

SOV/56-37-2-9/56

Investigation of the Influence of a Unilateral Compression Upon the Quantum Oscillation of the Magnetic Susceptibility of Bismuth

value the quantity  $E_0/\beta \sim S_m$  was determined ( $S_m$  is the extreme cross section of the Fermi surface with the plane that is perpendicular to the  $\vec{H}$ -direction,  $E_0$  - Fermi boundary energy,  $\beta$  - Bohr's magneton) for certain angles  $\Psi$  between  $\vec{H}$  and the binary crystal axis. Figure 2 shows  $E_0/\beta = f(\Psi)$ ,  $E_0/\beta$  for un-compressed samples agrees well with the theoretical value calculated according to Landau's formulas. In the case of unilateral compression the oscillation frequency decreases. Figure 3 shows the dependence of the relative variation of the oscillation frequency on the amount of pressure applied.  $\Delta(E_0/\beta)$ , in the case of compression along the trigonal axis, is anomalously high. At  $350 \text{ kg/cm}^2$  the decrease of  $E_0/\beta$  corresponds to such in the case of a universal compression with a pressure of about 1000 at. The results are briefly discussed on the basis of the semiphenomenological theory by Kosevich. The authors thank Professor A. I. Shal'nikov for his interest in this

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SOV/56-37-2-9/56  
Investigation of the Influence of a Unilateral Compression Upon the Quantum  
Oscillation of the Magnetic Susceptibility of Bismuth

work. There are 3 figures and 9 references, 8 of which are  
Soviet.

ASSOCIATION: Moskovskiy gosudarstvennyy universitet (Moscow State University)

SUBMITTED: March 13, 1959

Card 3/3

24(3),24(8)

AUTHORS: Brandt, N. B., Dubrovskaya, A. Ye., SOV/56-37-2-46/56  
Kytin, G. A.

TITLE: An Investigation of the Quantum Oscillations of the Magnetic Susceptibility of Bismuth at Very Low Temperatures

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1959, Vol 37, Nr 2(8), pp 572-575 (USSR)

ABSTRACT: The authors developed a method for the measurement of the anisotropy of the magnetic susceptibility of metals and semiconductors at very low temperatures. These measurements also prove to be interesting in themselves, as no investigations of the magnetic susceptibility of metals and semiconductors have hitherto come to the knowledge of the authors. In a figure the schematic design of the apparatus, which consists mainly of a torsion balance, is shown and is briefly discussed. The measurements were carried out on monocrystalline cylindrical (3.6 mm diameter and 7-8 mm length) bismuth samples produced from "Khil'ger" type bismuth which had been previously purified by a recrystallization in vacuum repeated thirty times. For the measurements the trigonal or binary axis, respectively, were arranged perpendicular or parallel

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with the axis of suspension of the torsion balance. At very low temperatures clearly distinguishable high-frequency oscillations occur in the curves of the low-frequency oscillations of the magnetic susceptibility. In a diagram the torque  $\Delta$  versus  $H$  function is shown for one of the angles  $\psi$  between the directions of  $\vec{H}$  and the trigonal axis of the sample. The oscillation frequency of the magnetic susceptibility (or also of  $\Delta$ ) varies under a change of  $H$  as the area of the corresponding extremal section  $S_m$  of the Fermi surface with the surface perpendicular to  $\vec{H}$ . The angular dependence of  $S_m$  for the new oscillations is given in another diagram. These oscillations can obviously be classed with a group of holes, the Fermi surface of which is a surface of revolution oblate in the direction of the trigonal axis. The high-frequency oscillations detected in the angle interval  $105^\circ > \psi > 75^\circ$  very probably belong to another group of current carriers. The authors express their gratitude to A. M. Kosevich for discussing the results, to A. I. Shal'nikov for his constant

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An Investigation of the Quantum Oscillations of the      SOV/56-37-2-46/56  
Magnetic Susceptibility of Bismuth at Very Low Temperatures

interest in this work, and to M. V. Volkova for her  
assistance in carrying out measurements. There are  
3 figures and 10 references, 4 of which are Soviet.

ASSOCIATION:    Moskovskiy gosudarstvennyy universitet (Moscow State  
University)

SUBMITTED:      May 14, 1959

Card 3/3

82904

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S/120/60/000/02/035/052  
E032/E314

AUTHOR: Brandt, N.B.

TITLE: Production of Ultrahigh Pressures<sup>21</sup> at Low Temperatures<sup>21</sup>

PERIODICAL: Pribory i tekhnika eksperimenta, 1960, No 2,  
pp 131 - 133 (USSR)

ABSTRACT: The principle of the method is as follows (Figure 1). Consider a cylindrical specimen 1, placed in the rigid container 2 and kept in position by the piston 3. It is assumed that a thin layer of an ideal lubricant is deposited on the surface of the specimen so that tangential stresses are absent. When the specimen is compressed by the piston 3, the elastic deformation of the specimen leads to the appearance of stresses which are perpendicular to its surfaces. If the specimen and the holder are made slightly conical, then the load on the curved surface can be increased relative to the load on the flat surface. If the external load P is increased further, the load on the curved surface will increase

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Production of Ultrahigh Pressures at Low Temperatures

more rapidly than the load on the flat surfaces until the two become equal. When this happens, the compression is all-sided. In practice, a layer of graphite 50  $\mu$  thick was used as the lubricant. Two types of multiplier were employed and are shown in Figure 2. The first type was designed for pressures of 16 - 18 katm (Figure 2a) and does not involve external support. The second variant (Figure 2b) was designed for pressures up to 20 - 23 katm. This multiplier incorporates external support, as shown. The pressure in the wide channel of the multiplier was produced by freezing water solutions of ethyl alcohol (Brandt and Tomashchik - Ref 2). In order to test the work of the multipliers a study was made of

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Production of Ultrahigh Pressures at Low Temperatures

the effect of all-sided pressure on the critical temperature of tin. A monocrystal of tin, 3 mm in diameter and 5 - 8 mm long, was inserted into the narrow channel of the multiplier and the lower support 7 was screwed in as far as possible. Then, the piston was tightly pressed against the specimen and the wide channel of the multiplier was filled with the alcohol solution of the required concentration. The insert 4 was then placed in position and the assembled multiplier was placed inside a helium dewar. The outer dewar was filled with liquid nitrogen and the instrument was slowly cooled down. The transition of the specimen into the superconducting state was measured by measuring the mutual inductance between two coils, one of which surrounded the multiplier. Figure 3 shows the transition of the tin specimen into the superconducting state at Card 3/45 katm and 7.4 katm. It is intended to use the



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Production of Ultrahigh Pressures at Low Temperatures

device to investigate the effect of all-sided  
compression on quantum oscillations in the magnetic  
permeability of bismuth at low temperatures.

Acknowledgment is made to A.I. Shal'nikov,  
N.I. Ginzburg and G. Kytin for assistance in the  
present work.

ASSOCIATION: Fizicheskiy fakul'tet MGU (Physics Department  
of Moscow State University)

SUBMITTED: January 30, 1959



Card 4/4

BRANDT, N.B.

91996

24.7000

S/120/60/000/03/033/055  
E030/E535

AUTHOR: Brandt, N.B.

TITLE: An Apparatus for the Investigation of the Anisotropy of the Magnetic Susceptibility of Metals at very Low Temperatures ↑

PERIODICAL: Pribory i tekhnika eksperimenta, 1960, No 3, pp 114-118

ABSTRACT: An apparatus is described for measuring the anisotropy of the magnetic susceptibility of metals and semi-conductors at temperatures from 0.07 to 0.3°K. A sketch of the apparatus is shown in Fig 1. Using adiabatic demagnetization of ferric ammonium alum for cooling, warm-up times of 60 to 70 mins are obtained from 0.065°K to 0.1°K. In single crystal specimens of bismuth, new high frequency quantum oscillations of the magnetic susceptibility have been discovered between 0.07 and 0.1°K, which have not been observed in the liquid helium region. It is suggested that these oscillations are associated with a group of "holes".

