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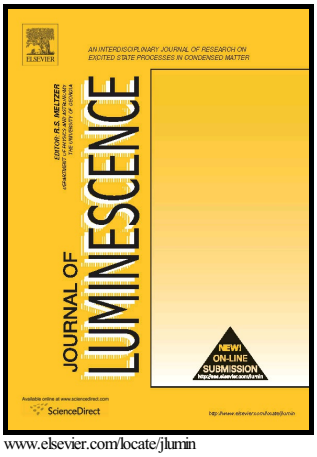

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PII: S0022-2313(17)32013-6
DOI: https://doi.org/10.1016/j.jlumin.2018.02.032
Reference: LUMIN15379

To appear in: *Journal of Luminescence*

Received date: 8 December 2017
Revised date: 13 January 2018
Accepted date: 7 February 2018

Cite this article as: S.G. Fedorenko, A.V. Popov, E.A. Vagapova, A.E. Baranchikov and Yu.V. Orlovskii, Concentration self-quenching of luminescence in crystal matrices activated by Nd^{3+} ions: theory and experiment, *Journal of Luminescence,* https://doi.org/10.1016/j.jlumin.2018.02.032

Concentration self-quenching of luminescence in crystal matrices activated by Nd^{3+} ions: theory and experiment

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Abstract

Resonance migration and cross-relaxation processes leading to concentration self-quenching of fluorescence have been studied theoretically and experimentally with Nd^{3+}: LaF_3 bulk crystal as an example. The time range of theoretical description of self-quenching kinetics has been expanded by including into consideration the long-range fluctuation stage that determines the slow luminescence quenching of donor centers isolated due to fluctuations of donor surroundings. New experimental data on fluorescence kinetics concentration dependence in a Nd^{3+}: LaF_3 bulk crystal are consistently described with single set of energy migration C_{DD} and cross-relaxation C_{DA} microparameters. The obtained results is the first step to solve the problem of quenching in RE doped nanocrystals where, along with self-quenching, the quenching by additional acceptors namely, various molecular groups, residing in the volume of the nanoparticles have to be accounted.

Keywords: self-quenching; energy transfer; fluctuation stage; Nd^{3+}: LaF_3 crystal; nanocrystals