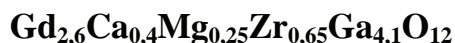


THE NATURE OF RADIATION COLOR CENTERS IN SINGLE CRYSTALS



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Thanks to high transparency of $(\text{GdCa})_3(\text{GaMgZr})_5\text{O}_{12}$ single crystals in visible and near IR regions of spectrum, they have found a wide application as substrates for Bi-containing magnetic garnet films, which are the most perspective material of applied magneto-optics.

The purpose of this work was studying of the nature of radiation color centers arising in single crystals of $\text{Gd}_{2,6}\text{Ca}_{0,4}\text{Mg}_{0,25}\text{Zr}_{0,65}\text{Ga}_{4,1}\text{O}_{12}$ under the influence of ultraviolet radiation, γ -quanta and fast electrons. Single crystals have been grown by the Chohralsky method in the environment of $\text{N}_2 + 1-2\% \text{O}_2$. The samples were plates with (111), (210), (110) and (100) crystallographic orientations, size of 10x10 mm and 500-900 μm in thickness.

The treatment of samples included ultraviolet flare by the xenon lamp, γ -quanta irradiation with industrial isotope installation on the basis of Co^{60} ($E_\gamma = 1,25 \text{ MeV}$) or irradiation by fast electrons on accelerator ($E_e = 6 \text{ MeV}$).

The irradiated samples were studied by methods of optical spectrophotometry and spectroscopy of thermoactivated current (temperature dependence of electrical conductivity and thermally stimulated polarisation (TSP)).

It has been found that the spectrum of additional absorption (AA) in the irradiated crystals has complex system of bands from 17000-20000 cm^{-1} to 42000 cm^{-1} with maxima about 24000 cm^{-1} , 32000 cm^{-1} and 40000 cm^{-1} . Even at initial doses of irradiations in spectra there is wide band of AA with $\nu_{\text{max}} = 24000 \text{ cm}^{-1}$, and initially transparent crystals get yellowy-brown coloring.

TSP spectrum of the irradiated samples consists of two groups of blocked peaks. A series of narrow intensive TSP peaks is observed in the region of 300-390 K. In the region of 450-570 K the wide nonelementary absorption band is observed with a maximum at $T = 51-540 \text{ K}$. The depth of traps, frequency factor, charge concentration of carriers on traps, calculated according to TSP spectra, are given.

Comparative studying of AA in crystals $(\text{GdCa})_3(\text{GaMgZr})_5\text{O}_{12}$, $\text{Gd}_3\text{Ga}_5\text{O}_{12}$, $\text{Gd}_3\text{Ga}_5\text{O}_{12}:\text{Ca}^{2+}$, $\text{Gd}_3\text{Ga}_5\text{O}_{12}:\text{Mg}^{2+}$ carried out. It is shown that formation yellowy-brown colouring in gallium garnet crystals caused AA band with $\nu_{\text{max}} = 24000 \text{ cm}^{-1}$, instead of band with $\nu_{\text{max}} = 29000 \text{ cm}^{-1}$ as was considered earlier. The complex structure of AA band with $\nu_{\text{max}} = 24000 \text{ cm}^{-1}$ is found out.

The possible mechanisms of the radiating F-centers formation in gallium garnet crystals are discussed.