Card 1/2 These have as their Fermi surface a figure of revolution

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An Apparatus for the Investigation of the Anisotropy of the  
Magnetic Susceptibility of Metals at very Low Temperatures

like an ellipsoid with an extended trigonal axis, with a boundary energy of  $2.5 \times 10^{-14}$  ergs. Their concentration is  $3.5 \times 10^{17}$  per  $\text{cm}^3$ , and their effective masses are  $m_1 = m_2 \approx 0.05 m_0$ , and  $m_3 \approx 0.7 m_0$ ; where  $m_0$  is the free electron mass. Acknowledgments are expressed to A. I. Shal'nikov for his interest and advice and to G. A. Kytin and A. Ye. Dubrovskaya for carrying out the measurements.

ASSOCIATION: Fizicheskiy fakul'tet MGU (Physics Department,  
Moscow State University)

SUBMITTED: February 9, 1959

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Card 2/2

83175

S/056/60/039/002/012/044  
B006/B056

24.7900

AUTHORS: Brandt, N. B., Razumeyenko, M. V.TITLE: The Problem of the Effect of Impurities on the Energy  
Spectrum of Electrons in BismuthPERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1960,  
Vol. 39, No. 2(8), pp. 276 - 284

TEXT: The authors investigated the effect of lead impurities upon the quantum oscillations of magnetic susceptibility within the temperature range of 1.7 - 4.2°K and various orientations of the magnetic field with respect to the crystallographic (trigonal) axes of the samples. A total of nine samples was investigated (with 0, 0.012, 0.02, 0.025, 0.03, and 0.037 wt% of Pb). The trigonal axis was perpendicular and the binary axis was parallel to the suspension pin of the weights. A bronze strip served for suspension. The measuring method is described in detail in the introduction. Fig. 1 shows some of the measured curves of the anisotropy of magnetic susceptibility  $\Delta\chi' = N/H^2 \sin\psi \cos\psi$  as functions of  $1/H$  at 1.65°K and two  $\psi$ -values near 0 and 90°. ( $\psi$  is the angle between

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The Problem of the Effect of Impurities  
on the Energy Spectrum of Electrons in  
Bismuth

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the trigonal axis and  $\vec{H}$ ). Fig. 2 shows the angular dependence of the oscillation frequency  $E_0/\beta_1 \sim S_m$  for pure Bi and Bi with 0.03% Pb. The solid curves were calculated from a formula by Landau. As may be seen from these diagrams, the angle of rotation of the ellipsoids of the Fermi surfaces round the binary axes is practically independent of an increase of the lead concentration to 0.03 wt%. ( $E_0$  denotes the Fermi energy,  $\beta_1$  - the effective mass function, and  $S_m$  - the extreme faces of intersection of the Fermi surface with the planes perpendicular to  $\vec{H}$ ).  $\Delta S_m/S_m$  as a function of the lead concentration is shown in Fig. 3. The oscillation amplitude rapidly decreases with growing lead concentration; the greatest amplitude decrease could be observed in the high-frequency range at angles near  $\psi = 0$ . This fact made it difficult to analyze the data obtained at lead concentrations of more than 0.04 wt%. The results obtained by the investigations are discussed in detail according to the individual effects. 1) The change in the shape of the Fermi surfaces for electrons. This shape is found to be nearly independent of the lead content up to concentrations of 0.035% Pb. 2) Change in the Fermi energy

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The Problem of the Effect of Impurities  
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of electrons. Fig. 4 shows  $\Delta E_0/E_0$  as a function of the lead concentration  $C$ .  $E_0$  decreases nonlinearly with increasing  $C$ . 3) Changes in the electron concentration  $n^e$ . Fig. 5 shows  $n^e(C)$ .  $n^e$  decreases practically linearly with increasing  $C$ . 4) Changes in the effective mass. Up to Pb-concentrations of 0.037%, the effective electron mass practically does not change. 5) Changes of the constant part of the anisotropy of magnetic susceptibility.  $\Delta\chi^e(C)$  shows, according to experiments, an increase with increasing  $C$ ; theoretically, however, a decrease occurs (cf. curves 1 and 2 in Fig. 6). This shows that the change in the anisotropy of the magnetic susceptibility of Bi occurring with  $C$  cannot be explained by changes in the electron- and hole-parameters. It may, on the other hand, be satisfactorily explained by Adam's theory (Ref. 3), who assumes that the bismuth valency band is strongly diamagnetic (cf. also Heine, Ref.2). The authors finally thank A. I. Shal'nikov for his interest, M. I. Kaganov for discussions, and G. A. Kytin for his assistance in the experiments. There are 7 figures and 11 references: 5 Soviet, 4 British, and 2 US.

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The Problem of the Effect of Impurities  
on the Energy Spectrum of Electrons in  
Bismuth

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ASSOCIATION: Moskovskiy gosudarstvennyy universitet (Moscow State  
University)

SUBMITTED: March 31, 1960

Card 4/4

88427

S/056/60/039/006/014/063  
B006/B056

24.2140 (1072, 1158, 1160)

AUTHORS: Brandt, N. B., Ginzburg, N. I.

TITLE: Superconductivity of Crystalline Bismuth Modifications

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1960,  
Vol. 39, No. 6(12), pp. 1554-1556

TEXT: The authors investigated the superconductivity of the bismuth modifications Bi II and Bi III and the stability of these modifications at helium temperatures. Bi III was known as a superconductor ( $T_c = 7.25^{\circ}\text{K}$  at  $25,000 < p < 29,000$  atm); however, the critical temperature was not quite accurately known and was now determined with greater accuracy. Bi II was also found to be superconductive, the critical temperature was about  $T_c = 3.93^{\circ}\text{K}$  ( $p = 25,000$  atm).  $\partial T_c / \partial p$  amounted to about  $-3.5 \cdot 10^{-5}$  deg/atm for Bi II and was for Bi III negligibly small. For investigating the stability of the superconductive modifications, experiments were carried out in which a pressure was applied at room temperature, lifted, and again applied at helium temperature. The Bi II modification,

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Superconductivity of Crystalline Bismuth  
Modifications

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when pressure is lifted at helium temperature, changes completely into Bi I. Bi III, formed at compressions of a Bi-single crystal, when pressure is lifted at about  $\sim 2.2^{\circ}\text{K}$ , changes into the non-superconductive modification Bi I ( $p \approx 20,000 \text{ atm}$ ), i.e., the transition at helium temperatures is characterized by a strong hysteresis. Repeated compression of one and the same specimen leads to the appearance of a finely dispersed crystalline structure. In this case, the superconductive modification remains conserved when pressure is lifted and changes into the non-superconductive Bi I at  $6.5 - 7.5^{\circ}\text{K}$ . It may therefore be assumed that the superconductivity of films deposited by evaporation at helium temperature is connected with the formation of a crystalline modification analogous to Bi III. Nor is it excluded that carbon deposited by evaporation on a diamond base, crystallizes at helium temperature with diamond structure. The authors thank A. I. Shal'nikov and N. Ye. Alekseyevskiy for their interest and S. G. Obruchnikov for highly qualified mechanical work. There are 3 figures and 7 references: 3 Soviet, 2 British, and 2 US.

ASSOCIATION: Moskovskiy gosudarstvennyy universitet (Moscow State University)

SUBMITTED: July 8, 1960  
Card 2/2

24.2140 (1072, 1164, 1482)

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30789  
S/181/61/003/011/032/056  
B125/B138

AUTHORS: Brandt, N. B., and Ginzburg, N. I.

