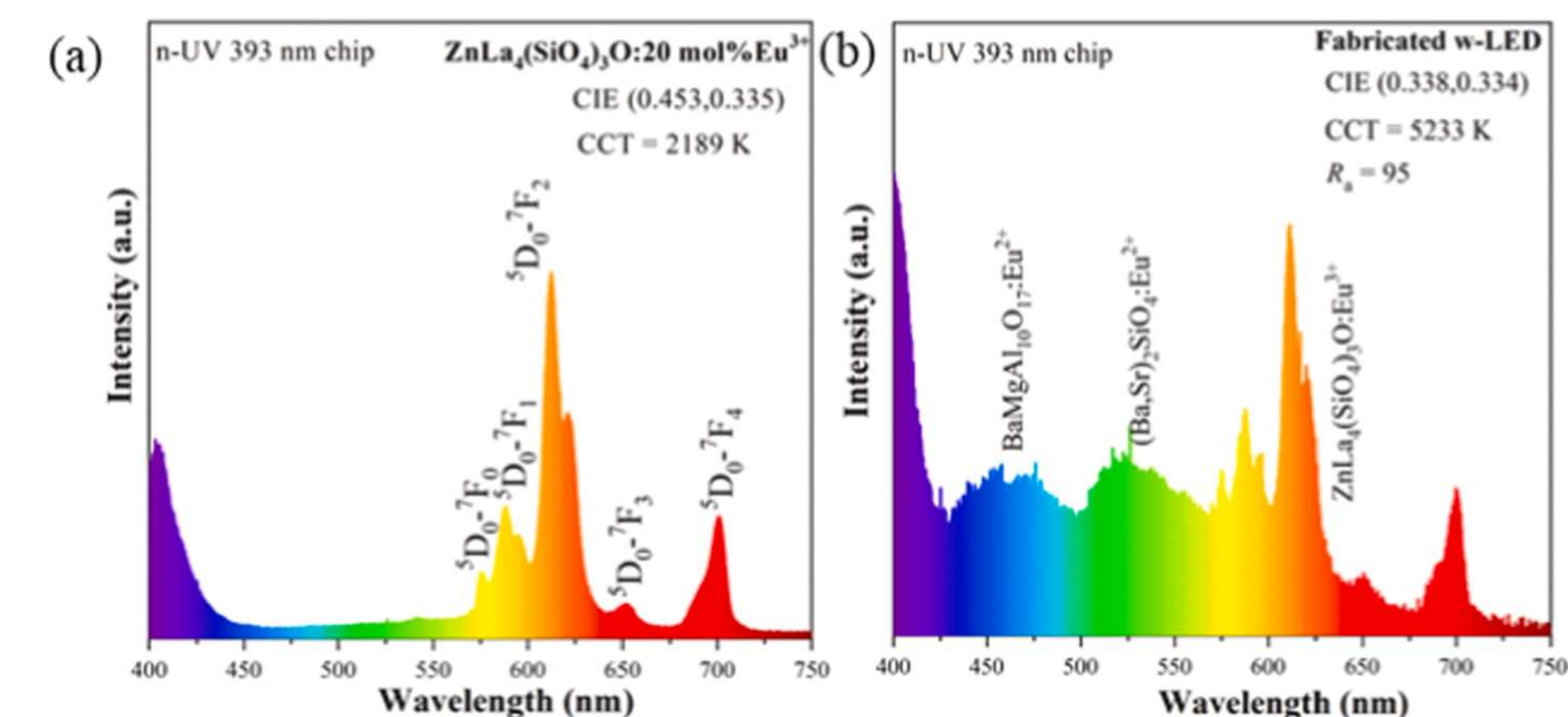


Fig. 7. (a) The EL spectrum of the red LED under 3.3 V and 300 mA. **(b)** The EL spectrum of the w-LED device under 3.3 V and 300 mA.

