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# DISTRIBUTION IN THE MATERIAL OF THE ABSORBED ENERGY OF A SPACE-LIMITED BEAM FLOW OF HIGH-ENERGY ELECTRONS

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When passing through a substance, electrons with energies up to 5 MeV lose their energy mainly to ionization. The cross section for the interaction of electrons with atoms of a substance depends on their energy, and their trajectory of their movement changes during the interaction. Therefore, the distribution of absorbed energy in matter has a complex character. Even more difficult is the energy distribution under the action of a spatially limited electron beam. Part of the energy is transferred outside the beam, and the energy is also redistributed in the plane perpendicular to the beam axis.

The distribution of absorbed energy in the target determines the nature of the processes stimulated by radiation in matter. If these processes have a linear dependence on the flux power density, then with an increase in the absorbed dose, proportional changes in the structure and properties in the irradiated substance are observed. In the case when the processes stimulated by radiation are non-linear depending on the power density, one can expect the manifestation of unusual processes that determine the result of radiation treatment. Such effects have been found, for example, in the synthesis of refractory luminescent ceramics based on metal fluorides and oxides [1, 2]. Above certain thresholds, the effects associated with the ionization of matter and active processes between short-lived radiolysis products become dominant.

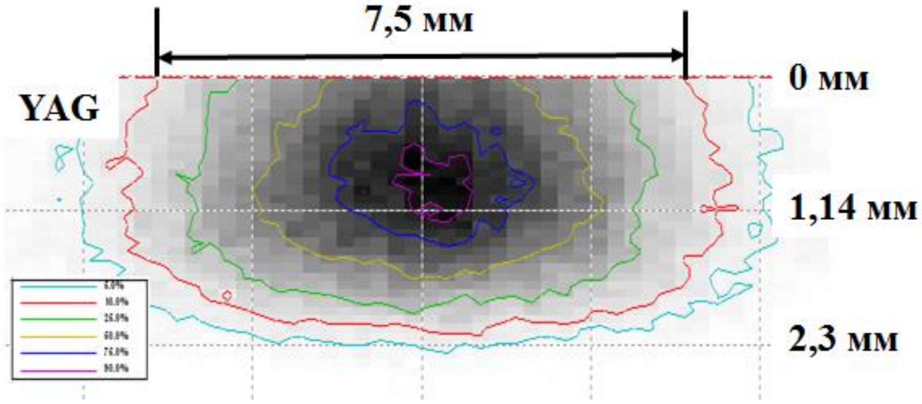


Fig.1. Energy Loss Distribution of an Electron Flow with E=2.0 MeV in YAG

We have calculated the energy losses of electrons with energies of 1.4 – 2.5 MeV in materials based on YAG, FSGM using Monte Carlo methods. Beams of streams of such electrons were used for the radiative synthesis of these materials. The beams had a Gaussian flux density distribution in cross section with a diameter near the surface of the irradiated charge of 7.5 mm. An example of the results of calculating energy losses is shown in the figure. The distribution of energy losses has the form of a curve with a maximum in sections parallel and perpendicular to the direction of the incident electron flow. The maximum energy of the electron beam with an energy of 1.4 MeV is absorbed in a region with a diameter of ≈4 mm in a cross section perpendicular to the direction of electron beam incidence and at a path depth of 1.5–2.0 mm. The highest energy loss density is inside the substance. Obviously, one should expect the manifestation of such a non-uniform distribution of the absorbed energy in matter in the processes of radiative synthesis.

With an increase in the electron energy, the region with the highest flux energy loss density increases in a disproportionate manner to the electron energy. The density of the generated electronic excitations in the irradiated region depends nonlinearly on the energy of the electrons. This effect must be taken into account when choosing the mode of radiation synthesis of dielectric materials.

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