$\omega d/v = \pi(2n + 1)$, the energy of the radiation is much greater than it is when only one boundary is present.

If the slab thickness is greater than the wavelength, interference maxima occur. These are due to multiple refractions of the radiation at the boundaries and interference between the radiation emitted at the first and second boundaries.

If the electron speed is such that $\epsilon\beta^2 > 1$, Cerenkov radiation will be emitted in the slab. It can be internally reflected, and then the characteristic maximum will not be observed. If the conditions for internal reflection are not satisfied, then there will be a sharp maximum at an angle ϑ given by

$$\beta^2 (\varepsilon - \sin^2 \vartheta) = 1, \quad (3)$$

The height of the maximum will depend on the Cerenkov radiation. The angle determined by (3) characterizes the Cerenkov cone, refracted at the boundary.

Quantitative comparisons between the theory of Cerenkov radiation and experiment have been made using slabs; some discrepancies were found. Our solution is exact, and a more reliable comparison with experiment can therefore be made. In addition, the process might be interesting as a microwave generator, but this awaits further investigations.

The author is grateful to V. L. Ginzburg, I. M. Frank, and B. M. Bolotovskii for discussions of his results.

*Where the dielectric constant is written without a prime, the slab is taken to be transparent.

†The final results in Refs. 1 and 2 have a misprint in the sign.

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Translated by R. Krotkov
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INFLUENCE OF ELECTROSTATIC FIELD ON THE ABSORPTION OF SOUND IN ROCHELLE SALT

I. A. IAKOVLEV, T. S. VELICHKINA, and K. N. BARANSKII

Moscow State University

Submitted to JETP editor June 27, 1957

J. Exptl. Theoret. Phys. (U.S.S.R.) **33**, 1075-1076 (October, 1957)

WE recently reported anomalous absorption of sound in Rochelle salt, observed by us at a temperature near its upper Curie point.[1] This absorption takes place for a transverse elastic wave propagating along the crystallographic z axis and polarized along the y axis. An examination of the piezoelectric properties of Rochelle salt shows that the shear strains connected with the propagation of this wave cause polarization of the crystal along its ferroelectric x axis. It is therefore important to investigate the absorption of the same waves in the case when a crystal is already polarized beforehand by an external electrostatic field directed along the same x axis.

The absorption of sound was measured by the pulse method. An oscillograph was used to record the amplitudes of the ultrasonic pulses passing through a Rochelle salt crystal. The pulse duration was 1.5 milliseconds and the oscillation frequency was 5 Mc.

Our experiments have shown that at temperatures above the Curie point, when the crystal loses its ferroelectric properties, absorption of sound is practically independent of the external field. At temperatures a few degrees below the Curie point, absorption of sound is weakly dependent on the external field. Specifically, a field of intensity ≈ 600 v/cm changes the sound absorption by only several percent. This is apparently due to the fact that the external field intensities away from the Curie point become small compared with the molecular field of the spontaneous polarization inside the crystal.

However, at temperatures 0.1° to 0.2° below the Curie point, the influence of the electrostatic field on the absorption of sound in the Rochelle salt is very large. At these temperatures placing the crystal in an external field of the intensity indicated increases the amplitude of the sound wave passing through this crystal by a factor of several times ten. Figure 1 shows two oscillograms of sound pulses passing through a Rochelle salt crystal at a temperature $T - \Theta_c \approx 0.2°$. The upper oscillogram corresponds to the passage of sound through an unpolarized crystal. It shows only the zero sweep line of the oscillograph, washed out by the noise. The sound signal is not noticeable at this temperature, owing to the strong absorption of sound at this temperature. The lower photograph shows an oscillogram of a sound pulse under the same conditions, but after passing through a crystal polarized by an external field. The amplitude of the pulse is increased by approximately 50 times.

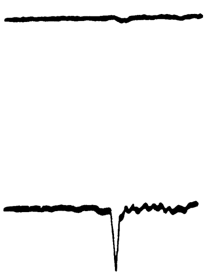

FIG. 1

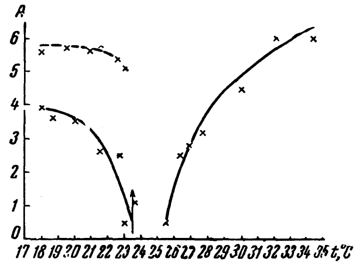

FIG. 2

The polarization of the crystal by an external field also affects substantially the temperature dependence of sound absorption below the Curie point. In the absence of an external field, in the temperature range from 23° to 19° C, the absorption of sound diminishes monotonically with cooling of the crystal, while in a crystal polarized by an external field near the Curie point, the absorption of sound becomes practically independent of the temperature. With this, the amplitude of the sound signal passing through the polarized crystal depends on the temperature at which the external field was applied to the crystal. Figure 2 shows typical plots of the temperature dependence of the amplitude of the signal passing through the Rochelle salt. The solid and dotted curves pertain to the unpolarized and polarized crystal respectively. The high temperature branches of both curves are identical. The arrow on the diagram shows the jump in intensity of sound signal as a result of the superposition of an external electrostatic on the crystal.

[1] Iakovlev, Velichkina, and Baranskii, J. Exptl. Theoret. Phys. (U.S.S.R.) 32, 935 (1957), Soviet Phys. JETP 5, 762 (1957).

Translated by J. G. Adashko
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CYCLOTRON RESONANCE IN TIN AT 9300 Mcs

P. A. BEZUGLYI and A. A. GALKIN

Institute for Technical Physics, Academy of Sciences, Ukrainian S.S.R.

Submitted to JETP editor June 29, 1957

J. Exptl. Theoret. Phys. (U.S.S.R.) 33, 1076-1078 (October, 1957)

AZBEL' and Kaner[1,2] showed that cyclotron resonance should take place in a magnetic field parallel to the surface of a metal provided that $\delta \ll r \ll \ell$ (δ is the skin-depth, r the radius of curvature of the electron orbit in the magnetic field, and ℓ the mean free path of the electrons). In contradistinction to diamagnetic resonance in semiconductors,[3] cyclotron resonance in metals takes place not only when the frequency of the external high frequency field ω coincides with the Larmor frequency Ω but also at