action is equivalent to application of a field $\sim 10^3$ V/cm. Under our conditions, however, the electric fields were larger by one order of magnitude, and therefore the influence of the electrodes on the behavior of I(H) was negligble, and the observed changes were due to the applied electric and magnetic fields.

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EXPERIMENTAL OBSERVATION OF THE INFLUENCE OF AN ELECTRIC FIELD ON THE PLASTIC DEFORMATION OF ZnSe CRYSTALS

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Great strengthening (up to 100%) of ZnSe single crystals was observed in constant electric field. The dependence of the effect on the temperature and on the applied voltage was investigated. The effect is attributed to a change in the states of the electron subsystem of the crystal.

We have previously observed and investigated a reversible effect of light on the plastic deformation of semiconductors (the photoplastic effect) [1 - 5]. It turned out that the change of the state of the electron subsystem of the crystal under the influence of the light leads to a change of the conditions for the dislocation motion, and consequently to a great strengthening of the crystal. To confirm this model, it was of great interest to attempt to change the state of the electron system of the crystal by some other means, say with an electric field, and see whether this affects the plastic deformation. The present paper is devoted to a description of such experiments, which revealed the effect of an electric field on the plastic deformation of semiconducting crystals. n-ZnSe single crystals with sphalerite structure were grown from the melt and had a resistivity 10^7-10^{10} Ω-cm. The sample for deformation were cut in the form of thin plates 0.3 × 4 × 8 mm, with the wide face (110). Current-conducting contacts of In, Ag, or Cu_2Se were deposited on both sides of the sample at the center of the wide faces (Cu_2Se is a p-type semiconductor and forms a heterojunction with ZnSe [6]). The indium contacts were fused in a hydrogen atmosphere at 500 - 600°C. The silver contacts were either evaporated or secured with silver solder. The Cu_2Se layer was grown on the ZnSe surface by a procedure described in [6]. The approximate contact area was 5 sq. mm, and the total thickness of the contacts did not exceed several microns. The plastic deformation was produced by three-point bending at temperatures from 40 to 210°C. The distance between the lower supports was 5 mm. The deformation was produced by bringing the supports closer together at a constant speed of 5 μ/min. The actively deformed region was then located between the two contacts. The voltage reached 2.4 kV, corresponding to average fields on the order of 100 kV/cm. Figure 1 shows a diagram of the deformation of an In-ZnSe-Ag plate. In the plastic-flow section, a voltage 1.2 kV (+ on the Ag contact) was turned on at the instant (1), and was turned off at the instant (2). A voltage of opposite polarity was turned on and off at the instants (3) and (4). As seen from Fig. 1, the sample becomes much stronger when the electric field is applied, and plastic flow resumes only at loads exceeding the yield point by 100%. The strengthening disappears when the field is turned off . We observed a similar phenomenon in the deformation of plates having all possible combinations of In, Ag, and Cu_2Se contacts. The maximum effect was observed for the

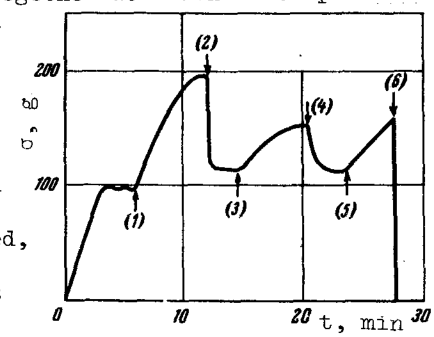

Fig. 1. Effect in Ag-ZnSe-In sample at T = 105°C.

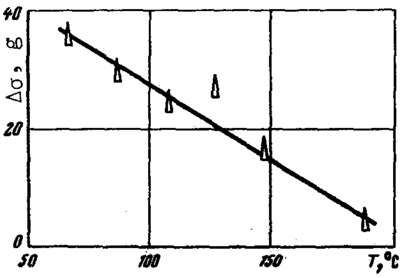

Fig. 2. Temperature dependence of the effect for Ag-ZnSe-Ag

systems Ag-ZnSe-In (approximately 100%) and Cu_2Se-ZnSe-In (approximately 60 - 70%) with the negative potential on the In. A minimum strengthening effect, of several per cent, was observed for In-ZnSe-In. The most reproducible results were obtained for Ag-ZnSe-Ag plates with silver-paste contacts. The main measurements were therefore made for such samples, although the effect was not very large for them. Figure 2 shows the temperature dependence of the effect. The field-induced strengthening decreases with increasing temperature T and vanished at T ≈ 200°C, which is 80 - 100° lower than the temperature at which the photoplastic effect is quenched in ZnSe. For all samples there existed a threshold voltage below which the effect was not observed. The threshold and its growth differed somewhat from sample to sample. No increase of the mechanical stresses was observed in the elastic-deformation region following application of ∿2 kV. At the voltages producing the effect, the currents through the samples ranged from 10^{-7} A (For the Ag-ZnSe-Ag systems) to 5×10^{-5} A (for In-ZnSe-In systems). The smallest resistances were those of the In contacts, but we nevertheless could not make them fully ohmic. The effect was observed also in alternating fields at frequencies ≤ 10 kHz, but was much weaker. For example, at 3.7 kHz it was one-tenth the effect in a constant field. In some samples, a jumplike decrease of the mechanical stresses, independent of the polarity of the voltage and weakly dependent on its value, was observed in both the elastic and the plastic region of deformation. This jumplike loss of strength vanished after several successive applications of the field. It can be assumed that it is connected with collective ejections of dislocations to the sample surface from the near-surface layers at the instant when the field is turned on. In electric fields that excite the effect, the resultant strengthening greatly exceeds the values of such jumplike losses of strength. We did not succeed in observing visible electroluminescence in the investigated samples. The lack of strengthening in the elastic region, the existence of a threshold voltage, and its independence of the polarity for symmetric systems (e.g., Ag-ZnSe-Ag), allow us to exclude from consideration such phenomena as thermal heating and piezoelectricity.

A possible mechanism of the observed phenomenon is the change of the state of the crystal electron subsystem by injection of minority carriers from the contact into the volume, accumulation of majority carriers, etc., or by ionization of point centers in strong electric fields. Experiments aimed at explaining the mechanism of the effect are now in progress.

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PHOTODISSOCIATION OF IODINE MOLECULES BY POWERFUL 5310-Å RADIATION. DETERMINATION OF RECOMBINATION RATE OF IODINE ATOMS IN THE PRESENCE OF INERT GASES

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There have been many investigations of atomic iodine recombination reactions $I + I + M \xrightarrow{c} I_2 + M$ [1]. In most cases, when recombination was investigated at relatively low temperatures, the initial concentration of the iodine atoms was produced by flash photolysis. The time variation of the molecular-iodine concentration was determined from the change in the signal of probing radiation in the range λ = 460 - 566 nm. A similar procedure, owing to the relatively long duration of the light from flash lamps, does not make it possible to observe without disturbance the signal of the probing radiation during the initial stage of the recombination process. In the present study we obtained the initial iodine-atom concentration by using a high-power radiation pulse at λ = 5310 Å, of energy 1.5 - 2 kJ and duration 50 nsec. When such