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# Afterglow and quantum tunneling in Ce-doped lutetium aluminum garnet

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Quantum tunneling between the activator and a nearby trap(s) is a phenomenon not infrequently encountered in scintillating materials. We confirmed its presence both theoretically and experimentally [1] (and references therein). Experimental evidence in a variety of Ce and Pr doped complex oxides was given by the delayed recombination technique, primarily developed to study the activator's excited state thermal ionization. In the delayed recombination measurement the slow tails of the luminescence decay after selective pulse excitation are monitored typically in the millisecond time window. The signal after successive pulses is accumulated for several minutes.

In this work we use an alternative technique to study quantum tunneling between the Ce3+ activator and host traps in Lu3Al5O12. We monitor an afterglow of several Ce3+ doped Lu3Al5O12 samples in the crystal and powder forms, as well as those Mg codoped, for several tens of minutes. Unlike in the usual afterglow measurement we do not use an excitation by ionizing radiation, we rather selectively excite by continuous light source directly into 5d1 Ce3+ excitation band. Such experiment (after initial emptying the traps) ensures that at low temperatures the traps cannot be filled by any other process than quantum tunneling from Ce activators. After excitation cut-off an afterglow signal is recorded and an inverse power-law function is fit to the data. Power-law exponent close to 1 confirms that the observed signal is due to quantum tunneling between the Ce activators and traps [2]. The experiment is performed in the extended temperature range within 8-400 K. The results obtained for different samples are compared and discussed.

**Acknowledgement**

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**References**

[1] E. Mihóková and M. Nikl, Luminescent materials: probing the excited state of emission centers by spectroscopic methods, Meas. Sci. Technol. 26 (2015) 012001 (17pp).

[2] D. J. Huntley, An explanation of the power-law decay of luminescence, J. Phys.: Condens. Matter 18 (2006) 1359–1365.

## Has accepted

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