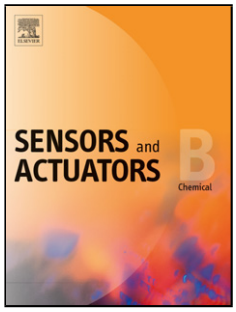

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Temperature sensitivity modulation through crystal field engineering in Ga^{3+} co-doped $Gd_3Al_{5-x}Ga_xO_{12}:Cr^{3+}$, Nd^{3+} nanothermometers

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Research Highlights

- $GdAl_{1-x}Ga_xO_{12}$:Cr,Nd nanocrystalline luminescent thermometers were synthesized
- Two temperature dependent parameters were used for temperature sensing
- The sensitivity was enhanced by crystal field strength modulation

Abstract

Luminescent nanothermometry (LNT) based on temperature-dependent emission intensity of transition metals (TM) is a promising new direction to enhance the performance and implement LNT in many fields of science and technology. However, insightfully understanding and analysis of the luminescence thermal quenching mechanisms in this type of compounds is required. In this work, we study temperature sensitivity (S) modified by crystal field engineering in $Gd_3Al_{5-x}Ga_xO_{12}:Cr^{3+}$, Nd^{3+} TM:LNTs. Substituting Al^{3+} ions in the host matrix by Ga^{3+} ones, caused gradual decline of crystal field strength from Dq/B=2.69 for $Gd_3Al_5O_{12}:Cr^{3+}$, Nd^{3+} to the Dq/B=2.18 for $Gd_3Ga_5O_{12}:Cr^{3+}$, Nd^{3+}. In consequence, improvement of relative sensitivity was observed. Two temperature dependent parameters were