TITLE: Investigation of the crystalline modifications of bismuth and some problems of technique in obtaining high pressures at low temperatures

PERIODICAL: Fizika tverdogo tela, v. 3, no. 11, 1961, 3461-3472

TEXT: The authors worked out a technique for obtaining high, but very homogeneous, pressures up to 30,000-40,000 kg/cm at low temperatures down to 1.6°K. This technique, which is very similar to the Bridgeman method, is used to induce, and to investigate, the superconductivity properties of the crystalline modifications of BiII and Bi III. Unlike the Bridgeman method, the cylindrical sample 2 is here surrounded by a thin (~50 μ) layer of graphite lubricant. At low temperatures, the pressure acting on the piston 2 is created by a multiplier and by a press. With a multiplier high pressures can be created quickly and reliably at low temperatures, which is very useful for magnetic measurements of superconductors. With a press of the type developed by V. I. Khatkevich (Dokt. diss., Institut

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Investigation of the crystalline...

fizicheskikh problem AN SSSR, M. 1952) the load acting on the piston can be varied during the experiment. N. Ye. Alekseyevskiy is thanked for lending the press. The crystalline modifications of bismuth are shown in the phase diagram in Fig. 6. According to the measurements carried out on monocrystalline samples of bismuth of the Hilger-type (purity 99.998 %), the electrical resistivity decreased 160-200 times during cooling from 273 to 4.2°K. The trigonal axis of most of the samples coincided with their longitudinal axis. The results of the first series of experiments, in which pressure was created by a multiplier and the measurements were carried out at 20,000-29,000 kg/cm<sup>2</sup>, are shown in Figs. 7, 8, and 9. The superconductivity of the modification Bi II is an unexpected result of the experiments. In the second series of experiments the pressure was created by means of a mechanical press at room and liquid nitrogen temperatures. Results of these experiments are shown in Figs. 10, 11, 12. The results of the investigations of Bi I, Bi II, and Bi III indicate the strong influence of crystal structure and of the energy spectrum of the electrons upon superconductivity. Hysteresis is intensified by the cooling of the sample. As the number of cycles increases the volume of the Bi III phase being transformed into Bi I decreases. This transformation always occurs

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independently of the number of cycles at the same pressure of 21,000 kg/cm<sup>2</sup>.

The superconductivity properties of Bi III under 27,000 kg/cm<sup>2</sup> do not depend on the number of compression cycles. The Bi III modification can also exist in the absence of external pressure. At nitrogen temperature, the hysteresis of the Bi I → Bi III transition is weaker than at helium temperature. At room temperature, there is hardly any hysteresis. No new low-temperature modification different from Bi III seems to exist.

A. I. Shal'nikov is thanked for his interest in the present paper. There are 15 figures and 21 references: 9 Soviet and 12 non-Soviet. The three most recent references to English-language publications read as follows: L. D. Jennings, C. A. Swenson. Phys. Rev., 112, 31, 1958; D. H. Bowen, G. O. Jones. Proc. Roy. Soc., A254, no. 1279, 522, 1960; D. Pines. Phys. Rev., 109, 280, 1958.

ASSOCIATION: Moskovskiy gosudarstvennyy universitet im. M. V. Lomonosova  
(Moscow State University imeni M. V. Lomonosov) d

SUBMITTED: June 19, 1961

Card 3/β 3

BRANDT, N.B.; PONOMAREV, Ya.G.

Performance of a magnetic torsion balance. Prib. i tekh.eksp.  
6 no.6:114--117 N-D '61. (MIRA 14:11)

1. Fizicheskiy fakul'tet Moskovskogo gosudarstvennogo universiteta.  
(Magnetic balance)

26695  
S/056/61/041/005/010/038  
B109/B102

24.2200

AUTHORS:

Brandt, N. B., Shchekochikhina, V. V.

TITLE:

Effect of antimony impurities on the de Haas - van Alphen effect in bismuth

PERIODICAL:

Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 41, no. 5(11), 1961, 1412 - 1420

TEXT: The de Haas - van Alphen effect in Bi-Sb alloys with an Sb concentration of from 0 to 1% by weight has been studied at temperatures between 1.6 and 4.20K. Various orientations of the magnetic field relatively to the crystallographic axes of the specimens have been examined. The anisotropy of magnetic susceptibility  $\Delta\chi = N/H^2 \sin\psi \cos\psi$  as a function of  $1/H$  is shown in Fig. 2 (1) for a Bi specimen (purity 99.998%,  $\psi = -35^\circ$ ) and in Fig. 2 (5) for Bi with 1% by weight of Sb ( $\psi = -30^\circ$ ).  $\psi$  denotes the angle between the magnetic field vector and the trigonal axis of the specimens. Circles refer to  $T = 3.37^\circ\text{K}$ , dots to  $T = 1.685^\circ\text{K}$ . Fig. 4 shows the relative variation of the quantity  $\Delta S$  (of Landau formula, Shoenberg. Phil. Trans. Roy. Soc., A245, 1, 1952; Proc. Roy. Soc., 170,

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... S. Meiboom.

S/120/62/000/005/027/036  
E039/E420

AUTHORS: Brandt, N.B., Ginzburg, N.I.

TITLE: A method of investigating the pressure-temperature phase diagrams at low temperatures

PERIODICAL: Pribory i tekhnika eksperimenta, no.5, 1962, 161-164.

TEXT: Samples of bismuth and cerium (1.9 mm diameter and 3 to 4 mm long) are compressed between two pistons of steel or tungsten carbide inside a solid ring of beryllium bronze with an internal diameter of 2 mm and thickness 7 to 8 mm and an external diameter of 30 to 40 mm. The pressure is measured by means of ~~Sp~~-2 (BF-2) strain gauges mounted on the outside of the ring. A screw device is used to apply pressure to the pistons and the whole apparatus is mounted inside a double Dewar flask. Temperatures of 1.7 to 4.2°K are obtained using liquid helium and 60 to 77°K using liquid nitrogen. A pressure calibration is obtained using a superconducting tin manometer at liquid helium temperatures and, because the elastic constants of beryllium bronze change very little in the temperature range 4.2 to 300°K, the calibration at room temperature differs very little from that  
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A method of investigating ...

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E039/E420

at 4.2°K. The change in volume of the sample during compression and at a phase change is determined from the number of turns of the screw mechanism which moves the pistons. In order to check the method the pressure at which the phase change in cerium occurs was measured at temperatures of 373, 293 and 77°K and shown to agree well with the results obtained by other workers using a different method. The phase changes BiI to BiII and BiII to BiIII are also observed to occur at pressures of 25.3 and 27 k atm at 300°K which is in good agreement with the results of Bridgeman. In order to avoid hysteresis effects data should be obtained on the first compression cycle. The results obtained testify to the reliability of the method for obtaining phase diagrams at low temperatures and for pressures up to 39 k atm. There are 5 figures. ✓

ASSOCIATION: Fizicheskiy fakul'tet MGU (Physics Faculty MGU)

SUBMITTED: October 30, 1961

Card 2/2



S/120/62/000/006/028/029  
E032/E114

AUTHORS: Brandt, N.B., and Balla, D.

TITLE: Method of studying the effect of high pressures on  
the galvanomagnetic properties of metals at low  
temperatures

PERIODICAL: Pribory i tekhnika eksperimenta, no.6, 1962, 135-137

TEXT: The multiplier used in this method was described  
in previous papers (H.B. Brandt, PTE, no.2, 1960, 131; and  
H.B. Brandt, N.I. Ginzburg, Fiz. tv. tela, v.3, no.11, 1961, 3461).  
Fig.1 shows a modified form of the lower part of this  
multiplier which was used in the present experiments. The  
specimen 1 which was cylindrical in form (1.2 mm diameter,  
3 mm long) was pressed into a silver chloride pellet and was  
placed into a 3.5 mm diameter channel in the holder 2. Four  
cones 3 serve as electrical leads into the high pressure chamber.  
They have a maximum diameter of 1 mm, are covered with 4 - 5 layers  
of the polymerized adhesive BF-2 (BF-2) and are pressed into the  
conical apertures in the bush 4 at 160 °C. All the components  
of the multiplier are made from refined beryllium bronze with  
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Method of studying the effect of ...

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E032/E114

the exception of the lead packing 6 and the insert 7. The pressure in the upper part of the multiplier was produced by freezing a water solution of ethyl alcohol. The pressure in the working channel of 2 at liquid helium temperatures was determined by measuring the shift in the superconducting transition temperature in the tin ring 9 with the aid of the coils 10 and 11. The entire assembly is inserted into a dewar containing liquid helium. The apparatus has been used to measure the resistance of tin during the transition to the superconducting state at pressures up to about 18 katm. There are 3 figures.

ASSOCIATION: Fizicheskiy fakul'tet MGU  
(Physics Department, MGU)

SUBMITTED: March 1, 1962

Card 2/3

8/056/63/044/002/014/065  
B102/B186

AUTHORS: Brandt, N. B., Ginzburg, N. I.