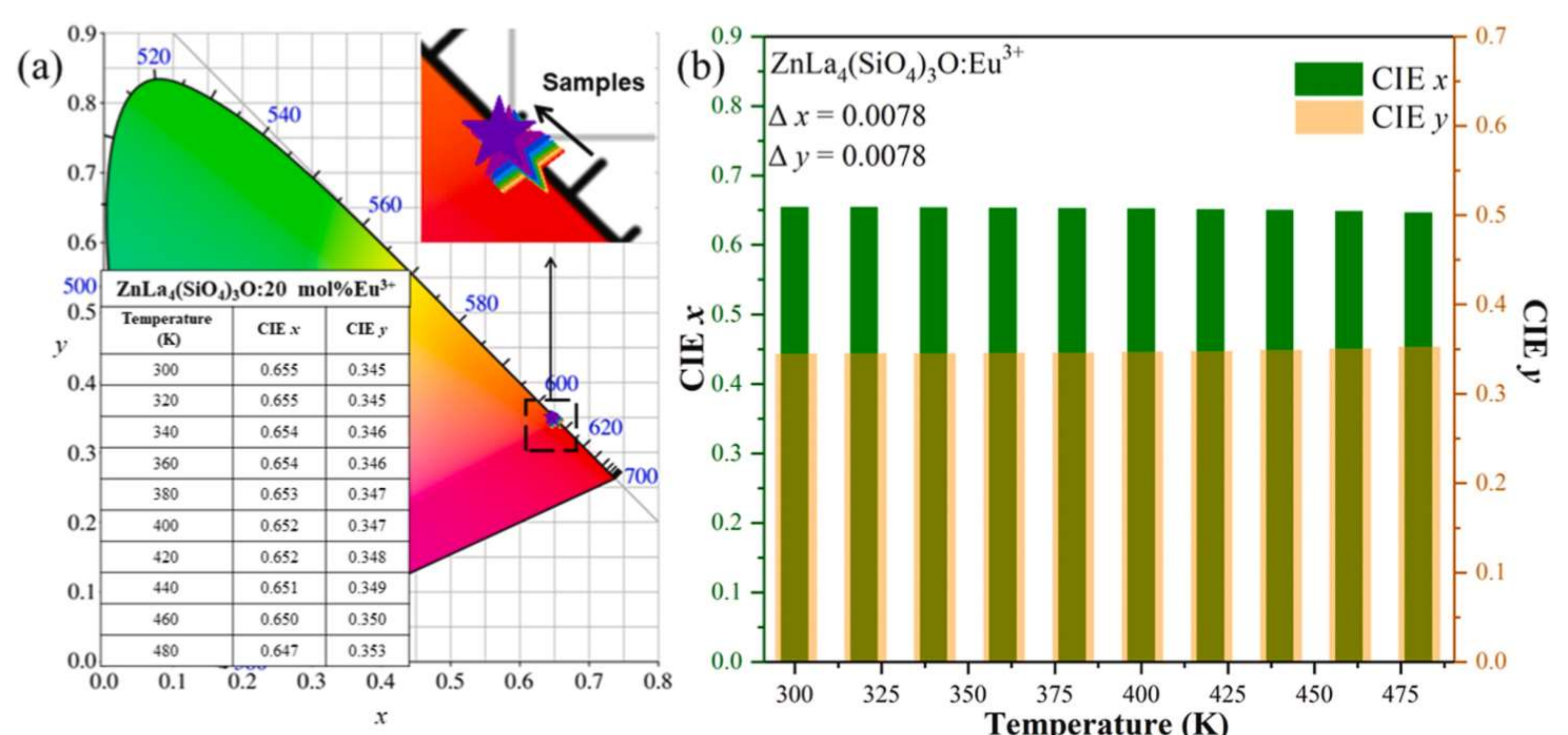


Fig. 4. (a) CIE chromaticity of ZLSO:Eu³⁺ from 300 to 480 K. **(b)** The standard deviations of the x and y of ZLSO:Eu³⁺ from 300 to 480 K.

