

The comparison of the thermometric performance of optical ceramics, microcrystals and nanocrystals of Cr³⁺-doped Gd₃Ga₅O₁₂ garnets

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Streszczenie

The remote temperature readout capability offered by luminescent thermometry has high application potential. Designing thermometers with predefined thermometric parameters is only possible by understanding the processes responsible for temperature-induced changes in the spectroscopic properties of phosphor. One of the key factors, that should be considered, is the influence of the morphology of the phosphor on their spectroscopic properties. In this work, we present for the first time an analysis of the influence of material morphology on the thermometric properties of a ratiometric luminescent thermometer based on the luminescence intensity ratio of 2 E_g→4 A₂ to 4 T₂→4 A₂ emission bands in Gd₃Ga₅O₁₂:Cr³⁺ nanocrystals, microcrystals and optical ceramics. As shown, limitations in the thermal coupling between the 2 E_g and 4 T₂ levels occurring in the cryogenic temperature range allowed to achieve a relative sensitivity of 5.8%/K at 11 K in optical ceramics compared to 2.6%/K and 1.95%/K in microcrystals and nanocrystals, respectively.

Słowa kluczowe

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