experiments, we can state that these curves illustrate clearly the effect of changing the polarization of the Li^7 nuclei under the influence of summary and difference ultrasound frequencies. The magnitude of the effect and the shape of the curves are in good agreement with the calculations; as to their width ($\delta^{\pm} \simeq 80$ kHz), it was determined both by the dependence of the probabilities $W^{\pm}$ on Δ, and by the factor T_3/Ω^2 preceding $(\Delta^{\pm})^2$ in formula (1). This factor can be estimated, generally speaking, by comparing the experimental curves II and III obtained at different acoustic-energy densities in the crystal, since the probabilities W^+ for these curves at fixed Δ should be related to each other as the squares of the strains, which are proportional to the voltage on the piezoelectric converter. This can be done more accurately, however, by saturating the forbidden transitions with a radio-frequency field, when the limiting change of the stationary polarization is reached. The results of such experiments will be published later.

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INVESTIGATION OF THE TEMPORAL CHARACTERISTICS OF DEFORMATION LUMINESCENCE

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It was shown in earlier papers [1 - 3] that glow - deformation luminescence - is produced when colored alkali-halide crystals are deformed. The deformation-luminescence process proceeds in two stages. The dislocations moving under the influence of the external stress release electrons from the F centers, and the electrons subsequently recombine at the luminescence centers - the Cu^{++} ions.

We investigate here the temporal characteristics of the luminescence; an analysis of these characteristics confirms the micromechanism proposed in [4] for interaction between the dislocations and the F centers.

The investigations were made on the crystals KBr (2×10^{-4}% Cu) and KCl (1.6×10^{-3}% Cu). The samples were colored with γ rays from a Co^{60} source at an irradiation dose 2×10^5 rad. The crystals were deformed by pulses of mechanical stress with duration 50 μsec (at the 0.5 level). To obtain pulsed loading, a setup was developed in which the lower plunger was a magnetostriction converter on which a coil was wound [5]. Passage of current through the coil produced elongation of the converter and deformation of the sample.

The glow was registered with a low-noise photomultiplier (FEU-77), a cathode follower, and an oscilloscope (S1-37 or C1-42). The second channel of

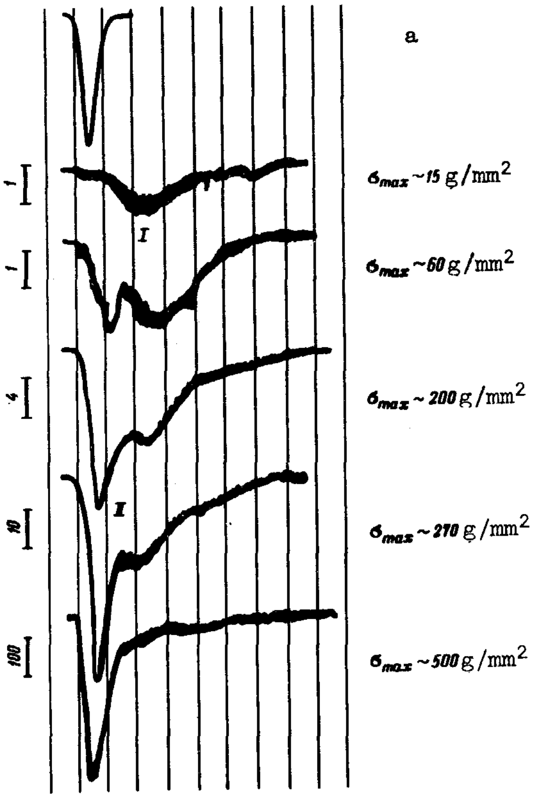

Fig. 1a

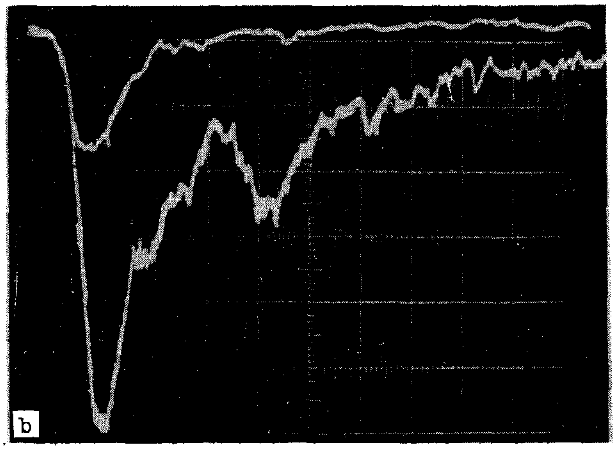

Fig. 1b

Fig. 1a. Shape of deformation-luminescence pulse vs. load. KBr crystal, 1 division = 100 μsec. Uppermost trace - mechanical-stress pulse.

Fig. 1b. Pulses of mechanical stress (upper curve) and of deformation luminescence, obtained for a KCl crystal. 1 division = 50 μsec (σ_{max} = 200 g/mm^2).

the S1-42 oscilloscope was used to record the mechanical-stress pulse, using a method based on registration of the birefringence produced in the case of uniaxial deformation of the crystal [5]. The luminescence and birefringence channels were separated by filters.

