the ions and atoms. They use this model to calculate the cross section from the drift velocity near large fields and arrive at a value which is in poor agreement with the results of Ziegler (Ziegler attempted to improve the agreement by subtracting (without presenting a reason) the gas kinetic cross section from the actual cross section). Furthermore, this model is not entirely in agreement with the relation obtained by Ziegler between the total cross section and the cross section of overcharging. Recently Wannier[14] rejected this model, and recognized that the model of pure overcharging is actually better. However, the cross section of overcharging calculated by him from the drift velocity in large fields [with the help of Eq. (1)] is not correct, apparently due to an error in conversion. The cross sections of overcharging calculated by the formula of Demkov[3] for He, Ne, A, Kr, Xe are equal respectively to 2.6, 3.0, 4.1, 4.6, and $5.3 \times 10^{-15} cm^2$. As is evident from the Table, agreement is best of all for He and Ne, and worse for A, Kr, and Xe. This also explains certain divergences between the theoretical and experimental curves for the cross section of the drift velocity of ions in these gases given in reference 7. This divergence is, in our opinion, entirely attributable to the inaccuracy of Demkov's calculation. We note that the determination of the cross section of overcharging made by Sena[15] leads to still worse agreement with the experimental values of the cross section.

Gas	q_n[6]	q[6]	q[9, 10]	q[11]
He	—	4.1	2.6	3.6
Ne	5	4.4	3.15	4.2
A	9	5.5	6.5	7.5
Kr	—	9	7.6	9.2
Xe	13	10.3	9.3	11.3

The calculated mobilities of Massey and Mohr[1], and of Holstein[4] appear to be more accurate, but up to now calculations have only been made for small fields. They agreed well with results of experimental work[11].

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The Effect of Pressure on the Superconductivity of Cadmium

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(Submitted to JETP editor September 7, 1955)
J. Exper. Theoret. Phys. USSR **29**, 898-899
(December, 1955)

THE effect of pressure on the displacement of the critical temperature of a superconductor has been studied by many authors[1-7]. However, they studied only superconductors whose transition temperatures are above 1°K. It seemed interesting to study the effect of pressure on the properties of superconductors with low transition temperatures. Such a superconductor is cadmium, which goes into the superconducting state at 0.54°K. We measured the critical magnetic field vs. the temperature of samples of polycrystalline cadmium without pressure as well as with pressure.

To obtain temperatures in the interval between 0.06 - 0.6°K we used the method of adiabatic demagnetization of a paramagnetic salt. The pressure was obtained by freezing water in a bomb of fixed volume[8]. Heat contact between the bomb and the salt was realized by means of a thermal conductor K (Fig. 1), a copper rod, 2 mm in diameter and 50 mm long, one end of which is pressed into the salt, and the other is cadmium soldered to the plug of the bomb. To assure a reliable contact between the salt and the thermal conductor, thin copper sheets were hard soldered to the end of the thermal conductor and pressed into the salt[9]. The bomb for retaining the pressure was made of beryllium bronze. It had an outer diameter of 10 mm, an inner diameter of 5 mm and a length of 80 mm. To seal the bomb plug a washer of annealed copper was used. The sample was prepared from 99.95% pure cadmium and was in the form of a rod 3 mm in diameter and 20 mm long. To be sure that the sample O makes reliable thermal contact with the salt, we soldered it to a small piece of copper wire, 0.5 mm in diameter, which in turn was soldered to the inside of the bomb roof. The solder was pure cadmium. A drawing of the apparatus is shown in Fig. 1. We obtained thermal contact between the salt and the liquid helium by admitting a small quantity of gaseous helium into space A through tube B. This helium after demagnetization is adsorbed by the salt F and in this way the thermal contact between the salt and the liquid helium is broken. The demagnetization was done at a field of 15,000 oersteds and an initial temperature of 1.6 °K. The salt used was iron ammonium alum. After the demagnetization the temperature obtained was of the order of 0.05-0.06

The subsequent warm-up to a temperature of 0.6°K took 4-5 hours. The salt temperature was measured as in former experiments[9] by the displacement of coil D, which is connected to the ballistic galvanometer. To determine the critical field of cadmium, the magnetic moment of the sample was measured by means of another coil E, which can also be connected to the ballistic galvanometer. The magnetic field was produced by a solenoid wound around the helium dewar. The detetmination of the pressure in the bomb, C, was derived from the displacement of the superconductivity transition of indium[6].

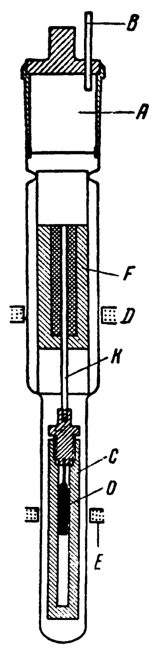

FIG. 1.

