Persistent Yellow Luminescence of Bulk GaN Doped with Beryllium

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So far most of the studies on GaN doped with beryllium have mainly concentrated on possible p type doping. Unfortunately, the realization of p type conductivity in GaN:Be appeared to be difficult. It seems, however, that due to its very strong yellow luminescence, GaN:Be could be used as a light converter [1]. In particular, it was revealed that GaN:Be phosphor possesses a broad-band yellow emission around 580 nm being excited in blue-UV range. This emission is also observed in the afterglow that lasts up to 1-2 minutes at room temperature (see Fig. 1).

Un till now there has not been a good model which could properly describe the optical properties of the yellow luminescence related to beryllium doping. To get better insight into the nature of the yellow luminescence, we performed detailed studies of the luminescence. We also measured the thermally stimulated luminescent (TSL) properties of this material in the 10-350 K temperature range.

The small GaN crystals doped with beryllium were grown by the High Nitrogen Pressure Solution Growth (HNPS) method. Our luminescent studies included measuring of the afterglow decay in the temperature range from 200 to 350 K, measuring of the thermal glow curves in the 10-350 K range, as well as temperature dependence of the emission intensity under continuous UV excitation. Our results testify a complex structure of the thermal glow that revealed the presence of a few shallow states involved in the yellow emission of the material. Activation energies of the shallow traps were determined from the thermal glow curves using the initial rise method. Obtained results will be discussed in relation to the available models of the point defects responsible for the yellow emission of GaN. We also compared our results with recently performed ODMR (optically detected magnetic resonance) studies (on the some set of samples).

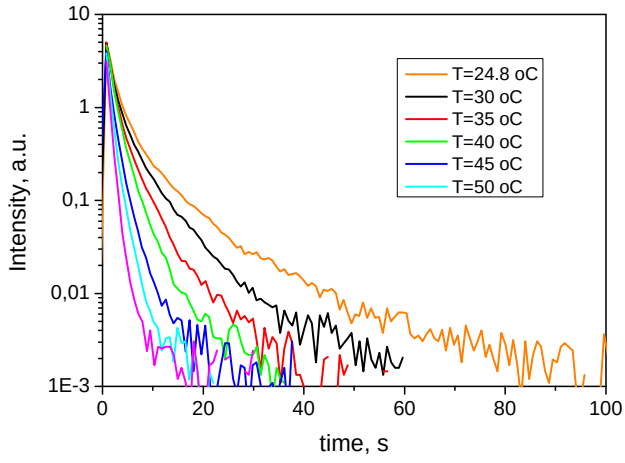

Fig. 1. The yellow afterglow of GaN:Be at various temperatures observed after UV excitation.

[1] H. Teisseyre, M. Bockowski, I. Grzegory, A. Kozanecki, B. Damilano, Y. Zhydachevskii, M. Kunzer, K. Holc, and U. T. Schwarz, *Appl. Phys. Lett.* **103**, 011107 (2013).