Explore Broadband Near-Infrared Phosphor Perovskite $LaLuO_3:Cr^{3+}$

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INTRODUCTION

The NIR-phosphor as indispensable role decides the properties and function of pc-LEDs. Thus, it is important to explore suitable phosphors. The transition metal Cr^{3+} is an ideal NIR emitter and the luminescence of Cr^{3+} ions can be tuned via crystal field engineering easily. Accordingly, perovskite structure oxide with diversified structure and composition can provide the variety of local coordination environment for Cr^{3+} ions. $LaLuO_3$ with perovskite structure was chosen as host for the Cr^{3+} activators. A novel phosphor with broadband emission spectrum centered at 880 nm were found and has the application foreground.

METHONDS

A series of $LaLu_{1-x}O_3:xCr^{3+}$ (LLO:xCr^{3+}, $0 \le x \le 0.06$) phosphors were successfully synthesized by solid-state reaction at high temperature. The stoichiometric raw materials La_2O_3 (99.99%), Lu_2O_3 (99.99%), Cr_2O_3 (99.95%) were homogeneously mixed in an agate mortar for more than 20 minutes. Then the powder blends were transferred into corundum crucibles and sintered at 1450 °C for 6 h. Finally, the synthesized samples were cooled to room temperature in a protective atmosphere and ground into powder for subsequent measurements.

RESULTS AND CONCLUSIONS

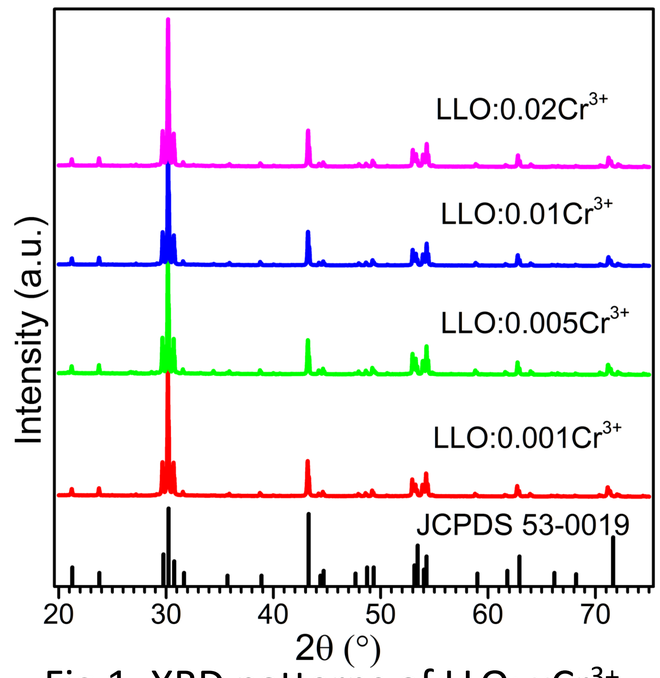

Fig.1. XRD patterns of LLO: xCr^{3+} samples and standard data of LLO phase (JCPDS No. 53-0019)

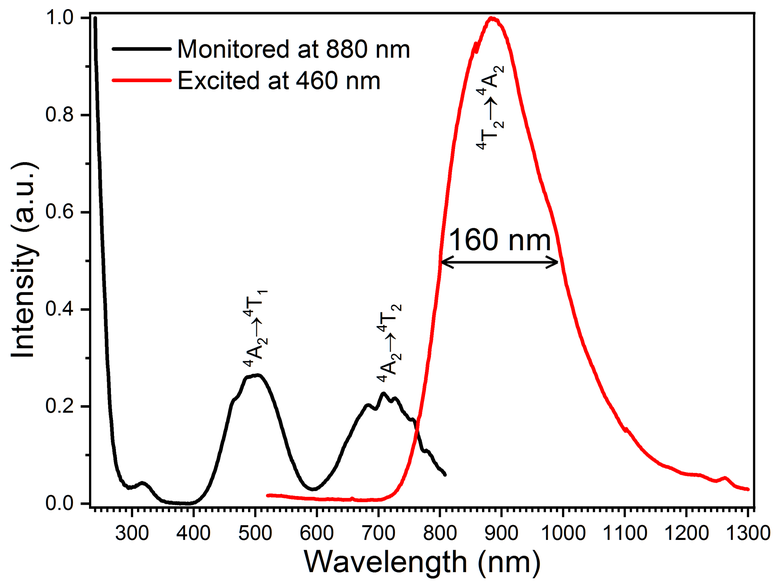

Fig.2. PL and PLE of LLO:1.5%Cr^{3+} at room temperature.

