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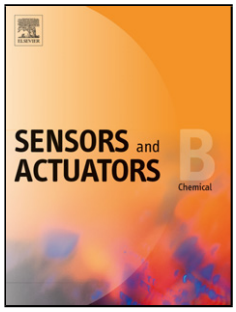

Title: The influence of grain size and vanadium concentration on the spectroscopic properties of YAG:V^{3+},V^{5+} and YAG: V, Ln^{3+} (Ln^{3+}null=nullEu^{3+}, Dy^{3+}, Nd^{3+}) nanocrystalline luminescent thermometers

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The influence of grain size and vanadium concentration on the spectroscopic properties of YAG:V^{3+},V^{5+} and YAG: V, Ln^{3+} (Ln^{3+}=Eu^{3+}, Dy^{3+}, Nd^{3+}) nanocrystalline luminescent thermometers

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Highlights

- The first demonstration of using V-based phosphor as a luminescent temperature sensor is presented.
- The influence of dopant concentration and size of the nanocrystals on the emission color output of the YAG:V^{3+}, V^{5+} was analyzed
- The usable temperature range of this kind of thermometers can be extended by introducing lanthanide ions
- It was showed that by the appropriate choice of lanthanide co-dopants, the temperature range in which high sensitivity can be modulated

Abstract

The first demonstration of using V-based phosphor as a luminescent temperature sensor is presented. The luminescent properties of YAG:V^{3+}, V^{5+} and YAG:V Ln^{3+} (Ln^{3+}= Eu^{3+}, Nd^{3+} and Dy^{3+}) nanocrystals were investigated in a wide range of temperature (-150ºC-300ºC). The influence of dopant concentration and size of the nanocrystals on the emission color output of the YAG:V^{3+}, V^{5+} was analyzed. The provided analysis reveals that V^{3+} and V^{5+} are mainly localized in octahedral sites of Al^{3+} of core part of the nanocrystals and surface tetrahedral sites of Al^{3+}, respectively. The emission spectra consists of two broad emission bands, attributed to the CT emission of V^{5+} (at 520 nm) and $^3T_{2g}\rightarrow{}^3T_{1g}$ electronic transition emission of V^{3+}(at 820 nm). It was found that emission color output of the YAG:V^{3+}, V^{5+} nanocrystals can be modulated either by the vanadium concentration or by the size of nanocrystals. Based on the V^{3+} to V^{5+} emission intensity ratio (LIR) in the temperature range from -150ºC to 300ºC self-reference thermometer was defined, which reveals 0.7%/ºC of sensitivity at the