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# Optical temperature sensing properties of $KLu_2F_7$: $Yb^{3+}/Er^{3+}/Nd^{3+}$ nanoparticles under NIR excitation

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**Abstract**: $Yb^{3+}/Er^{3+}/Nd^{3+}$ tri-doped $KLu_2F_7$ nanoparticles were fabricated via a typical co-precipitation method, and their phase structure, up-conversion (UC) emission and temperature sensing properties have been investigated in this work. An intense UC green emission originated from $Er^{3+}$ ions is observed under the near infra-red (NIR) excitation. The maximum sensitivity of temperature is approximately $0.0044K^{-1}$ at 533K and $0.0041K^{-1}$ at 413K under the excitation of 980 and 808 nm, respectively. Meanwhile, $KLu_2F_7$: $Yb^{3+}/Er^{3+}/Nd^{3+}$ nanoparticles exhibit excellent thermal stability under the NIR excitation. However, the thermal effect induced by 808 nm laser excitation is negligible compared with that of induced by 980 nm excitation, especially under a high pump power density excitation. It indicates that the employment of 808 nm excitation on $KLu_2F_7$: $Yb^{3+}/Er^{3+}/Nd^{3+}$ system circumvents the laser-induced thermal effect as well as improves the accuracy of temperature sensing. Thus, it was proved that these nanoparticles provide a potential multifunctional application as thermometers and biosensors.

**Keywords:** UC emission; temperature sensing; thermal stability