3.2×10^5 rad/sec, calculation leads to $t/\tau = 65$ and 230 respectively. Consequently, effect (a) is of no significance; in any case, the sensitivity of the fluorescence to the electric field would decrease with increasing dose intensity as a result of (a), thus contradicting the experimental data. More hopeful is the allowance for the deformation of the potential well, which leads, in final analysis, to a change in the recombination rate of the charges.

It is quite interesting to note that the sensitivity of the normal and excimer fluorescence to the electric field turns out to be different. It is known that the formation of excimer molecules occurs in the process $^1S^* + S \rightarrow {}^1SS^*$. If this process were to be the only one leading to the formation of excimers, then the normal and excimer fluorescence would behave in similar fashion under all conditions. The observed difference in the sensitivity to the electric field indicates that the excimers are produced also in other processes, such as recombination of the ions P^+ and P^- [7] or the formation of dimer ions PP^+ with subsequent recombination.

An investigation of the sensitivity of the fluorescence to the electric field, observed in the present paper, may be a useful method of distinguishing experimentally between the processes of charge transfer and excitation-energy transfer in radiation physics and chemistry.

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POSSIBILITY OF DIRECT INVESTIGATION OF THE INFLUENCE OF DISLOCATIONS ON THE PROCESSES OF MAGNETIZATION OF YTTRIUM IRON GARNET CRYSTALS

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Ever since it became known that materials with specified magnetic properties can be produced by different plastic-deformation and heat-treatment procedures, the influence of defects of the crystal structure and the associated internal stresses on the magnetization of ferromagnets has received much attention. Particular interest attaches to investigations of the interaction of dislocations with the magnetic structure of the crystal, since the dislocations are the most important source of the long-range internal-stress field.

A theoretical study of the influence of dislocations on the magnetization of ferromagnets is based on the consideration of the magnetoelastic interaction between the stress field due to the dislocations and the magnetization in the domains and domain boundaries [1-6]. It turns out that the result depends appreciably on the concrete form of the dislocation and

domain structures of the crystal. The main experimental investigations were aimed at observing the influence of the plastic deformation on the macroscopic characteristics of ferromagnetic metals [4-10]. This entails appreciable difficulties arising in the simultaneous and direct investigation of both the real dislocation strucutre, which results from the plastic deformation, and the kinetics of the variation of the domain strucutre of these crystals. So far it has been impossible to perform a direct experimental study of the influence of the individual dislocations on the change of the domain structure and the magnetization of the crystal.

In the present communication we demonstrate the possibility of realizing such an investigation by a polarization-optical method in yttrium iron garnet crystals. It is known [11] that their domain structure can be revealed in polarized light by determining the difference in the rotation of the plane of polarization of a light beam passing through differently magnetized domains. Our investigations have shown that in these crystals it is simultaneously possible also to reveal single dislocations by determining the birefringence connected with the elastic-stress field around the dislocations, using methods and apparatus developed as applied to the study of dislocations in semiconductors [12].

The samples for the investigations were plane-parallel plates 0.3 - 2 mm thick cut perpendicular to the ⟨112⟩ axis from single crystals of $Y_3Fe_{4.7}Ga_{0.3}O_{12}$, grown from the solution in the melt by A. G. Titova. The samples were mechanically polished after cutting.

Figure 1 shows a crystal containing dislocations and domains as observed with a parallel beam of plane-polarized 1.2-μ irradiation in the absence of an external magnetic field. The edge dislocations, located perpendicular to the plate, are revealed in the form of dark-white rosettes. The large lobes of the rosette are elongated along the slip plane {113} of the dislocation, which coincides with the direction of the oscillations in one of the crossed Nicol prisms. In the lower part of the photograph we see one dislocation of a different type - with a slip plane {111}. The broad fringes with different illumination intensity are connected with the domains. The magnetization vectors in neighboring domains make an angle of

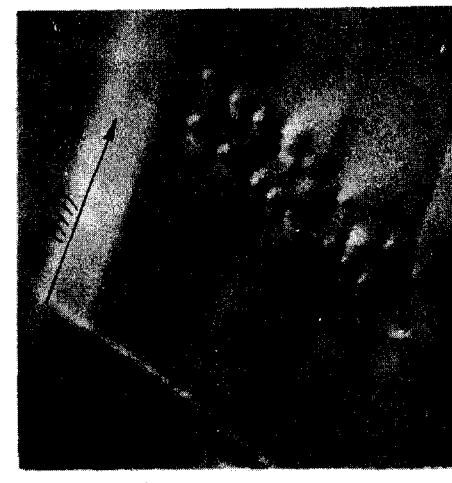

Fig. 1. Domains and dislocations in an yttrium iron garnet crystal plate revealed with the aid of polarized infrared in the absence of an external magnetic field.