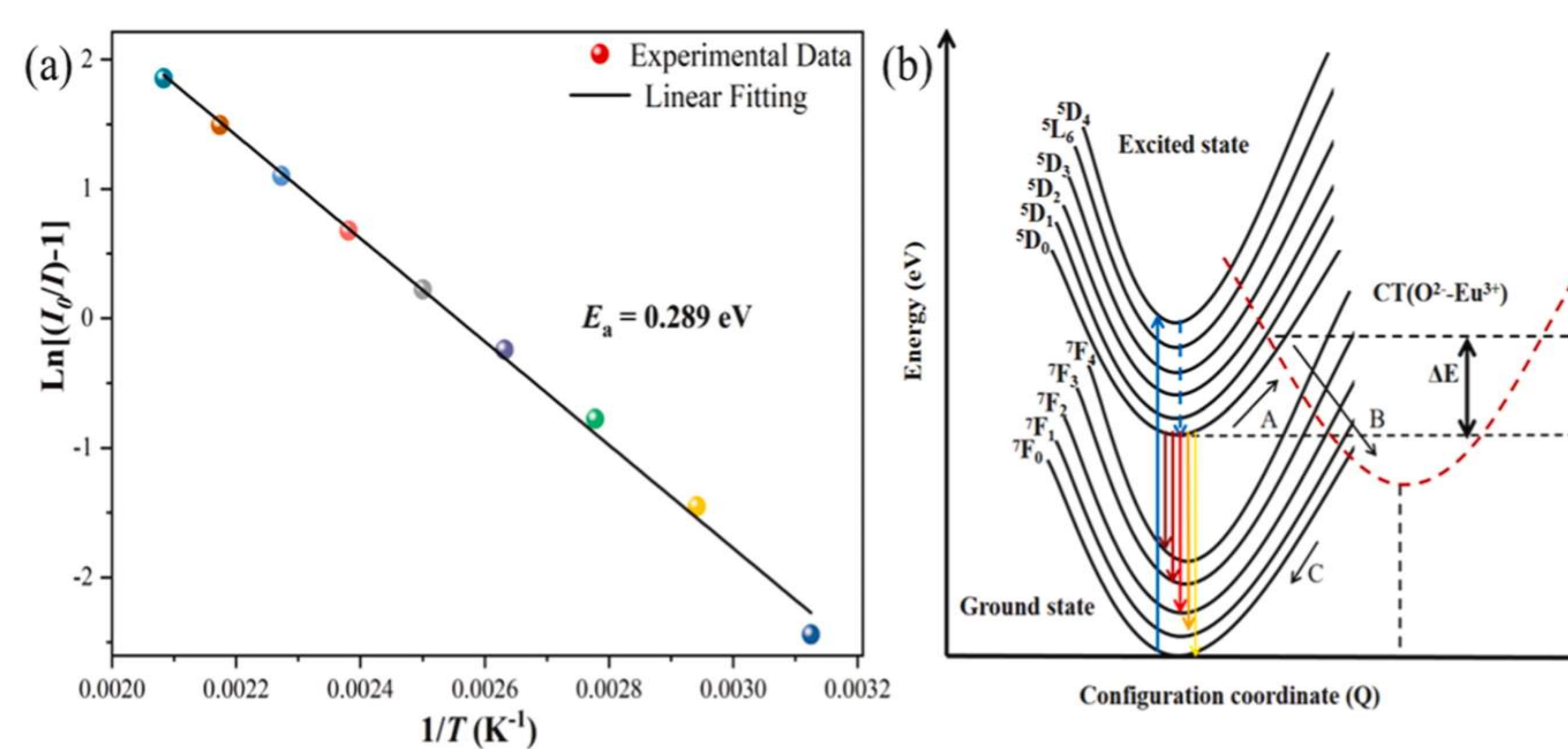


Fig. 6. (a) The fitting between $\ln[(I_0/I)-1]$ and $1/T$. **(b)** The configuration coordinate scheme of the Eu^{3+} ions.

