Investigation of Spectroscopic Properties of $Y_3Al_5O_{12}$ Crystals Activated by Rare-Earth Ions

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In this work, we have studied spectroscopic properties, the absorption spectrum, luminescence and electron paramagnetic resonance (EPR) of yttrium-aluminium garnets (YAG) activated by rare-earth ions TR_3 (Pr, Nd, Dy, Er,Tb).

Investigation of these properties was made using the interaction with several types of radiation: gamma (γ) and neutrons. It was determined that by the action of γ -radiation on the samples color was changed, the density of which depends on the dose and temperature of the radiation. At the same time it was noticed that YAG –TR_3, under action of γ – radiation, glowed intensively, the spectra of which corresponds to ions of TR_3 . The defect centers under action of neutron I radiation are formed most effectively, and that is observed in spectra of absorption photoluminescence, thermoluminescence and EPR.

Thermal heating of the irradiated crystals results in trans formation of the centers and creation of more complicated aggregations. Thermodynamic-evolutionary processes displayed upon repeated thermoluminescence are presented by us as coagulation in clusters of dot radiative – induced defects at the expense of strong phonon- phonon and electron- phonon interations.

The considerations of these complicated interconnected dynamic processes results in the phenomenon self-aggregation of the elementary radiative- induced defects with formation of clusters of a polydisperse type.