An optical thermometry based on near-infrared luminescence of $LiGaSiO_4:Cr^{3+}$ phosphors excited by red light

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二.成果简介：

In this study, $LiGaSiO_4:Cr^{3+}$ phosphors with triple temperature detection function were successfully synthesized by high temperature solid phase method. The results showthat the phosphor exhibits the strongest NIR emission when the doping concentration of Cr^{3+} is 0.05%. The emission peaks are composed of weak emission peak (670 nm $4T^2 \rightarrow 4A^2$ (I_3)) and strong emission peak(705 nm (I_2), 721 nm (I_1) $2E \rightarrow 4A^2$). The temperature-depended luminescent spectra of $LiGaSiO_4$:0.05%Cr^{3+} show the three emission peaks showed different changing trends with the increase of temperature in 313 K–513 K. The results showed that the dependences of temperature on three FIR models including 670/705, 705/721 and 721/605 all show excellent linearity, which can be utilized to measure the temperature. And, the combination of three FIR models can provide higher temperature sensing sensitivity and accuracy. Furthermore, FIR (705/721) can provide the highest temperature sensing performance and its S_r is up to 4.32 K^{-1}. All these results indicate $LiGaSiO_4:Cr^{3+}$ possessed great potential in the application of temperature sensing.

三. 主要研究内容及创新点：

Contents and innovations: The best luminescence properties of $LiGaSiO_4:Cr^{3+}$ phosphors were obtained by controlling the concentration of doped Cr^{3+}. The thermal stability and temperature sensing properties of the samples were studied, and the relationship between luminescent intensities and temperature was explored. On this basis, the best optical temperature sensing material is obtained. The obtained results show that the dependences of temperature on three fluorescence intensity ratio (FIR) models including 670/705, 705/721 and 721/605 all show excellent linearity, indicating that high temperature sensing sensitivity and accuracy can be obtained via the combination of three FIR models.

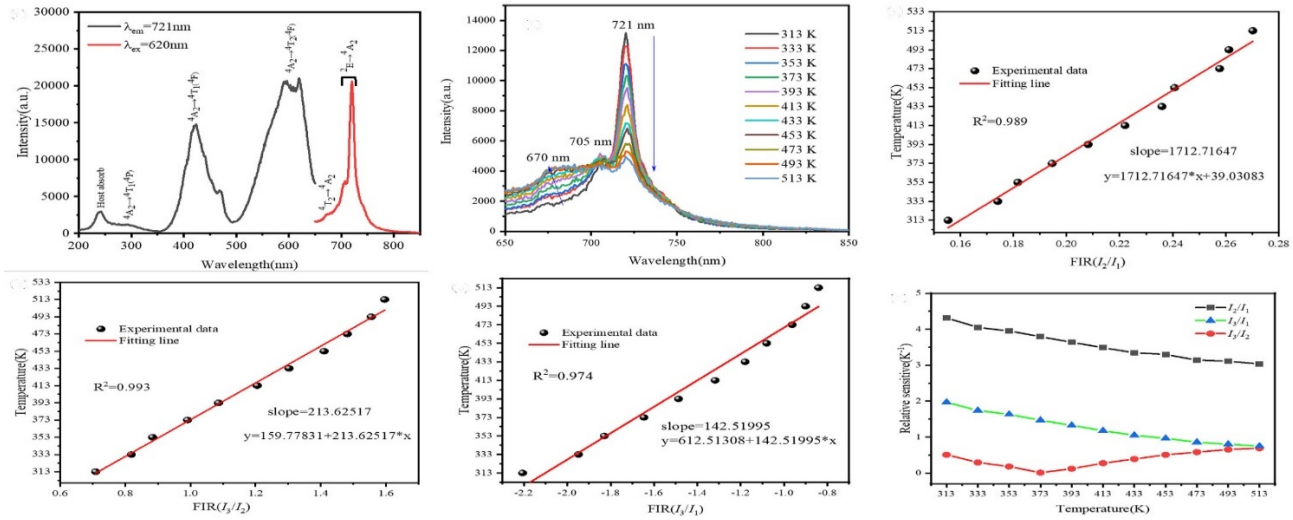


Figure 1. The optical properties and relative sensitivity values at different temperatures.

四. 主要研究成果及应用情况

1、2022 年在 SCI 二区期刊《Journal of luminescence》发表论文《An optical thermometry based on near-infrared luminescence of $LiGaSiO_4:Cr^{3+}$ phosphors excited by red light》。

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