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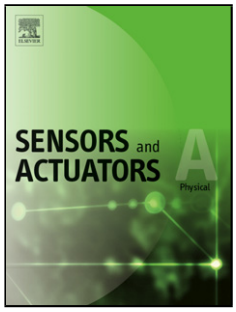

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ACCEPTED MANUSCRIPT

Temperature sensor based on upconversion luminescence of Er^{3+}-doped fluoroaluminate glasses

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Highlights

- Fluoroaluminate glasses doped with Erbium fluoride ErF_3 with concentrations of 0.1, 0.5, 1.0 mol. % were examined as a host matrix for optical thermometry
- Fluorescence intensity ratios and thermal sensitivity parameters were determined
- The maximum value of absolute thermal sensitivity S_{max} was found to be 69 $\times 10^{-4}$ $^{o}C^{-1}$ at 235^{o}C

Abstract

New Er^{3+}-doped fluoroaluminate glasses were examined as a host matrix for optical temperature sensors. The upconversion spectra as a function of temperature have been measured in the temperature range from 20 ^{o}C (293K) to 235 ^{o}C (508K). The nature of the upconversion luminescence bands with maxima around 522 nm and 550 nm corresponding to the transitions from levels $^2H_{11/2,}{}^4S_{3/2}$ and $^4F_{9/2}$ to the ground state $^4I_{15}$ was explained basing on two-photon processes. The measured values of fluorescence intensity ratios (FIR) were approximated by a linear function with the slopes varying from 0.0022 to 0.0039. The sample doped with 0.1 mol. % of ErF_3 has the steepest inclination and the best response to temperature changes. The maximum value of absolute thermal sensitivity S_{max} of 69 $\times 10^{-4}$ $^{o}C^{-1}$ at 235 ^{o}C was obtained for the sample doped with 0.1 mol. % of ErF_3. The S_{max} value is one of the highest values for different glass hosts found in the literature. The data obtained show that new Er^{3+} doped fluoroaluminate glass of the composition under investigation is a good host matrix for sensing element in optical thermometry.

Keywords: fluoroaluminate glass; upconversion luminescence; optical temperature sensor; Er^{3+}.

1. Introduction

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