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Nd^{3+}- DOPED TELLURITE GLASS FOR RATIOMETRIC FLUORESCENT THERMOMETERS

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Introduction: The temperature sensors are commonly used in several technological and scientific applications. However, there is a lack of appropriate sensors in some cases, e.g., thermocouples are not suitable for measurements near installations with high electromagnetic interference (near electromagnetic coils), or for biological applications where the device is required with reduced instrumental dimensions and high sensitivity (measurements at micro and nanoscale to cellular temperature mapping, for example) [1,2]. Fluorescent thermometers based on fluorescent intensity ratio technique of some trivalent lanthanide ion (Ln^{3+}) has attracted a great interest due the possibility (by the thermal energy) of the change of the electron population in two thermally coupled levels, predicted by the Boltzmann's distribution, that change the emission intensity associated with these levels with the temperature [1,2]. **Aim and Methodology**: Here, we explore the Nd^{3+}-doped tellurite glass (TL: Nd^{3+}) with nominal (in wt.%) composition [$80.0TeO_2$+$20.0Li_2CO_3$+ $0.5Nd_2O_3$] excited at 583nm and 532nm (laser dye and diode laser), under 299 – 371K temperature range for fluorescent ratiometric thermometers. **Results and discussion**: In the Fig. 1a) is observed a decrease of the emission at 893nm, due to the decrease of population of excited state $^4F_{3/2}$ by thermal excitation to upper levels $^4F_{5/2}$,$^2H_{11/2}$, and $^4F_{7/2}$, confirmed by the increase of the emission bands at 816 and 760nm ($^4F_{5/2,\ 7/2} \rightarrow {}^4I_{9/2}$ transitions). The calculated relative sensitivity Fig. 1b) of this material reaches to 1.63%K^{-1} at 299K, comparable to other values found in glasses systems within emission bands in the first biological window [3].

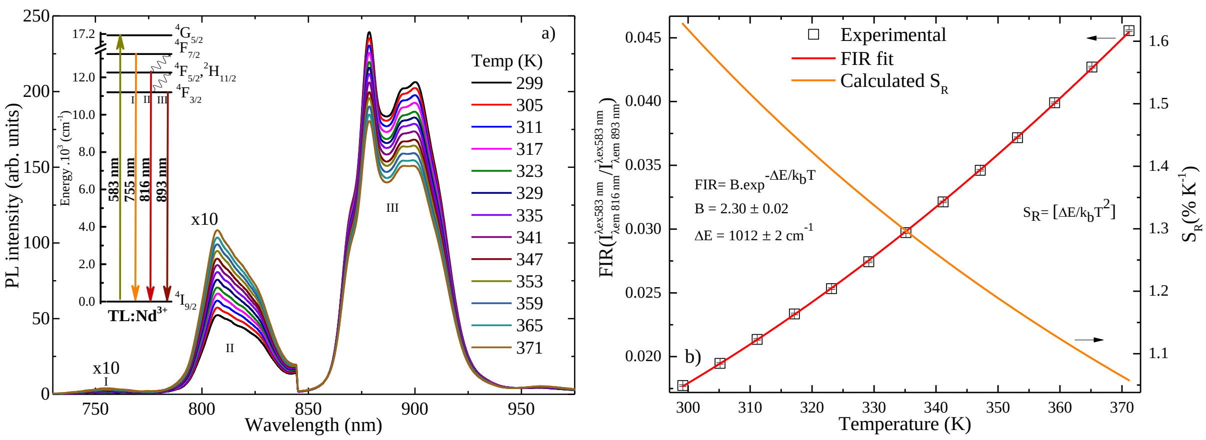

Fig. 1. a)$^4F_{7/2} \rightarrow {}^4I_{9/2}$ (I), $^4F_{5/2}$, $^2H_{11/2} \rightarrow {}^4I_{9/2}$(II), and, $^4F_{3/2} \rightarrow {}^4I_{9/2}$ (III) emission bands. The intensity of $^4F_{5/2}$, $^2H_{11/2} \rightarrow {}^4I_{9/2}$, and, $^4F_{7/2} \rightarrow {}^4I_{9/2}$, were multiplied by a factor of 10 to best visualization of the emission at different temperatures; **b)** FIR calculated taking the ratio between the areas of the bands II and III, fitted by the model, and relative sensitivity S_r.

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