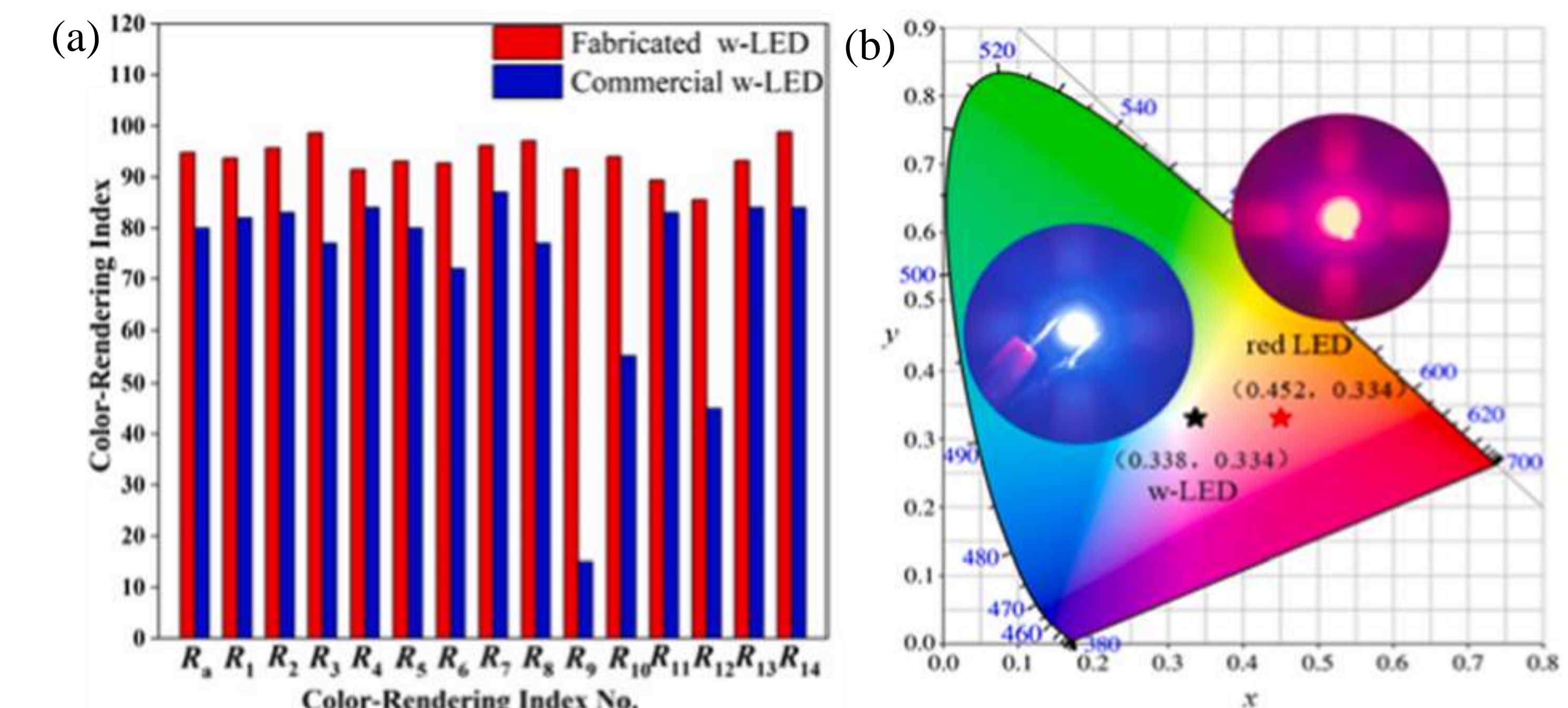


Fig. 8. (a) CRI values comparison between pc-LED and commercial w-LED. **(b)** The CIE chromaticity coordinates of w-LED and red LED.

Conclusion

- Red-emitting ZLSO: Eu^{3+} phosphors with multiple applications were successfully produced via the high-temperature solidphase method. The ZLSO phosphors were inferred to possess an oxyapatite structure and good phase purity.
- The chromaticity coordinates of ZLSO: Eu^{3+} phosphors were located near the margin of the red zone. Moreover, the fabricated w-LEDs with ZLSO: Eu^{3+} phosphors showed a decent CIE (0.338, 0.334), a high R_a (95), and a low CCT (5233 K).

Achievements



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