

Nonlinear Luminescence Quenching in Eu_2O_3

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ABSTRACT

Nonlinear luminescence quenching has been documented in numerous systems such as organic crystals, rare earth insulators, laser materials, semiconductors, and phosphors. In each of these systems nonlinear luminescence quenching occurs under conditions of high excitation density from interactions between excited centers, the result is an additional nonradiative decay pathway that lowers luminescence quantum efficiency.

During investigations into the spectra and dynamics of Eu_2O_3 , an apparent saturation dip in the excitation spectra of nano-sized Eu_2O_3 particles was observed. This thesis describes the investigation into the nature of the saturation effect. The samples studied using luminescent spectroscopy included micron sized Eu_2O_3 crystals of both cubic and monoclinic phases, nanocrystal monoclinic Eu_2O_3 , and a large fused crystal of monoclinic Eu_2O_3 . It was determined that the saturation effect was due to nonlinear luminescence quenching occurring at the wavelengths of absorption maxima. The mechanism of nonlinear luminescence quenching was concluded to be upconversion by energy transfer.

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