in the region $\omega_p^2 < \omega_B^2$, $\Gamma/\gamma_\beta \ll 1$.

A detailed corroboration of our deductions will be published later [3].

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USE OF RUBY TO OBTAIN INFRALOW TEMPERATURES BY ADIABATIC DEMAGNETIZATION

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To obtain very low temperatures by adiabatic demagnetization, it is customary to use compounds containing ions of paramagnetic metals, such as iron and manganese alums, sulfates, nitrates, and others. It must be noted, however, that practically all the compounds presently used for demagnetization have many serious shortcomings: they decompose readily, they have relatively low thermal conductivity (especially when working with polycrystals), they are brittle, etc.

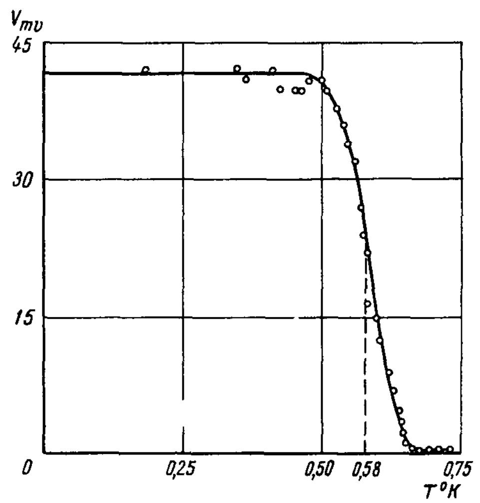
It is therefore natural to attempt to replace the presently-used salts with other magnetic systems. Suitable objects for this purpose are, for example, oxides with a small amount of paramagnetic ions added. These substances include, as is well known, ruby, which is an Al_2O_3 crystal in which chromium is dissolved in the form of Cr^{3+} ions.

The magnetic susceptibility of ruby single crystals was investigated in detail in [1,2]. Sevast'yanov and Baibakov [3] investigated the anisotropy of the magnetic susceptibility and its dependence on the concentration.

We used for the experiments a cylindrical ruby crystal whose axis was inclined $\approx 60°$ to the principal axis of the crystal. The chromium content was $\approx 0.5\%$. An electromagnet producing a field of ≈ 23 kOe was used in most measurements. The initial temperature when working with this apparatus was 1.4°K. A number of experiments were made also with apparatus in which the field was produced with a superconducting solenoid and amounted to 55 kOe at an inside diameter 37 mm.

We could not measure the magnetic temperature in the superconducting solenoid, because the residual field of the solenoid greatly influenced the measurement results. Therefore the internal Dewar was lifted together with the ampoule after the demagnetization in such a way that the ampoule was raised approximately 200 mm above the solenoid during the measurement. The measurements were made both with ampoules from which the heat-exchange helium was pumped out by a sorption pump, and with permanently filled ampoules, similar to those used by Alekseevskii and Migunov [4]. In the latter case the ampoule, whose volume was ≈ 15 cm^3, was filled at room temperature with helium gas to a pressure ≈ 20 mm Hg. The susceptibility of several ruby samples was estimated by a ballistic method. The data obtained agree with those of [1,2].

We determined the transition temperatures of Cd films evaporated at helium temperatures on one of the polished faces of the ruby. The figure shows one such transition curve, obtained for a cadmium film 1.46×10^{-5} cm thick. When plotting this curve, the earth's field was compensated for with a system of Helmholz coils and did not exceed 0.01 kOe. The transition curves were measured by an induction method similar to that described earlier [5].



We can conclude from the results that in spite of having a magnetic susceptibility lower than paramagnetic salts, ruby is perfectly suitable for use in adiabatic-demagnetization apparatus for the production of infralow temperatures. It is best to use here a superconducting solenoid producing a field ≈ 50 kOe, and then the final temperature T_f can reach ≈ 0.05°K, which is quite adequate for many experimental applications.

Since the Curie point of ruby may be quite low, it can be used in many cases as the second stage in a two-stage adiabatic-demagnetization apparatus. Ruby can also be used in cyclic installations, and then the use of superconducting switches may be more convenient than in installations with paramagnetic salts. Ruby is especially convenient for the investigation of thin films of metals and semiconductors at infralow temperatures, since its surface can be polished to a high degree, and the crystal itself has a high thermal conductivity.

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