TITLE: The critical fields in the crystalline modifications Bi II and Bi III

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 44, no. 2, 1963, 478-480

TEXT: The modifications Bi II and Bi III forming at room temperature under a pressure of 25 tons/cm<sup>2</sup> show superconductivity at  $T \leq T_{cr} = 3.916^{\circ}\text{K}$  (25 t/cm<sup>2</sup>) and  $T \leq T_{cr} \approx 7^{\circ}\text{K}$  (27-30 t/cm<sup>2</sup>). The critical fields ( $H_{cr}$ ) were measured for these modifications (purity 99.999%). Superconductivity was measured with constant temperature and slowly increasing field strength (Bi II), and with constant field strength and slowly increasing temperature (Bi III).  $H_{cr}$  was determined in the usual way by extrapolating the linear sections of the curves. The values obtained for transverse and longitudinal fields agreed within the experimental limits of error. From  
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B102/B186

The critical fields in the ...

the  $H_{cr}(T)$  curves it can be seen that Bi II is a "soft" superconductor whose critical-field curve resembles that of tin. Bi III is a "hard" one  $\left(\frac{\partial H_{cr}}{\partial T}\right)_{T=T_{cr}} \approx 2600 \text{ oe/deg}$ , this value being almost independent of

pressure in the interval 28-30 t/cm<sup>2</sup>. There are 3 figures.

ASSOCIATION: Moskovskiy gosudarstvenny universitet (Moscow State University)

SUBMITTED: September 11, 1962

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L 9877-63 EWT(1)/EWP(q)/EWT(m)/BDS/  
EEC(b)-2--AFPTC/ASD/ESD-3--GG/JD/IJP(C)/K

ACCESSION NR: AP3003115

S/0055/63/044/006/1876/1883

AUTHOR: Brandt, N. B.; Ginzburg, N. I.

TITLE: Study of the effect of high pressure on superconductivity in cadmium

SOURCE: Zhurnal eksper. i teor. fiziki, v. 44, no. 6, 1963, 1876-1883

TOPIC TAGS: superconductivity in cadmium, pressure-dependent superconductivity

ABSTRACT: The ratio of the critical temperature gradient to the pressure gradient in the critical field curve of cadmium is investigated within a wide range of pressures, furthering the investigations of N. Ye. Alexseyevskiy and Yu. P. Gaydukov (Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 29, 1955, p. 895), who found the ratio to be negative and its absolute value to be close to that of tin- and indium-type superconductors. Spectrally pure polycrystalline cadmium cylinders 2 to 3 mm in diameter and 2.5 to 3.4 mm long were tested. The effect of pressures up to 27,000 atm on the critical field curves and critical temperature for the superconductive transition in the 0.08 + or - 0.5K temperature range was investigated. A large relative change in critical temperature, about 80% at 26,400 atm, was obtained. The critical temperature changed 4.4 times within the pressure interval from zero to 26,400 atm. The investigation indicates the

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ACCESSION NR: AP3003115

possibility of transferring cadmium to the nonsuperconducting state at unchanged crystal modification. This possibility is analyzed to some extent. "In conclusion, we take the opportunity to thank V. L. Ginzburg for his discussion of the results, and A. I. Shal'nikov for his interest in the work." Orig. art. has: 5 figures and 1 table. G

ASSOCIATION: Moskovskiy gosudarstvennyy universitet (Moscow State University)

SUBMITTED: 13Feb63      DATE ACQ: 23Jul63      ENCL: 00

SUB CODE: 00      NO REF SOV: 004      OTHER: 010

*jin/dyk*  
Card 2/2

I 17606-63 EWT(1)/EPF(n)-2/EWP(q)/ S/056/63/044/003/011/053  
EWT(m)/BDS AFFTC/ASD/SSD Pu-4 WW/JD/JG 70  
AUTHOR: Brandt, N. B. and Ginzburg, N. I. 68  
TITLE: Effect of antimony and lead impurities on phase transitions 18  
in bismuth  
PERIODICAL: Zhurnal eksperimental'noy i tekhnicheskoy fiziki, v. 44, no. 3,  
1963, 848-851

TEXT: One of the authors investigated earlier, Ref. 1 (N. B. Brandt and M. V. Razumeyenko, ZhETF, 39, 276, 1960) and Ref. 2 (N. B. Brandt and V. V. Shchekochikhina, ZhETF, 41, 1412, 1961), the effect of Sb and Pb impurities on the energy spectrum of electrons in Bi and proceeded then with the study of effects these same impurities (0-2.5 wt.% of Bi, 0-1.2 wt.% of Pb) have on the pressure-temperature phase diagram of Bi. The phase transitions were investigated following a method described by the authors in an earlier paper (Ref. 3: PTE, 5, 161, 1962). It is found that with increase of the concentration the region of existence of the Bi II modification becomes narrower in the phase diagram and apparently disappears completely for Sb concentrations exceeding 0.8 wt. %.

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L 17606-63

S/056/63/044/003/011/053

2

Effect of antimony and lead impurities...

Pb impurities do not apprecisbly affect the nature of the phase diagram. A comparison with the energy spectrum effects shows that while Pb impurities cause strong changes in the electron part of the Fermi surface, they do not appreciably change the characteristics of the phase transition in the Pb phase diagram. The Sb impurities act exactly in an opposite fashion. Consequently, at helium temperatures the phase diagram is quite insensitive to the changes in the electron part of the Fermi surface and depends very much on the changes within the crystalline lattice, which prove to be more involved than the mere change in impurity concentration. There are 2 figures.

ASSOCIATION: Moskovskiy gosudarstvennyy universitet (Moscow State University)

SUBMITTED: October 4, 1962

Card 2/2



BRANDT, N.B.; DOLGOLENKO, T.F.; STUPOCHENKO, N.N.

Studying the de Haas-van Alphen effect in bismuth at ultralow  
temperatures. Zhur. eksp. i teor. fiz. 45 no.5:1319-1335 N '63.  
(MIRA 17:1)

1. Moskovskiy gosudarstvennyy universitet.

ACCESSION NR: AP4031141

S/0056/64/0046/004/1216/1219

AUTHORS: Brandt, N. B.; Ginzburg, N. I.

TITLE: Effect of high pressure on the superconducting properties of zirconium

SOURCE: Zh. eksper. i teor. fiz., v. 46, no. 4, 1964, 1216-1219

TOPIC TAGS: zirconium, superconductivity, critical temperature, critical field, pressure effect, hydrostatic compression effect, annealing effect

ABSTRACT: Earlier work on the effect of hydrostatic compression on the superconductivity (ZhETF v. 44, 1876, 1963) is extended from cadmium to zirconium. Pressures up to 24000 atm and a temperature range 0.08--0.8K were employed. Hydrostatic compression is shown to cause a considerable increase in the critical temperature, which reaches 70% at 24000 atm, and in the temperature gradient of the

Card 1/54

ACCESSION NR: AP4031141

critical field, amounting on the average to 20--25% as the pressure is changed from 0 to 20000 atm. Both annealed and unannealed samples were tested, and a stronger increase in the critical temperature was observed in annealed samples. The results are interpreted in light of the plastic deformation which can arise in the sample as a result of the method used in the experiment to produce high pressure. Results obtained with other metals and alloys are compared. "In conclusion we thank V. L. Ginzburg for a discussion of the results and N. N. Mikhaylov for graciously supplying the zirconium." Orig. art. has: 3 figures and 1 formula.

ASSOCIATION: Moskovskiy gosudarstvennyy universitet (Moscow State University)

SUBMITTED: 24Oct63

DATE ACQ: 07May64

ENCL: 03

SUB CODE: PH

NO REF SOV: 005

OTHER: 004

Card: 2/82

ACCESSION NR: AP4043616

S/0056/64/047/002/0455/0463

AUTHORS: Brandt, N. B.; Gaydukov, Yu. P.; Itsekevich, Ye. S.;  
Minina, N. Ya.

