The values of the energy Q_M were measured for migration in the vicinities of the faces (110) and (100) in the entire possible interval of positive and negative fields (i.e., with the point positive and negative).

Figures 2 and 3 show the results of measurements of $Q_M(F)$. The curves obviously do not agree with formula (1). The presence of clearly pronounced maxima and minima indicates a more complicated character of the action of the external electric field on the surface atoms of the tungsten. The values of Q_M lie in the ranges (0.5 - 2.3) ± 0.05 eV for the (011) face and (1.1 - 2.7) ± 0.05 eV for the (001) face. The interval of variation of $Q_M(F)$ greatly exceeds the measurement error.

The asymmetry of $Q_M(F)$ relative to the point F = 0, especially for the (001) face, points to the presence of a term $p_{eff}F$, where p_{eff} is the effective dipole moment of the atom adsorbed on its own lattice. The greatly different behavior of $Q_M(F)$ on the faces (001) and (011) indicates that p_{eff} (and also α_{eff}) depends strongly on the surface structure.

It is impossible at present to offer a definite interpretation of the observed effect.

As a working hypothesis, we can suggest the following explanation: In a field $F \sim 10^7$ V/cm (i.e., lower by one order of magnitude than the lattice field and higher by two orders than the fields causing splitting of the levels of the free atoms), intersection and mixing of the levels of the surface atoms occurs and leads to a dipole-moment variation that is resonant in the field, and hence to a change in the migration energy Q_M.

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ACOUSTO-ELECTRONIC INTERACTION IN CdS FOR PURE SHEAR SURFACE WAVES

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It was shown in recent papers [1, 2] that in crystals of class C_{6v} there can propagate piezoactive waves of a new type, namely pure shear surface waves (SSW), wherein the particles are displaced only along the propagation surface. There are no published reports of investigations of interactions between the SSW and electrons. We have investigated electron absorption and amplification of SSW, and also the acousto-electric (AE) effect in CdS single crystals on surface waves.

The experimental setup is shown in Fig. 1a. Two systems of electrodes are placed on two etched side surfaces of a photosensitive CdS crystal with length perpendicular to the C_6 axis - one on the $\{10\bar{1}0\}$ plane for the excitation and reception of the SSW, and one on the {0001} plane for the Rayleigh

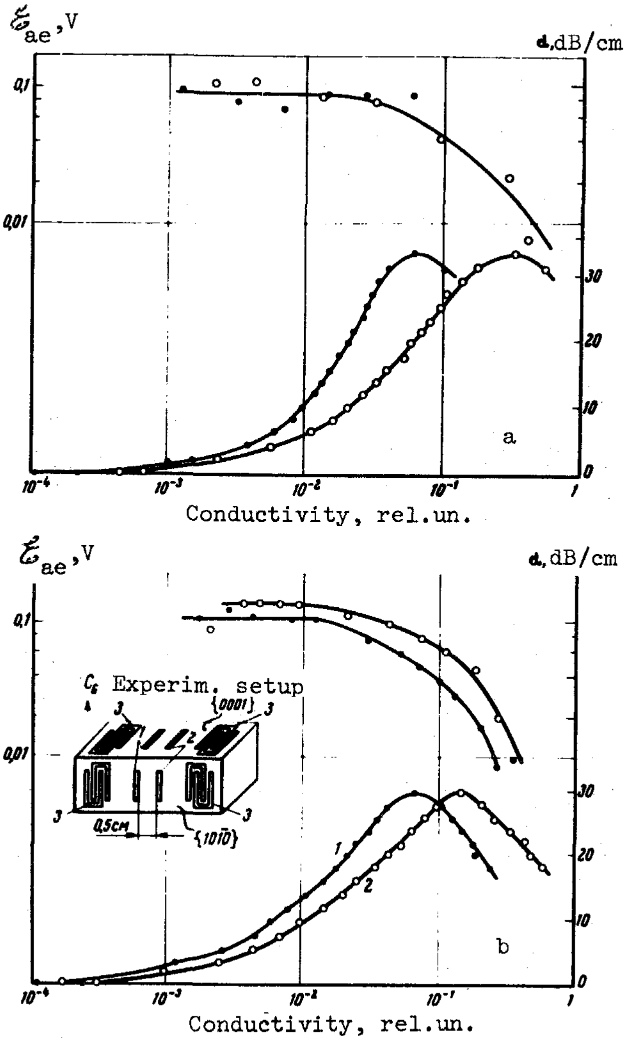

Fig. 1. Acousto-electric emf and ultrasound absorption vs. conductivity. Filters: 1) 1 cm H_2O + 0.2 cm CdS; 2) 1 cm H_2O + SZS-20; a) SSW, f = 10.9 MHz, b) Rayleigh waves, f = 10.4 MHz. Upper corner - experimental setup; 1, 2 - measuring electrodes, 3 - ridge junction.

waves (which were investigated in the same crystal for comparison)[1]. A parallel beam of light is incident perpendicular to the {10$\bar{1}$0} or {0001} plane between the electrodes 1 and 2, and the remaining parts of the crystal are kept in darkness. To decrease the influence of the scattered light on the converter, long CdS crystals were used (L ≃ 50 mm); the large distance between converters ensured also the necessary time delay of the transmitted pulse.

