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Novel optical signatures of sub-3 nm rare earth sesquioxide nanocrystals. JAMES DICKERSON, Department of Physics and Astronomy, Vanderbilt University, Nashville TN, SAMEER MAHAJAN, Interdisciplinary Program in Materials Science, Vanderbilt University, Nashville, TN — Europium and terbium based sesquioxide nanomaterials, known for their characteristic red and green luminescence, respectively, have recently garnered much research attention due to their size-dependent optical properties. Here, we present systematic investigation of the size-dependent optical properties Eu_2O_3, Tb_2O_3, and Gd_2O_3:Eu^{3+} / Tb^{3+}nanocrystals (NCs) in the size range of 1-3 nm in diameter. We observe a new luminescence peak at 620 nm in Eu_2O_3 and Gd_2O_3:Eu^{3+} NCs, which represents modulation of the $^7F_2$ transition in Eu^{3+} ion. Intensity modulation with respect to the 612 nm is observed as a function of nanocrystal size. For the Tb_2O_3 NCs, a new luminescence signature at 548 nm characterizes modulation of the $^7F_5$ transition in Tb^{3+} ion. In addition, we probe the effect of NC size on the luminescence efficiencies of the doped and pure sesquioxide NCs. The concentration quenching effect, which leads to low luminescence efficiencies in bulk, pure sesquioxides, is explored in sub-3 nm sesquioxides.

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