The study of the glow induced in colored crystals by mechanical-stress pulses has revealed that the temporal parameters of the deformation-luminescence pulse (leading front, position of the maximum) depend on the external stress. The luminescence pulses obtained from colored KBr crystals at different values of the mechanical-stress pulses are shown in Fig. 1. It is seen from the figure that at a stress $\sigma_{max} \sim 20$ g/mm^2 the flash of deformation luminescence has one maximum I. The flash retains the same form up to stresses $\sigma_{max} \sim 40$ g/mm^2. At $\sigma_{max} < 40$ g/mm^2, the glow flares up after the removal of the mechanical stress, and a maximum of the deformation luminescence is observed after $\tau_d \sim 200$ μsec, after the mechanical stress has already reached the maximum (τ_d is the delay time). An increase of the voltage produces another peak II on the luminescence pulse. Its maxumum shifts with the increasing load, approaching the position of the maximum of the external voltage. At large loads

$\sigma_{max} > \sigma_{el}$ (σ_{el} - elastic limit, 250 g/mm^2 for KBr crystals), the delay time for peak II is 10 - 20 μsec. The position of the first maximum remains practically unchanged at all values of the mechanical stress. The intensity of peak II increases with increasing load and becomes much larger than peak I at large stresses.

Analogous regularities in the behavior of the flash of light were observed for deformed KCl crystals. However, even at small loads, $\sigma_{max} \sim 40$ g/mm^2, the flash of deformation glow has two maxima of approximately equal intensity. τ_d for the peak I in KCl crystals is ∿170 μsec. An increase of the load, just as for the KBr crystals, leads to a redistribution of the intensities of the two maxima - the second becomes larger than the first. At large loads, the intensity I^{II}_{max} of the maximum II is approximately five times I^{I}_{max}.

The luminescence spectra of the first and second peaks coincide within the limits of experimental error and correspond to the spectrum of the intracenter luminescence of copper ions.

The evolution of the shape of the flash can be understood by analyzing the micromechanism of the interaction of dislocations with F centers.

When a dislocation interacts with an F center, the electron can in principle fall in the conduction band and then recombine at the glow center. The energy required to realize this act is 2 eV. The possibility of realizing this mechanism can be verified in the following manner:

When a colored crystal is illuminated with F light, F electrons of the conduction band are released and recombine with the radiation at the glow centers. Thus, when a colored crystal is illuminated with F light, it becomes possible to simulate the process of recombination of electrons localized at capture centers with glow centers via the conduction band.

Figure 2 shows oscillagrams of the pulses of the exciting F light (λ_{max} = 630 nm) and of the luminescence (λ = 400 nm). (Analogous results were obtained for KCl crystals.) From a comparison of Figs. 1 and 2 we see that there is an essential difference between the development of deformation luminescence at small σ and F-stimulated glow, thus demonstrating that the model indicated above is inconsistent. The presence of peak I indicates that when the F electron is released from dislocation there is an intermediate state (possibly, capture in the dislocation zone), in which the electron stays prior to recombination at the glow center. (The existence of localized states connected with dislocations was predicted in a number of papers, for example [6].)

The electron captured in a one-dimentional dislocation zone can move along the dislocation under the influence of Coulomb attraction produced by the glow center - the Cu^{++} ions. The presence of charged steps on the dislocations in alkali-halide crystals [7] slows down the motion of the electron in the dislocation

Fig. 2. Pulses of F-light (upper curve) and F-stimulated luminescence from a KBr crystal (1 division = 50 μsec).

zone considerably. This is probably the cause of the long flareup time of deformation luminescence at small σ.

At the same time, it follows from the analysis of the possible micromechanism of electron release by dislocations from F centers [4] that, at all values of the mechanical stress, the most probable is capture of an F electron in the dislocation zone. Therefore, the peak II, which arises at large mechanical stresses, meaning also at large dislocation velocities, is apparently connected with the supply of electrons to the moving dislocations from the glow centers.

Thus, the F electron captured in the dislocation zone can move along the dislocation, and also move through the crystal together with the dislocation.

If the dislocation velocity V_d is lower than the effective velocity of the electron along the dislocation V_e, then the luminescence kinetics is determined by the first process. This situation apparently is realized at low stresses (Fig. 1a). Indeed, as seen from Fig. 1, the glow intensity continues to increase after the crystal load is removed (peak I), when the dislocations no longer move.

When the stress is increased, the velocity of the dislocation increases. When the condition $V_d > V_e$ is satisfied, the second micromechanism becomes dominant, and the supply of electrons to the glow centers is determined mainly by the transport of electrons by the moving dislocations (peak II).

If the foregoing assumptions are correct, then the parameters of the dislocation zone can be determined in principle from the analysis of the waveform of the luminescence pulse.

In conclusion, the authors consider it their pleasant duty to thank V.L. Broude, V.Ya. Kravchenko, and V.L. Pokrovskii for fruitful discussions and valuable advice.

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SUPERCONDUCTIVITY OF COLD-DEPOSITED FILMS OF ALLOYS OF GERMANIUM WITH NOBLE METALS

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In [1] we reported that films of the system Au-Ge, evaporated by a laser pulse on a cold substrate, are superconducting and have a transition temperature 2.7°K. It was of interest to verify the possibility of formation of analogous metastable modifications in alloys of germanium with other noble metals. In this paper we describe an investigation of the superconductivity of cold-deposited films of the alloys Ag-Ge and Cu-Ge.