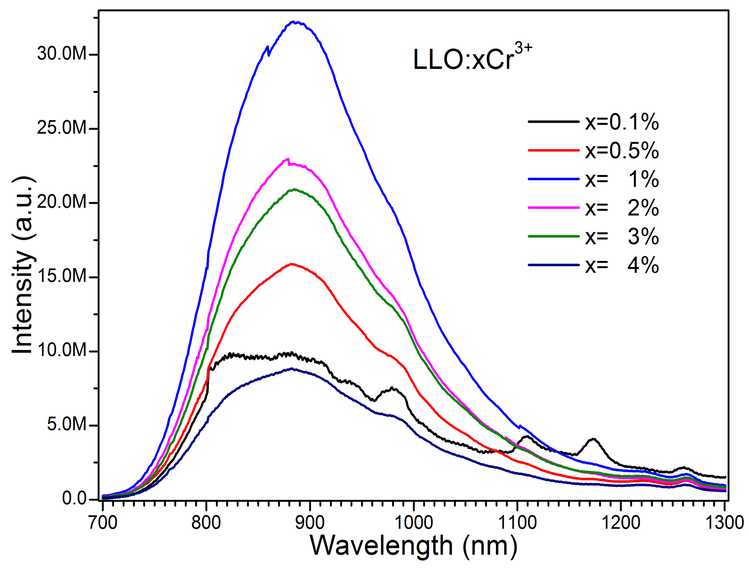

Fig.3. PL spectra of LLO:xCr^{3+}

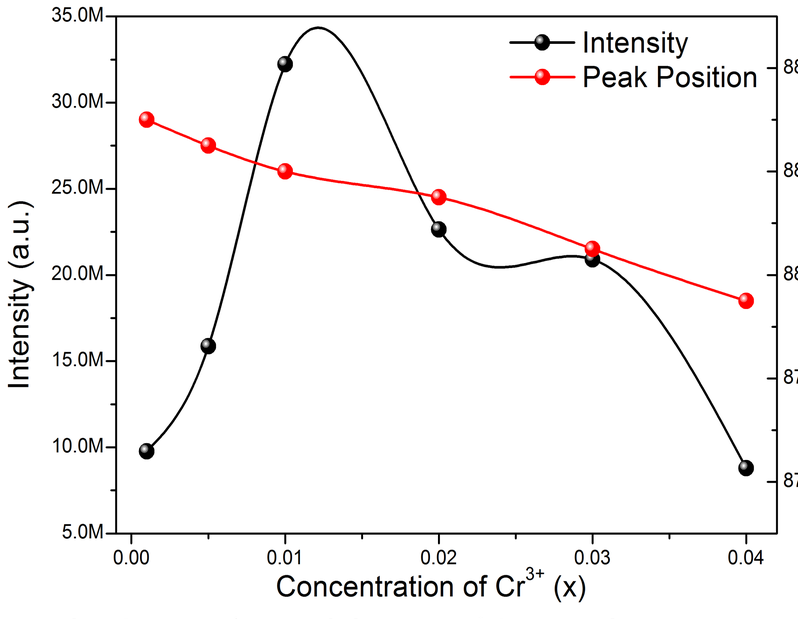

Fig.4. Peak position and Intensity changes with Cr^{3+} concentration

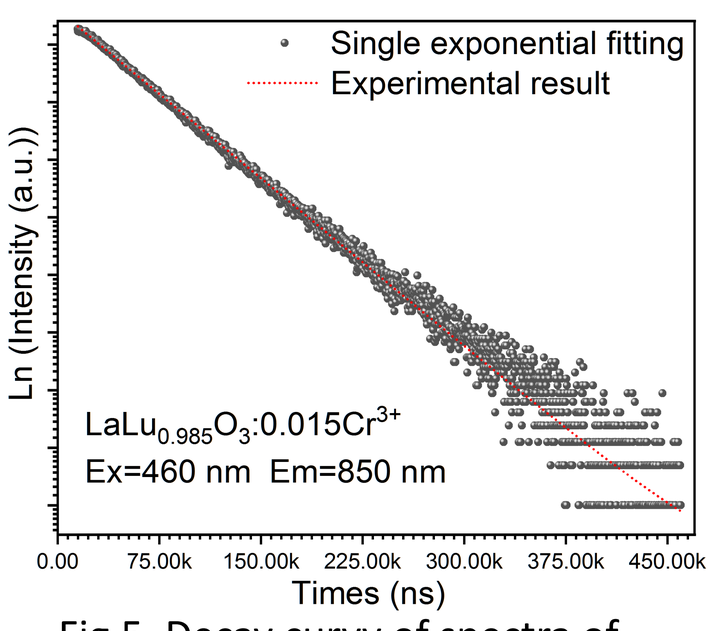

Fig.5. Decay curvy of spectra of LLO:0.015Cr3+ monitored at 850nm.

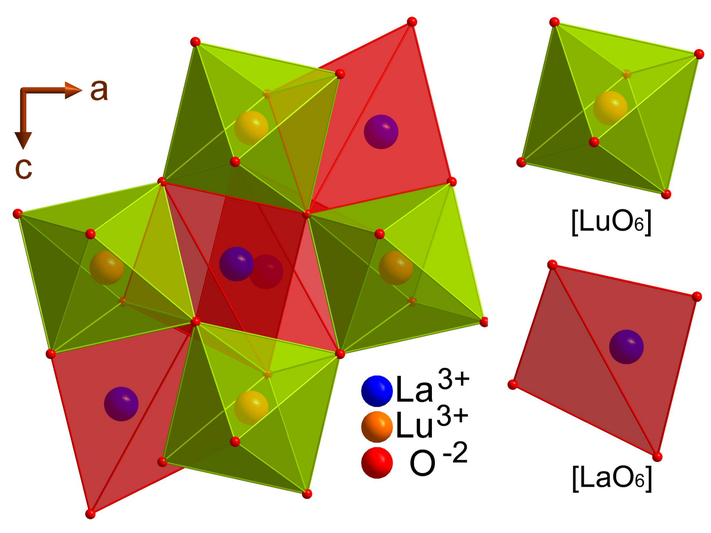

Fig.6. Crystal structure of LLO.

Conclusions

Cr^{3+} ions doped broadband near-infrared phosphor is obtained. PL is identified to originate from one available octahedral sites for Cr^{3+} ions. The optimal doping concentration of Cr^{3+} ions is 1.5%. The QY of LLO:0.01Cr^{3+} might be 26.5%.