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 [...] with pressure.

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

This paper presents results on tunnelling investigations of the energy ga[...] 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 electromagn[...] Junction quality in the sense of fitness for their use in pressure measureme[...] 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 vacuu[...] 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 deposit[...] and subsequent heating up to room temperatures. Junctions with resista[...] 50 to 100 Ω were chosen. Al–I–Tl samples were covered with Si monoxide [...] 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 film[...] $\frac{R_{300}}{R_{4.2}} = 14$ to 18.

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

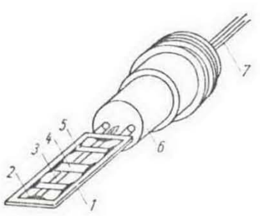

Fig. 1. Tunnel sample and obturator. 1 Sample holder made [...] getinax, 2 indium contacts, 3 Al film, 4 In and Tl films, 5 co[...] glass, 6 obturator, 7 electrical wires

2.2 High pressure technique

[...]igh pressure bomb with kerosene–oil mixture [8] was used in all investi[...]. 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 [...]re 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[...]tion 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-[...]mic potentiometer to within $\approx 1\ \mu$V 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 [...]ter 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 [...]ritical 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 ($\mp$ 0.01 °K)	$t = \frac{T}{T_c}$	$2\,\Delta(p, t)$ ($\mp$ 0.01 meV)	$2\,\Delta/kT_c$ (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