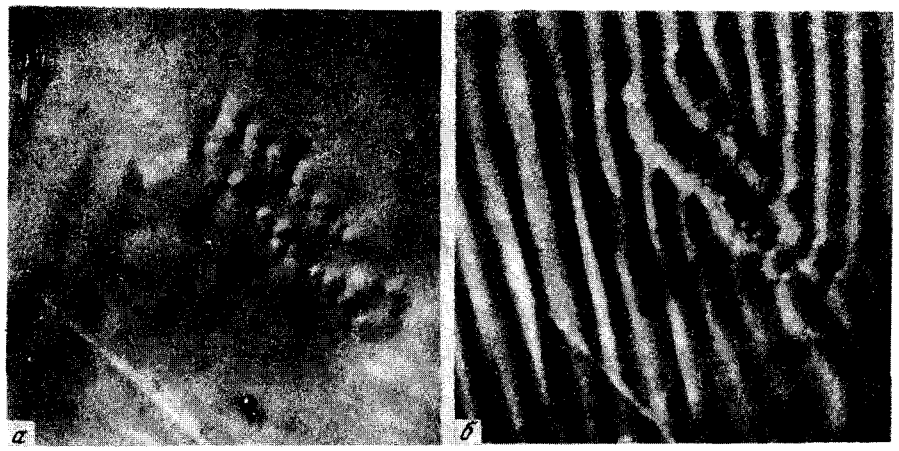

Fig. 2. Variation of crystal domain structure upon superposition of an external magnetic field: a - H = 20 Oe, b = 60 Oe.

180° with each other and are located approximately along the direction ⟨111⟩ of easy magnetization of the crystal, which lies in the plane of the plate.

Figure 2 shows the character of the variation of the domain structure upon superposition of an external magnetic field which does not coincide with the direction of the vector of the spontaneous magnetization in the domains. In a weak magnetic field, the magnetization process is due to the displacements of the 180° domain boundaries, on which the dislocation stress field does not exert any noticeable influence. In stronger fields, domains forming 71° boundaries appear. New domains appear either near the dislocations or at the edge of the sample (Fig. 2a). When the field is increased to 50 - 70 Oe, the entire crystal breaks up into 71° domains. The dislocations exert a strong influence on the formation of the new domain structure. It is seen from Fig. 2b that the motion of the 71° domain boundaries was stopped by the dislocations. The domains with different magnetization-vector directions (dark and light figures) lie in those regions of the crystals, in which tangential stresses of opposite sign act. On approaching the saturation region in strong magnetic fields, the crystal becomes single-domain. The last to vanish are the domains near the dislocations. This indicates that the dislocations influence the magnetization process in the region of rotation of the magnetization vectors. When the external magnetic field is decreased, the breakdown of the crystal into 71° domains starts as a rule near the dislocations.

The results illustrate clearly the great opportunities afforded by the use of the polarization-optical method in investigations of the influence of dislocations on the processes occurring on different sections of the magnetization curve. The quantitative data on the interactions between various types of dislocations, domains, and domain boundaries, which will become available following the investigation of the piezooptical properties of yttrium-iron-garnet single crystals, will make it possible to verify directly the presently prevailing theoretical notions.

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LASER BASED ON RAMAN SCATTERING IN LIQUID NITROGEN

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An important parameter of a coherent-radiation source is its brightness ($W/cm^2 sr$). A promising method of increasing the brightness of such a source is to transform its emission into generation by means of stimulated Raman scattering (SRS). We report here for the first time an increase of brightness in a liquid (liquid nitrogen) Raman laser [1)].

It was observed in [1-2] that SRS in liquid nitrogen makes it possible to transform effectively the radiation of a ruby laser into Stokes components. No noticeable effect of stimulated Mandel'shtam-Brillouin scattering (SMBS) and self-focusing was observed in this case, this being due to their higher threshold pump intensities compared with SRS. In organic liquids these thresholds are of the same order as those of SRS. Therefor SRS in these liquids is accompanied as a rule by SMBS and by self-focusing. This apparently explains why it is impossible to obtain an increase in brightness in Raman lasers using these liquids [3,4]. This effect is observed only in gaseous hydrogen [5], in which the SRS threshold is much lower than the SMBS and self-focusing thresholds.

A block diagram of the experimental setup is shown in Fig. 1. The pump source is a Q-switched ruby laser with a rotating prism. An off-axis pumping scheme was used, i.e., the light beam of the pump propagates at a certain angle to the axis of the Raman-laser resonator. Such a scheme makes it possible to separate spatially the pump and generation light beams. The temporal characteristics of the pump and generation were investigated with the aid of FEK-09 coaxial photocells with a high-speed oscilloscope. The spatial distribution of the generation was fixed with a photographic camera (PC), and the angular distribution was measured with interchangeable diaphragms D located in the focal plane of the lens L_2 of focal length 2 m. The radiation energy was measured with calorimeters C_1 and C_2. A selective filter F_2 was used to separate the Stokes components $\lambda_1 = 0.828\ \mu$ and $\lambda_2 = 1.026\ \mu$.

1) We shall henceforth use for brevity the term "Raman laser" in place of "laser based on stimulated Raman scattering."