TITLE: Effect of pressure on the oscillation effects in bismuth

SOURCE: Zh. eksper. i teor. fiz., v. 47, no. 2, 1964, 455-463

TOPIC TAGS: bismuth, quantum statistics, resistance, magnetic susceptibility, low temperature phenomenon, high pressure research, Fermi surface

ABSTRACT: This is a sequel of an earlier study by two of the present authors (Gaydukov and Itskevich, ZhETF, v. 45, 71, 1963) on the effects of uniform compression on the quantum oscillations of the electric resistance (Shubnikov-deHaas effect) of zinc. The present study is devoted to the effective uniform compression on the quantum oscillations of the magnetic susceptibility (pressures

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ACCESSION NR: AP4043616

1300--1600 kg/cm<sup>2</sup>) and the electrical resistance (at 3000--7500 kg/cm<sup>2</sup>) in bismuth at liquid helium temperatures. The test procedure is described. In addition, the influence of pressure on the deHaas-van Alphen effect was investigated using a procedure described elsewhere (N. B. Brandt, Ya. G. Ponomarev, PTE, no. 6, 114, 1961). The influence of uniform compression on the quantum oscillations of the electric resistance was measured by a method of Ye. S. Itskevich (PTE, no. 4, 148, 1963). The results showed a decrease in the oscillation frequency, amounting to 37% at 7500 kg/cm<sup>2</sup>. The results are interpreted on the basis of a model wherein the Fermi surface of bismuth consists of one hole and three electron ellipsoids, and the test results on the two effects in bismuth are in good mutual agreement. An analysis of the influence of uniform compression on the Fermi surface shape and on other characteristics of bismuth at low temperatures is presented. The possibility that bismuth would go over into a dielectric state at low temperatures is discussed. "We thank L. F. Vereshchagin and A. I. Shal'nikov for

Card 2/4

ACCESSION NR: AP4043616

their interest in this work and V. A. Sukharov for help with the experiments." Orig. art. has: 6 figures and 1 table.

ASSOCIATION: Moskovskiy gosudarstvennyy universitet (Moscow State University); Institut fiziki vy\*sokikh davleniy Akademii nauk SSSR (Institute of Physics of High Pressures, Academy of Sciences SSSR)

SUBMITTED: 17Mar64

ENCL: 01

SUB CODE: SS

NR REF SOV: 014

OTHER: 006

Card 3/4

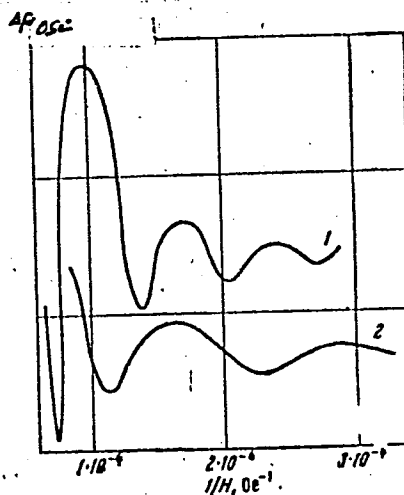
ACCESSION NR: AP4043616

ENCLOSURE: 01

Dependence of oscillating part  
of magnetoresistance on the  
reciprocal magnetic field in-  
tensity at 1.5K.

1 -  $p = 0$   
2 -  $p = 7500 \text{ kg/cm}^2$

Curves shifted vertically in  
arbitrary fashion



1. 17073-65 EWT(m)/EWA(d)/EWP(t)/EWP(k)/EWP(b) PF-4 IJP(c) JD/HW

ACCESSION NR: AP5000309

S/0056/64/047/005/1653/1663

AUTHOR: Balla, D.; Brandt, N. B.TITLE: Investigation of the effect of hydrostatic compression on the temperature dependence of the electric conductivity of bismuth

SOURCE: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 47, no. 5, 1964, 1653-1663

TOPIC TAGS: bismuth conductivity, bismuth carrier mobility, bismuth carrier concentration, pressurized bismuth

ABSTRACT: The conductivity of 99.9999%-pure bismuth single crystals was investigated under pressures up to 25,000 atm in directions along and perpendicular to the trigonal axis at temperatures between 4.2 and 300K. Temperatures below 4.1K were measured by helium-vapor tension and other temperatures, by carbon-thermometer and copper-constantan thermocouples. The measurements revealed that pressure had a marked effect on the resistivity, which normally drops uniformly with lowering temperature, increases considerably with higher pressure, and develops an upward hump at temperatures below 100K, with steepness increasingly pronounced at pressures above 10,000 atm and up to 20,000 atm. At higher pressures, a sharp upward jump is observed which

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L 17073-65

ACCESSION NR: AP5000309

retains its achieved level at temperatures approaching zero. This levelling-off takes place, for instance, at 2.3K under 24,000 atm pressure at a resistivity value 290 times higher than that observed after removal of the pressure. The effect is fully reversible, except in cases where the application of pressure differs from hydrostatic and causes plastic deformations of the crystal. In the latter case, a small residual effect was observed. It is concluded that bismuth will turn dielectric at about 26,000 atm pressure. It remains dielectric up to pressures of about 45,000 atm at which point bismuth changes to its superconductive modifications, Bi II and Bi III. The temperature dependence of carrier concentration was studied, and an attempt was made to separate the pressure effect on mobility from the combined effect on mobility and concentration. It is shown that at temperatures higher than the degeneration temperature, the carrier concentration follows the  $3/2$ -power law closely within the pressure interval up to 18,000 atm. At higher pressures, the dependence grows more pronounced and approaches the quadratic law at 25,000 atm. At temperatures lower than that of degeneration, the dependence is generally less pronounced and never reaches the quadratic law except perhaps at extremely low temperatures. The main mechanism responsible for the temperature dependence of carrier concentration above the degeneration point is the heat excitation of carriers resulting from the narrow overlap of energy levels. Orig. art. has: 10 figures.

Card 2/3

1. 17073-65

ACCESSION NR: AP5000309

ASSOCIATION: Moskovskiy gosudarstvennyy universitet (Moscow State University)

SUBMITTED: 16May63

ENCL: 00

SUB CODE: SS, EM

NO REF SOV: 014

OTHER: 006

ATD PRESS: 3149

Card 3/3

L 16091-65 EWT(1)/EPA(s)-2/EWT(m)/EWP(t)/EWP(b) Pt-10 IJP(c)/ESD(t)/  
ACCESSION NR: AP5000318 ESD(gs)/AFWL S/0056/64/047/005/1711/1716  
JD/GG

AUTHORS: Brandt, N. B.; Lyubutina, L. G.

TITLE: Investigation of the frequency modulation of quantum oscillations of the magnetic susceptibility of bismuth

SOURCE: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 47, no. 5, 1964, 1711-1716

TOPIC TAGS: bismuth, magnetic susceptibility, quantum oscillation, single crystal

ABSTRACT: The periodic variation of the oscillation frequency of the magnetic susceptibility of bismuth at very low temperatures as a function of the reciprocal magnetic field, observed earlier by one of the authors (Brandt with T. F. Dolgolenko and N. N. Stupochenko, ZhETF v. 45, 1319, 1963), was further investigated at three principal orientations of bismuth single crystals relative to the

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L 16091-65

ACCESSION NR: AP5000318

suspension axis of the torsion balance used. The temperature was 0.1°K, and the samples and procedure were the same as used in the previous study. The purpose was to investigate this effect in greater detail simultaneously on the hole and electron equal-energy surfaces, thus clarifying the nature of the effect. The tests have shown that variation in the frequency of the hole oscillations is opposite in phase to the variation of the frequency of the electron oscillations. For the electronic high frequency oscillations the effect is much weaker than for the hole oscillations. The periods of the frequency modulation correspond to the periods of the fundamental low-frequency oscillations observed at a given orientation of the magnetic field. Extrapolation into the region of larger fields results in an increase in the frequency of the electronic oscillations and a decrease in the frequency of the hole oscillations in the last period of the low-frequency oscillations. The model proposed by C. G. Grenier et al. (Phys. Rev. v. 132, 1, 1963) for the electron transitions between closed equal-energy sur-

Card 2/3

L 16091-65

ACCESSION NR: AP5000318

faces, occurring with variation of the magnetic field, is found to agree with the observed singularities in the frequency modulation. "In conclusion we thank A. I. ShaI'nikov for interest in the work." Orig. art. has: 4 figures.

ASSOCIATION: Moskovskiy gosudarstvenny\*y universitet (Moscow State University)

SUBMITTED: 04Jun64

ENCL: 00

SUB CODE: SS, EM

NR REF SOV: 002

OTHER: 002

Card 3/3

L 52968-65 EWT(1)/EPA(s)-2/EWT(m)/EWP(w)/EWA(d)/EEC(t)/T/EWP(t)/EWP(b)

Pt-7/P1-4 IJP(c) JD/CG

ACCESSION NR: AP5010524

UR/0056/65/048/004/1206/1209

32  
30  
B

AUTHOR: Azbel<sup>1</sup>, M. Ya.; Brandt, N. B.

