Luminescence properties of cubic stabilized zirconia crytals

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The catodoluminescence (CL), γ-ray luminecsence (GL) and thermostimulated luminescence (TCL) of yttrium stabilized zirconia (YSZ) crystals were investigated. The experiments were performed on single crystals of ZrO_2-Y_2O_3 (10 wt %). The CL excitation was realized by pulses of electrons with 300 kev energy and of 10 ns duration. The CL spectrum being measured at 297 K at once after electron pulse excitation consists of two wide bands on 4.4 and 2.8 eV. The former was first found in YSZ crystals and it is characterised by short decay time of the order of 60 ns at 297 K. This emission was not seen at 77 K because of intensive reabsorption in short-wave region. The attempt to find this emission in TSL spectra of γ-irradiated crystals was'not successful. These results allow to conclude that emission at 4.4 ev is'not connected with recombination of separated charge carriers and due to exciton-like state, formed as a result of reciprocal attraction of electrons and holes in the course of relaxation. In 10 ns after pulse excitation only emission band on 2.8 ev appears, which is complex and consists of some bands with different decay times from hundred ns to a few μs. In a course of spectra relaxation two independent overlapping structures on 2.8 ev and 2.4 ev were observed such emission bands were deffected in stationary GL and TSL spectra. The short-wave emission band can be photoexcited in the fundamental absorbtion region on 4.2 ev at 77 K. That circumstance as well as large half width, essential stokes' shift allow to consider that this luminescence is intrinsic and can used by radiative decay of electron-hole-like excitations, resulting from recombination of electrons with (sets) trapped holes ground state of which is deep settled in the gap band.