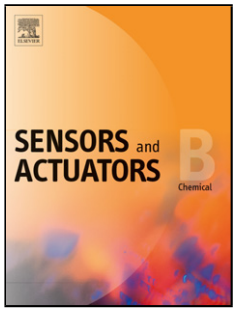

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TeSen - tool for determining thermometric parameters in ratiometric optical thermometry

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Highlights:

- Optimization techniques are employed to develop a software (TeSen) for determining thermometric parameters
- Three new ratiometric optical sensor lanthanide materials are reported
- Discussion on the use of different thermometric parameter Δ models and data selections is carried out

Abstract:

This work presents the method and numerical program along with graphical user interface (GUI) for calculating the standard parameters necessary to evaluate luminescence ratiometric thermometers – the thermometric parameter Δ, absolute sensitivity S_a, and relative sensitivity S_r. Despite the high interest in temperature sensing materials, to the best of our knowledge, no such tool has been reported up to date. This is currently usually done by researchers using a trial and error method and is a rather laborious task, with high risk of errors. The undoubtful benefit of employing an optimization technique lies in the very fast and precise determination of the parameters employing different models. The thermometric parameters Δ, S_a and S_r are calculated based on the luminescence emission spectra measured over a certain temperature range. Using the TeSen tool the thermometric parameters Δ can be calculated based both on the peak maxima and integrated surface areas under the peaks. The tool also allows testing the ratio of multiple peaks, different peak ranges, and different temperature ranges in a very convenient way. In this work TeSen tool was used to study several new sensor materials, presenting new cases of single and dual center luminescent ratiometric theremometers.