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Near infrared optical thermometry in fluorophosphate glasses doped with Nd^{3+} and Nd^{3+}/Yb^{3+}

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Optical thermometry via luminescence intensity ratio (LIR) (1-2) is often explored in the visible spectrum range of trivalent rare earth doped materials but much less so in the near infrared region. This work range, which can be explored in Nd^{3+} and Yb^{3+} doped materials, overlaps with the first and second biological window thus making these thermometers interesting for bio applications. In this work (3), proof of concept is given by developing highly sensitive optical thermometers based on Nd^{3+}-singly doped and Nd^{3+}/Yb^{3+}-co-doped fluorophosphate glasses with superior optical properties than phosphate and fluoride glasses. The developed systems offer the possibility of simultaneously using two LIR as thermometric parameters with high measurement accuracy, in wide temperature ranges. The Nd^{3+}-based thermometer operating via three energy level sets emitting in the 730–950 nm range has relative sensitivities spanning from 1.7% K^{-1} (at room temperature) to 0.6% K^{-1} (at 520 K). The Nd^{3+}/Yb^{3+} system presents, in addition to the use of Nd^{3+} transitions LIR, a new possibility of temperature detection up to 520 K. A decreased intensity of the zero-phonon line of Yb^{3+} at 975 nm was detected and used by comparison to the Nd^{3+} emission around 800 nm, resulting in relative sensitivities of $\sim$ 2% K^{-1} at room temperature.

Palavras-chave: Luminescence. Thermometry. Lanthanides.

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