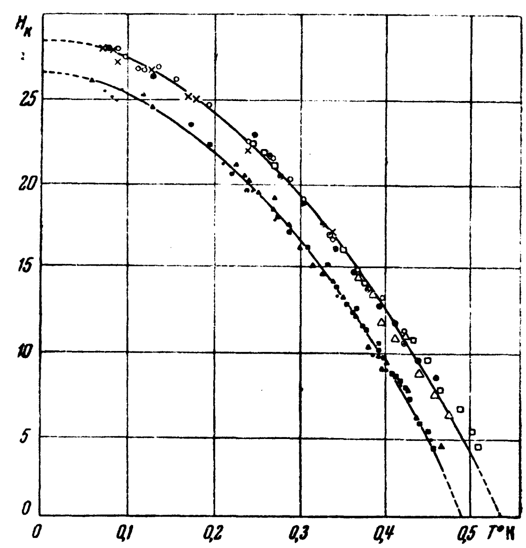

FIG. 2 Measurements 1954 - Without pressure: □-Nov. 26; ⊖-Nov. 11; Δ- Nov. 10; O-Nov.2; X-Nov.4. Under pressure: ▲-Nov. 3; ■-Oct. 22; ●-Oct. 28.

The results of the measurements obtained at $p = 0$ and $p = 1550$ atm are shown on Fig. 2. In these experiments the temperature of the sample was assumed to be the same as the temperature of the salt, the truth of which was ascertained in separate experiments. The curves we obtained for the critical fields fit the following formulas well:

$$(H_k/28.5) + (T/0.54)^2 - 1 \text{ for } p = 0$$

$$(H_k/26.5) + (T/0.495)^2 = 1 \text{ for } p = 1550 \pm 50 \text{ atm.}$$

H_k is shown as a function of T^2 on Fig. 3, indicating the accuracy of the derived equations. H_0 and T_k have the following values for cadmium:

at $p = 0$, $H_0 = 28.5$ oersteds, $T_k = 0.540$°K;

at $p = 1550$ atm, $H_0 = 26.5$ oersteds, $T_k = 0.495$.

Thus:

$$\partial T_k/\partial p = 3 \times 10^{-11}\text{°K dyne}^{-1}\text{ cm}^2$$

$$\partial H_0/\partial p = 1.27 \times 10^{-9}\text{oersteds dyne}^{-1}\text{cm}^2,$$

i.e., they have the same order of magnitude as for other superconductors [6,10]. Thus we note the change of T_k by a pressure ~1500 atm is 8.3%, i.e., slightly larger than the corresponding value for other superconductors.

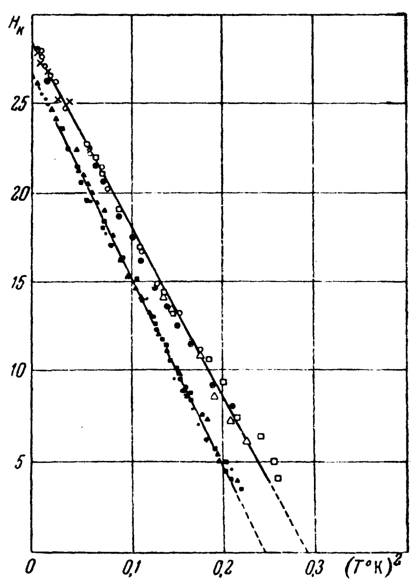

FIG. 3. Same meaning of symbols as in Fig. 2.

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Translated by S. D. Sydoriak
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The Quantum Theory of the Magnetostriction of Cubic Monocrystals of Ferromagnetics at Low Temperatures

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(Submitted to JETP editor November 10, 1954)
J. Exper. Theoret. Phys USSR 29, 895-897
(December, 1955)

IN an earlier paper[1] we presented a general method for the quantum treatment of the magnetostriction of ferromagnetic single crystals at low temperatures. The results were applied to crystals of hexagonal symmetry.

All the basic physical assumptions of the theory outlined in reference 1 are also valid for the cubic lattice. The special peculiarity of the latter is its much higher symmetry, which in particular, does not permit us to extend the theory of magnetic anisotropy, developed for hexagonal crystals, to cubic crystals.[2] In the case of magnetostriction, this difficulty arises to a significant degree, since the deformation of the lattice by the magnetic forces eliminates the symmetry and there is introduced into the Hamiltonian the operators of magnetoelastic interaction which are quadratic in the spin operators and linear in the components of the deformation tensor. This difficulty affects the consideration of the magneto-elastic anisotropy which appears in the phenomenon of magnetostriction.