TITLE: Transformation of a metal into a dielectric and singularities of electronic characteristics of metals in strong magnetic fields

SOURCE: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 48, no. 4, 1965, 1206-1209

TOPIC TAGS: carrier density, metal dielectric transformation, magnetic field effect, thermodynamic potential, chemical potential

ABSTRACT: The authors calculate the shift in the boundaries of the energy bands in a metal, necessary for this metal to turn into a dielectric. The feasibility of such a shift with the aid of a constant magnetic field is illustrated using as an example electrons with a quadratic dispersion law. For anomalously minimal bands and for metals of the bismuth type, the required field is of the order of  $10^5$ -- $10^6$  Oe. The dependence of various electronic characteristics on the magnetic field is analyzed. This includes the conductivity and the thermodynamic and chemical potentials. It is shown that at the value of the field at which the edges of the bands come in contact, the thermodynamic potentials and their derivatives remain constant

Contd 3/2

L 52968-65

ACCESSION NR: AP5010524

(except for the derivatives with respect to the magnetic field). The magnetic moment has the same singularities and the same character of dependence on the magnetic field as the conductivity. At 0°K the magnetic susceptibility experiences an infinite jump at  $H = H_0$ . Similar singularities result when the chemical potential assumes values of the energy that are singular for the given band (at which a new equal-energy surface appears, at which a transition takes place from the open surfaces to the closed ones and vice-versa, etc.). It is shown also that variation of the chemical potential in the magnetic field can be used to investigate the dispersion law and its singularities over a wide range of energies. Orig. art. has: 2 figures and 3 formulas.

ASSOCIATION: Moskovskiy gosudarstvennyy universitet (Moscow State University)

SUBMITTED: 23Jan65

ENCL: 00

SUB CODE: SS

MR REF SOV: 009

OTHER: 002

gal  
668-2/E

L 6223D-65 EPA(s)-2/EWA(h)/EWP(k)/EWA(c)/EWT(l)/EWT(m)/EWP(b)/EWA(d)/EWP(t) IJP(c)

ACCESSION NR: AP5019219

CG/JD/HW/JG

UR/0056/65/049/001/0085/0089

AUTHOR: Brandt, N. B.; Ginzburg, N. I.; Ignat'yeva, T. A.; Lazarev, B. G.; Lazareva, L. S.; Makarov, V. I.

44  
42  
5

TITLE: Influence of impurities on the pressure effect in thallium 27

SOURCE: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 49, no. 1, 1965, 85-89

TOPIC TAGS: thallium, mercury, mercury impurity, impurity effect, pressure effect, Fermi surface, high pressure research

ABSTRACT: This is a continuation of an earlier study (ZhETF v. 48, 1065, 1965) of the influence of impurities on the superconducting transition temperature of thallium under pressure. In the present study, to check on some of the hypotheses advanced in the earlier paper, the authors extended the pressure range to 28,000 atm, and measured the pressure effect in both pure and mercury-bearing thallium, using the same thallium-mercury alloys as in the earlier work. Cylindrical samples of 2.5 mm diameter and 3-4 mm length were used, and the superconducting transition was measured with a tin manometer and recorded by an induction method. The apparatus and procedure employed were the same as described in detail elsewhere (PTE no. 2, 131, 1960; FTT v. 3, 3461, 1961), apart from slight modifications. It was

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I-62230-65

ACCESSION NR: AP5019219

2

found that at high pressures (20,000—28,000 atm) the dependence of the transition temperature ( $T_c$ ) on the pressure (P) was similar for the mercury-bearing and pure thallium, but different at low pressures (up to approximately 7000 atm), with the sign of the effect reversing at a concentration ~ 0.9% Th. It is suggested that this behavior of thallium and its alloys is related to the characteristic features of the pressure dependence of the density of states on the Fermi surface. In particular, the results confirm hypotheses advanced in the earlier paper, that thallium has two components in the pressure dependence of  $T_c$ , linear and nonlinear, and that the impurity content affects mainly the nonlinear component. It is possible that the impurity dependence affects the Fermi-surface topology of thallium. Orig. art. has: 3 figures. [02]

ASSOCIATION: Moskovskiy gosudarstvennyy universitet (Moscow State University); Fiziko-tekhnicheskiy institut Akademii nauk UkrSSR (Physicotechnical Institute, Academy of Sciences, UkrSSR)

SUBMITTED: 05Feb65

ENCL: 00

SUB CODE: AA,SS

NO REF SOV: 005

OTHER: 002

ATD PRESS: 40 75

Card 2/2

L 3467-66 EWT(1)/EPA(s)-2/ENT(m)/ENP(w)/EPF(n)-2/T/ENP(t)/ENP(b)/EWA(h)/EWA(c)  
ACCESSION NR: IJP(c) JD/WJ/JG/GG AP5009069 UR/0053/65/085/003/0485/0521

AUTHOR: Brandt, N. B.; Ginzburg, N. I. 544

TITLE: Effect of high pressure on the superconducting properties of metals 21.44.55 77 66 B

SOURCE: Uspekhi fizicheskikh nauk, v. 85, no. 3, 1965, 485-521

TOPIC TAGS: superconductivity, pressure effect, hydrostatic pressure, high pressure, metal physical property

ABSTRACT: This is a review paper dealing with the advances made in the study of the superconducting properties of metals at high pressures, and particularly the developments not treated in a 1960 review paper by C. A. Swenson. The sections heading are: I. Introduction. II. Methods of obtaining high pressures at low temperatures. 1. Production of "frozen-in" pressures using an intermediate medium. 2. Production of "frozen-in" pressures without the use of a transmitting medium, 3. Production of pressures directly at low temperatures using an intermediate medium. 4. Production of pressures directly at low temperatures without an in-

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Lr 3467-66

ACCESSION NR: AP5009069

intermediate medium, III. Effect of pressure on the properties of superconductors,  
1. Tin and indium, 2. Tantalum, 3. Mercury, 4. Thallium, 5. Cadmium, 6.  
7. Aluminum, 7. Zirconium and titanium, 8. Alloys, 9. Superconductivity of  
crystalline modification. 10. Investigation of the stability of superconducting  
modifications. IV. Influence of pressure and microscopic theory of supercon-  
ductivity, V. Some remarks on the prospects of further research, Orig. art. has:  
38 figures, 18 formulas, and 2 tables.

ASSOCIATION: None

SUBMITTED: 00

ENCL: 00

SUB CODE: GP

NR REF SOV: 030

OTHER:052

Card

2/2

AP

BRANDT, N.B.; GINZBURG, N.I.

Effect of hydrostatic pressure and plastic deformation on the  
superconducting properties of titanium. Zhur.eksp. i teor.fiz.  
49 no.6:1706-1714 D '65. (MIRA 19:1)

1. Moskovskiy gosudarstvennyy universitet. Submitted June 16,  
1965.

L 25694-66 EWT(1)/EWT(m)/EPF(n)-2/EWP(t)/EWP(k) IJP(c) JD/WH/HW/GG  
ACC NR: AF6002707 SOURCE CODE: UR/0056/65/049/006/1706/1714

AUTHOR: Brandt, N. B.; Ginzburg, N. I.