Upon illumination of the crystal surface, an appreciable AE effect and electron absorption were observed for both types of waves. The features of the Rayleigh waves of the SSW became manifest in the character of variation of the transmitted signal and of the AE emf $\mathcal{E}_{ae}$ when a drop of liquid is placed between the electrodes 1 and 2. In the case of the Rayleigh waves, the signal decreased by 10 - 15 dB, and $\mathcal{E}_{ae}$ decreased by a factor 6 - 10, depending on the conductivity of the interelectrode section. To the contrary, no changes were observed in $\mathcal{E}_{ae}$ in the case of the SSW, when there was no longitudinal particle-displacement component. However, coating with a substance in which shear deformation is possible (ED-5, indium, resin) caused the signal to decrease by 3 - 4 dB. Thus, salol in the liquid state did not change the attenuation of the SSW, but when solidified it increased the attenuation by 4 dB, whereas the attenuation of the Rayleigh waves was larger in both cases, amounting to 12 dB. The smaller dependence of the attenuation of the SSW on the surface state is connected with the greater depth of penetration of these waves [1, 2].

Figure 1 shows plots of $\mathcal{E}_{ae}$ and of the electron absorption of the ultrasound α against the conductivity. It is seen that for both types of waves the general character of the $\mathcal{E}_{ae}$ variation (the plateau region, the decrease in the region of the absorption maximum) corresponds to the linear theory and is analogous to those observed for volume waves in CdS [5]. The quantity $\mathcal{E}_{ae}$, in accord with the Weinreich relation, depended linearly on the intensity of the surface waves and reached 4 V (E_{ae} = 8 V/cm).

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1) The investigations of the absorption and amplification of Rayleigh waves are described in [3, 4].

From the values of α_{max} we determined the effective constants K_{eff} of the electromechanical coupling. In the calculations we used the surface-wave velocities $v_p = (1.72 \pm 0.02) \times 10^5$ cm/sec and $v_{SSW} = (1.80 \pm 0.02) \times 10^5$ cm/sec, which were determined from measurements of the synchronism frequency and the lattice period. $K_{eff} = 0.19 \simeq K_{15} = 0.188$ [6], for Rayleigh waves, and $K_{eff} = 0.29$ for SSW. This agrees with the theoretical estimate [1], which shows that for SSW the value of K_{eff} is of the order of K_{15}.

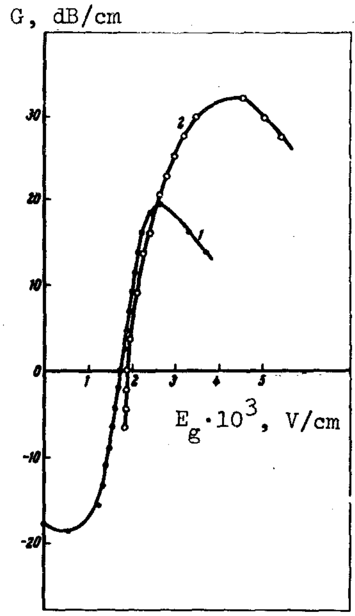

Fig. 2. Gain of the SSW vs. the drift field: 1) f = 10.9 MHz, 2) f = 19.5 MHz.

Figure 2 shows plots of the gain G of the SSW against the drift field E_g. The obtained gain reached 32 dB/cm at 19.5 MHz and 24 dB/cm at 10.9 MHz, and was larger by 5 - 6 dB/cm than for Rayleigh waves.

The electromagnetic-coupling constant determined from the gain of the SSW, $K_{eff} = 0.17$, is also close to K_{15}.

Thus, an investigation of the acousto-electric interaction for the waves of the new type in CdS has shown that the magnitude of this interaction is somewhat larger than for Rayleigh waves. This, together with the greater depth of penetration, makes the use of such waves promising for high-frequency acousto-electronic devices.

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PHOTOCURRENT INSTABILITY AND MULTIPHOTON PROCESSES IN $CdSnP_2$

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1. We wish to point out here several peculiarities of multiphoton absorption of light and of the relaxation of nonequilibrium carriers in a semiconductor having a complicated band structure, such as the recently obtained and thoroughly investigated compound $CdSnP_2$.