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SUPERCONDUCTIVITY OF La_3Te_4

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The Americans have recently reported that the chalcogenides of lanthanum, La_3Se_4 and La_3S_4, turn into superconductors below 8.6 and 6.5°K respectively [1]. The superconductivity of La_3S_4 was also reported in another brief note [2].

We show in this paper that the third member of this group of chalcogenides, La_3Te_4, is also a superconductor of the second kind, and that the superconducting-transition temperature of this substance depends on the technology of its preparation and is possibly connected with some deviation of the composition from stoichiometry.

Lanthanum telluride La_3Te_4 was synthesized from 99.5% pure lanthanum and tellurium purified by vacuum sublimation and zone melting. A detailed description of the synthesis procedure is given in [3].

We investigated two samples. The first (I) was pressed from previously fused material and annealed at 1450°C for 1.5 hours; the second sample (II) was obtained by melting in a molybdenum crucible. An x-ray diffraction phase analysis has shown that the samples are single-phase and have a structure of the Th_3P_4 type (a = 9.619 Å). The experimental temperature dependence of the resistivity of the investigated La_3Te_4 samples, plotted in Fig. 1, indicates that at current density 0.4 A/cm² the transition temperature T_{cr} is 2.45°K for sample I and 3.75°K for sample II. The width of the temperature region of these transitions is $\Delta T \approx 0.1$°K.

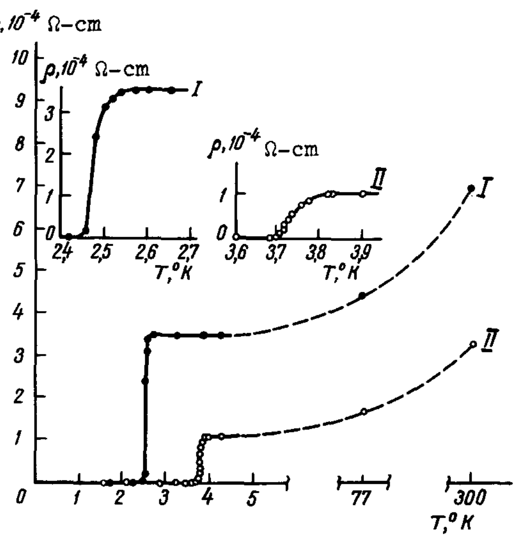

Fig. 1. Temperature dependence of resistivity

The destruction of superconductivity by a transverse magnetic field at T = 1.4°K at the same current density is illustrated in Fig. 2, from which it is seen that the critical fields (H_{c2}) at which normal resistance is restored are 8 and 12.5 kOe for samples I and II respectively.

The magnetic properties of La_3Te_4 were investigated in a homogeneous constant field by comparing the ballistic deflections produced by succesively introducing into the induction coil the investigated samples and a standard pure-lead sample of the same size (6 x 6 x 20 mm). The plots of

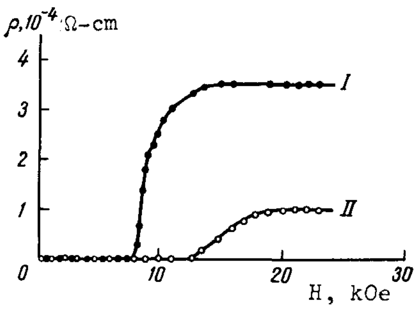

Fig. 2. Resistivity vs. transverse magnetic field intensity at T = 1.4°K.

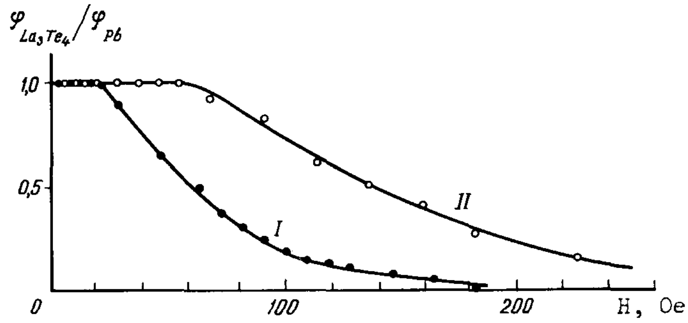

Fig. 3. Relative magnitude of the magnetic moment of La_3Te_4 (relative to lead) vs. longitudinal magnetic field intensity at T = 1.4°K.

the ratio of the deflection angle of the ballistic galvanometer, shown in Fig. 3, show that at 1.4°K the Meissner effect manifests itself in sample I in fields up to H_{c1} = 20 Oe, and in sample II in fields up to H_{c1} = 60 Oe.

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MEASUREMENT OF THE DISTANCE TO THE MOON BY OPTICAL RADAR

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Optical ranging of celestial bodies can be used for purposes of astrometry. We describe below experience in measuring the distance to the surface of the moon with the aid of optical radar. The work constituted one stage in a series of measurements (see [1]) aimed ultimately at determining the parameters of the moon's orbit and figure as well as other astrometric constants, using eventually artificial light reflectors placed on the moon [2]. We therefore undertook, in addition to the main purpose - also the development of apparatus and a procedure.

The experimental set-up is shown in Fig. 1. A ruby laser 1 and a photomultiplier 2, which receives the light signal reflected from the moon, are installed in a fixed position at the Coude focus of telescope 3. A tuned interference filter 4 is placed in front of the photomultiplier cathode. The diaphragm 5 determines the field of view of the receiving part. An automatically tilting mirror 6 is used to switch the apparatus from transmission to reception. The pulses from the photomultiplier are shaped and amplified in block 7. The time