ORG: Moscow State University (Moskovskiy gosudarstvennyy universitet)

TITLE: Investigation of the effect of hydrostatic pressure and plastic deformation on the superconducting properties of titanium

SOURCE: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 49, no. 6, 1965, 1706-1714

TOPIC TAGS: titanium, superconductivity, pressure effect, critical point, plastic deformation, critical magnetic field, hydrostatic pressure, single crystal

ABSTRACT: This is a continuation of earlier work by the authors dealing with the effect of pressure on the superconducting transition (ZhETF v. 46, 1216, 1964), and is aimed at checking on the hypothesis that the superconducting transition temperature increases under pressure. The superconducting properties of samples of 99.99% pure titanium iodide were investigated in the 0.06--0.6K region, and the effects of plastic deformation and hydrostatic pressures up to 26,000 atm were studied. The experimental setup and measuring technique were described in detail elsewhere (ZhETF v. 44, 1876, 1963). The results show that plastic deformation and the surface states of samples strongly affect the superconducting transition temperature and the critical field of titanium. Nearly-hydrostatic pressures up to approximately 14,000 atm either produce no effect or cause a very small reversible increase in the critical tempera-

91  
89  
B  
18

L 25694-66

ACC NR: AP6002707

ture and field in single-crystal plastically-deformed or lathe-turned titanium samples, ,  
regardless of their superconducting parameters. Between 14,000 and 26,000 atm, re-  
versible increases of the field and temperature are observed in plastically deformed  
samples, at an average rate of  $\sim 0.7 \times 10^{-5}$  deg/atm. The increase in the supercon-  
ducting transition temperature of titanium under pressure confirms the hypothesis  
advanced in the earlier work. Differences between the behavior of titanium and  
zirconium are described and explained, and the superconducting transition tempera-  
tures of different titanium samples are compared with the corresponding densities of  
the states at the Fermi surface. Authors thank L. N. Fedotov for providing the pure  
titanium. Orig. art. has: 6 figures and 2 formulas. 18

SUB CODE: 20/ SUBM DATE: 16Jun65/ ORIG REF: 006/ OTH REF: 007

S 36247-66 EWT(0)/EWT(1)/EWT(05)/EWT(8)/ETI IJP(0) WS, ID

ACC NR: AP6023637

SOURCE CODE: UR/0386/66/004/001/0027/0032

AUTHOR: Brandt, N. B.; Svistova, Ye. A.; Tabiyeva, G. Kh.

03  
12  
0

ORG: Physics Department of the Moscow State University im. M. V. Lomonosov (Fizicheskiy fakul'tet Moskovskogo gosudarstvennogo universiteta)

TITLE: Magnetoresistance of bismuth in fields up to 450 kOe at helium temperatures

SOURCE: Zhurnal eksperimental'noy i teoreticheskoy fiziki. Pis'ma v redaktsiyu. Prilozheniye v. 4, no. 1, 1966, 27-32

TOPIC TAGS: bismuth, magnetoresistance, electric resistance, pulsed magnetic field, glavanomagnetic effect, carrier density, semiconductor carrier

ABSTRACT: Results are reported of an investigation of the electric resistance of single-crystal samples of bismuth in a transverse magnetic field of intensity up to 450 kOe at liquid-helium temperature, with primary purpose of obtaining information on the character of the carrier dispersion in bismuth. Earlier investigations at helium temperatures were made at lower field strengths (up to 100 kOe). The magnetic field was produced by a pulse method and the difficulty connected with the destruction of the sample by interaction between the eddy currents and the field was eliminated by superimposing a constant field on the pulsed one. Samples of different shapes and different thermal coefficients of resistivity were tested. In all cases the plots showed a monotonic increase of the magnetoresistance with the field, following a quadratic law up to 25 - 35 kOe, nearly linear from 25 - 35 to 200 kOe, followed by

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L 36247-66

ACC NR: AP6023637

6

saturation at 200 - 400 kOe, and then by a decrease. Superimposed on the monotonic component are clearly pronounced Shubnikov - deHaas magnetoresistance oscillations, but without the periodicity in the reciprocal field normally observed in weak fields. The results are interpreted as being due to non-quadratic dispersion of the electrons and to a linear increase in the carrier density with increasing field, but definite conclusions call for additional experiments in very strong fields. The authors thank M. Ya. Azbel for a discussion, A. I. Shal'nikov for interest in the work, N. L. Shofman, T. V. Gorskhaya, and A. N. Radionova for help with the measurements, and senior machinist A. P. Popov for high-grade mechanical work. Orig. art. has: 3 figures.

SUB CODE: 20/    SUBM DATE: 03May66/    ORIG REF: 004/    OTH REF: 005

Card

2/2 *llb*



L 4533C-66 EWT(m)/T/EWP(t)/EII IJH(c) JD/JG

ACC NR: AP6024864 SOURCE CODE: UR/0056/66/051/001/0059/0061

AUTHOR: Brandt, N. B.; Ginzburg, N. I.

ORG: Moscow State University (Moskovskiy gosudarstvennyy universitet)

TITLE: Effect of high pressure on the superconducting transition temperature of the  $\text{Mo}_{90}\text{Re}_{10}$  and  $\text{Nb}_{75}\text{Mo}_{25}$  alloys

SOURCE: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 51, no. 1, 1966, 59-61

TOPIC TAGS: molybdenum alloy, niobium alloy, temperature dependence, pressure effect, molybdenum rhenium alloy, niobium molybdenum alloy

ABSTRACT: The effect of pressures up to 28,000 atm on the superconducting transition temperature of  $\text{Mo}_{90}\text{Re}_{10}$  and  $\text{Nb}_{75}\text{Mo}_{25}$  alloys has been investigated. It was found that the transition temperature in  $\text{Nb}_{75}\text{Mo}_{25}$  alloy decreases with hydrostatic pressure whereas it increases in  $\text{Mo}_{90}\text{Re}_{10}$ . The results obtained

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L 45330-66

ACC NR: AP6024864

2  
were compared with the variation of the density of states on the Fermi surface N(O) during compression. The original article offers curves showing the N(O) density of states dependence on the number of valence electrons, the superconducting transition of the Nb<sub>75</sub>Mo<sub>25</sub> alloy at various pressures, and the superconducting transition temperature dependence of the Mo<sub>90</sub>Re<sub>10</sub> and Nb<sub>75</sub>Mo<sub>25</sub> alloys on pressure. The authors thank V. V. Baron, Institute of Metallurgy, Academy of Sciences SSSR for making available high quality alloys for the experiment. Orig. art. has: 3 figures and 1 formula. [Based on authors' abstract] [KP]

SUB CODE: 20/ SUBM DATE: 11Feb66/ ORIG REF: 004/ OTH REF: 004/

Card

2/2 LC

ACC NR: AP6024869 SOURCE CODE: UR/0056/66/051/001/0108/0117

AUTHOR: Brandt, N. B., Minina, N. Ya., Chzhu Chzhen'-gan

ORG: Moscow State University (Moskovskiy gosudarstvennyy universitet)

TITLE: Investigation of the De Haas-Van Alfen effect in antimony at ultralow temperatures 2727

SOURCE: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v.51, no.1, 1966, 108-117

TOPIC TAGS: quantum oscillation, magnetic susceptibility, antimony, effective mass, ~~De Haas Van Alfen effect~~, fermi level

ABSTRACT: The angular dependences of the period and the temperature dependences of the quantum oscillation amplitude of the magnetic susceptibility of antimony are investigated for two principal orientations of the crystals at helium temperatures (4.2-1.5°K) in a magnetic field up to 19 koe. A deviation of the isoenergy surface of antimony from an ellipsoidal shape which does not exceed 10% and which is in accordance with the work of L. R. Windmiller and M. G. Priestly is found. The possible nature of the deviation is discussed. A pronounced deviation of the effective masses from proportionality to the respective cross sections is noted which indicates that the electron

Card 1/2

ACC NR.: AP6024869

and hole dispersion law differs greatly from the quadratic law. Orig.  
art. has: 6 figures, 2 tables, and 1 formula. [CS]

SUB CODE: 20/ SUBM DATE: 23Feb66/ ORIG REF: 003/ OTH REF: 007

Card 2/2

L 36460-66 EWT(m)/T/EWP(t)/ETI IJP(c) JD

ACC NR: AP6018804 SOURCE CODE: UR/0056/66/050/005/1260/1264

AUTHOR: Brandt, N. B.; Ginzburg, N. I. 39

ORG: Moscow State University (Moskovskiy gosudarstvennyy universitet)

TITLE: Temperature-pressure dependence of the superconducting transition in zinc v1

SOURCE: Zh eksper 1 teor fiz, v. 50, no. 5, 1966, 1260-1264

TOPIC TAGS: zinc, temperature dependence, pressure effect, superconducting transition

ABSTRACT: The effect of uniform pressure on the superconducting transition temperature  $T_k$  in zinc has been investigated at pressures up to 26,000 atm. The superconducting transition temperature at 26,000 atm is reduced by a factor of 2.7. It has been shown that an exponential function most satisfactorily describes the dependence of  $T_k$  on pressure. The possibility of transferring a superconductor to the normal state by subjecting it to pressure has been described. Orig. art. has: 2 figures, 7 formulas, and 1 table. [Based on authors' abstract] [NT]

SUB CODE: 20/ SUBM DATE: 30Dec65/ ORIG REF: 005/ OTH REF: 006

Card 1/1 45

BRANDT, N.D.; GINZBURG, N.I.

