In all investigations concerning pressure influence on supercondu[…] main attention is given to the change of the critical temperature T_c and […] magnetic field H_c [3]. In [4] it was considered that $2\,\Delta/kT_c$ does not c[…] with pressure.

One of the direct experimental methods for the study of the energy ga[…] superconductors is the electron tunnelling technique. Possibilities of […] finest instrument allowed to find out a change of $2\,\Delta/kT_c$ with pressure at […] for Pb [5] and then less for Sn [6].

This paper presents results on tunnelling investigations of the energy gap […] In and Tl under pressure.

2. Experimental Technique

2.1 Samples

As is known [7] the best gaps can be obtained on superconductor–barr[…] superconductor tunnel systems. This made superconducting diodes useful […] investigations under pressure. Of all systems investigated the best are p[…] prepared on Al base, i.e. an Al–Al_2O_3 superconductor.

Al–I–In and Al–I–Tl samples were prepared by deposition in high (1×10^{-6} T[…] vacuum on a cooled (up to 80 to 100 °K) glass slide 4×16 mm². There w[…] three junctions on one slide, each $1_{Al}\times0.5_{In,\,Tl}$ mm² (Fig. 1). To avoid e[…] effects films were deposited through stencils supported by an electromag[…] Junction quality in the sense of fitness for their use in pressure measurem[…] much depended on condensation and oxidation conditions of the Al fi[…] Aluminium was sprayed from a tungsten U-vaporizer. During deposition t[…] vacuum did not become worse due to preliminary long annealing (up to vacuum restoration) of the vaporizer and the hinge. Oxidation took place in the atmo[…] phere of dry air at a pressure of 0.2 Torr for 5 min. Sample preparation wa[…] controlled by film and junction resistance measurements both during depositi[…] and subsequent heating up to room temperatures. Junctions with resistan[…] 50 to 100 Ω were chosen. Al–I–Tl samples were covered with Si monoxide o[…] about 1 μm thickness. In and Tl film thickness was determined by Linnik […] microinterferometer MII-4 and was equal to (1000 ± 100) Å. For Tl films $\frac{R_{300}}{R_{4.2}}$ = 14 to 18.

Al films had resistivities of 4000 to 6400 Ω mm², and their initial critical temperature varied from 1.65 to 2 °K.

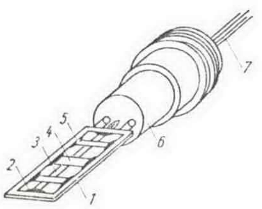

Fig. 1. Tunnel sample and obturator. 1 Sample holder made of getinax, 2 indium contacts, 3 Al film, 4 In and Tl films, 5 cover glass, 6 obturator, 7 electrical wires

2.2 High pressure technique

[…]igh pressure bomb with kerosene–oil mixture [8] was used in all investi[…]s. Pressure was created at room temperature and controlled by a hydraulic […]ure manometer. Here an almost linear change of tunnel junction resistance […] for $R(0) = 100\ \Omega$, $dR/dp = 6\ \Omega$/katm) was a reliable indication. Sensiti[…] of junction resistance to pressures gave the possibility of rejecting samples […]e immersing into liquid helium. The final pressure in the bomb at low […]peratures was calculated from T_c changes of an In wire [9]:

$$T_c = 4.36\times10^{-5}\,p + 5.2\times10^{-10}\,p^2.$$

[…] electrical conductors were introduced into the obturator, this allowed mea[…]surements to be carried out simultaneously, by means of a 4-probe system, […] the critical temperature of films, the In wire, and corresponding tunnel […]aracteristics.

2.3 Cryogenics and measuring apparatus

Low temperature measurements were carried out in a metal cryostat where […] was possible to get temperatures from 4.2 to 1.15 °K. The bomb with samples […] in liquid helium.

During the experiments the voltage–current characteristic was measured both […] constant voltage and constant current conditions. Depending on the con[…]ion dI/dU or (dU/dI)–U at a modulation frequency of 383 Hz were plotted. All tunnel characteristics were recorded automatically on a X–Y coordinate […]PP-09-type register. Constant voltage at a sample was measured by a high-[…]onic potentiometer to within ≈ 1 μV during recording.

3. Results and Discussion

Indium: After preparation Al–I–In samples were annealed for some days […] room temperature. The critical temperature of In films practically did not […]ffer from T_c for massive pure indium. The halfwidth of the superconducting […]nction did not exceed 0.01 °K for all pressures. Table 1 gives the change of […]itical temperature for the film which is found to be

$$\frac{dT_c}{dp} = -\,(3.65 \pm 0.15)\times10^{-5}\,\frac{°K}{atm},$$

Table 1

T_c and $2\,\Delta$ of indium under pressure

p (katm)	T_c (∓0.01 °K)	$t = \frac{T}{T_c}$	$2\,\Delta(p,t)$ (∓0.01 meV)	$2\,\Delta/kT_c$ c (p,t)	$2\,\Delta(p,0)$ (meV)	$2\,\Delta/kT_c$ $(p,0)$
0	3.42	0.342	1.090	3.69	1.09	3.69
5	3.23	0.36	1.01	3.63	1.02	3.66
7	3.15	0.372	0.982	3.62	0.99	3.64
7.9	3.13	0.374	0.974	3.61	0.98	3.64
10.5	3.03	0.387	0.930	3.57	0.94	3.60
14	2.91	0.4	0.880	3.51	0.89	3.55