Crystalline modifications of bismuth and some aspects of  
the technique of obtaining high pressures at low temperatures.  
Fiz.tver.tela 3 no.11:3461-3472 N '61. (MIRA 14:10)

1. Moskovskiy gosudarstvennyy universitet im. M.V.Lomonosova.  
(Bismuth crystals) (Low temperature research)

CHERKASSKIY, P.Z.; BRANDT, P.A.

Grinding of spherical surfaces in piece production. Mashinostreitel'  
no. 5s33 My '64. (MIRA 17:7)

POLAND/Chemical Technology. Chemical Products and           H  
Their Uses. Part III. Food Industry.

Abs Jour : Ref Zhur-Khimiya, No 15, 1958, 51822

Author : Beski, Stanislaw; Brandt, Rudolf

Inst : -

Title : Another Method of Wheat Milling.

Orig Pub : Przegl. zboz.-mlynarski, 1957, L, No 6,  
11-12

Abstract : No abstract.

Card : 1/1



BRANDT, R.

Milling grain on two rollers in a small flour mill. p. 74

PRZEGLAD ZBOZOWO-MLYNARSKI (Polskie Wydawnictwo Gospodarcze) Warszawa, Poland.  
Vol. 3, no. 3, Mar 1959

Monthly List of East European Accessions (EEAI) LC, Vol. 8, no. 9, September 1959.  
Uncl.

BRANDT, S.B., kandidat tekhnicheskikh nauk; POKROVSKIY, N.B., kandidat  
~~tekhnicheskikh nauk~~; FINKLER, I.E., inzhener.

Discussion of IU.M.Korobov's article "What a telephone apparatus  
should be like." S.B.Brandt, I.E.Finkler, N.B.Pokrovskii. Vest.  
svyazi 14 no.1:28-29 Ja '54. (MLRA 7:5)

1. Nachal'nik laboratorii Ufimskogo zavoda MESEF (for Brandt)
2. Dotsent VKIAS (for Pokrovskiy)  
(Telephone--Apparatus and supplies) (Korobov, IU.M.)

AMIRKHANOV, Kh.I.,; BRANDT, S.B., red.; SHCHERBAKOV, D.I., akad.; KLEYZMER,  
I.A., tekhn. red.

[Determination of the absolute age of rocks on the basis of  
radioactive transformation of potassium 40 into argon 40.] Opređenje  
absolütного vozrasta gor'nykh porod po radioaktivnomu prevrashcheniu  
kaliia 40 v argon 40. Makhachkala, Akad. nauk SSSR, Dagestanskii  
filial, 1956. 149 p. (MIRA 11:11)

(Radioargon dating)

AMIRKHANOV; Kh.I.; BRANDT, S.B.; BARTNITSKIY, Ye.N.

Some problems relative to the theory of the argon method of the  
determination of the absolute age of rocks. Trudy Geol.inst.-  
Dag.fil. AN SSSR 1:175-187 '57. (MIRA 14:9)  
(Geological time) (Argon)

AMIRKHANOV, Kh.I.; BRANDT, S.B.; BARTNITSKIY, Ye.N.; ANOKHINA, L.K.;  
IVANOV, V.S.

Diffusion of the radiogenic argon in micas. Trudy Geol.inst.  
Dag.fil. AN SSSR 1:188-193 '57. (MIRA 14:9)  
(Diffusion) (Argon) (Mica)



BRANDT, S.B.; GABIBOV, F.S.; BATYRMOUZAYEV, A.S.

Determination of radiogenic argon in mineral using isotope  
dilution methods. Metod. opr. abs. vozr. geol. obr. no. 68  
53-62 '64 (MIRA 18:2)

BRANDT, S. B.

AUTHORS:      Amirkhanov, Kh. I., Member of AN Azerb.      20-4-37/52  
                 SSR, Magatayev, K. S., and Brandt, S. B.

TITLE:            Determination of the Absolute Age of Sedimentary Minerals  
                 by Radioactive Methods (Opredeleniye absolyutnogo vozrasta  
                 osadoohnykh mineralov radioaktivnymi metodami).

PERIODICAL:    Doklady AN SSSR, 1957, Vol. 117, Nr 4, pp. 675-677 (USSR)

ABSTRACT:      Though most of the works deal with the determination of the  
                 age of eruptive rocks and minerals, the primary conditions  
                 of radioactive geochronometry can also be applied with  
                 depositions. That requires that a precipitating mineral  
                 contains a radioactive mother-rock, and further that the  
                 developing daughter-rock remains well conserved in the  
                 mineral and that it is not contained in the mineral in the  
                 moment of precipitation. Finally it is required that the  
                 moment of formation of the respective mineral agrees with the  
                 moment of precipitation of all other sediments of the  
                 respective horizon containing it. Since the absolute age  
                 of the sylvinite could be determined (reference 1), this  
                 problem was attacked with respect to an authigenic mineral -  
                 glauconite (reference 2). The age of 45 samples, altogether,  
                 was determined. 26 measurements agree quite precisely with the

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Determination of the Absolute Age of Sedimentary  
Minerals by Radioactive Methods

20-4-37/52

geological data. In 11 samples, radiogenic argon was not found, whereas in 8 cases - on account of too small quantities of argon - the rocks are of lower age. In no case an increased age was determined. From this it can be concluded that radiogenic argon was fully obtained in many samples. This obtaining concerns a wide range of geologic ages. In one part of the samples, the quantity of radiogenic argon was rigorously reduced up to completely lacking. The respective results are given in table 1. The age varies accordingly from 20 (Chokrak, miocene) to 400 (silurian) million years. The too small quantity of radiogenic argon can be attributed to paleo-temperature effects, metamorphic processes, local warming-up and weathering with glauconite. They act here more intensely than with magmatic rocks. Concluding, the applications of the new method are described. There are 1 figure, 1 table, and 5 references, 4 of which are Slavic.

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Determination of the Absolute Age of Sedimentary  
Minerals by Radioactive Methods

20-4-37/52

ASSOCIATION: Dagestan Branch AN USSR (Dagestanskiy filial Akademii nauk  
SSSR)

SUBMITTED: July 2, 1957

AVAILABLE: Library of Congress

Card 3/3

BRANDT, S. B.

Brandt, S. B. - "The Method of Mass-Spectroscopic Determination of Radiogen Argon  
In Rocks".

report presented at the Sixth Session of the Committee for Determining the  
Absolute Age of Geologic Formations at the Department of Geologic-Geographical  
Sciences (OGGN) of the USSR Academy of Sciences at Sverdlovsk in May 1957.  
Izv. Ak Nauk SSSR, Ser. Geol., No. 1, 1958, p. 115-117 author Pekarskaya, T. B.

SOV/49-58-9-11/14

AUTHORS: Tabulevich, V. N., Struk, Ye. V. and Brandt, S. B.

TITLE: Automatic Reception of Time Signals of the "Makhachkala" Seismic Station (Avtomaticheskiy priyem signalov vremeni seysmostantsiyey "Makhachkala")

PERIODICAL: Izvestiya Akademii Nauk SSSR, Seriya Geofizicheskaya, 1958, Nr 9, pp 1137-1138 (USSR)

ABSTRACT: Under the conditions at Makhachkala the daily variations of the audibility of the large radio stations and also the radio disturbances caused by the frequent hurricanes are of great importance. For ensuring regular automatic reception of the time signals, the personnel of the Makhachkala seismic station developed an amplifier (attachment to the radio receiver "Rodina") which ensures automatic reception of time signals without the above mentioned drawbacks. The circuit, Fig.1, is connected to the non-symmetrical output of an additional loud-speaker and begins with a trigger type amplitude limiter, the response threshold of which is so chosen that at the output oscillations of a practically square topped shape are obtained. This is followed by a selective amplifier with a twin T-shaped RC bridge and a cathode repeater and also an

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SOV/49-58-9-11/14

Automatic Reception of Time Signals of the "Makhachkala" Seismic Station

auxiliary resonance circuit tuned to 1000 c.p.s. The output voltage of the amplifier is rectified by a diode and fed into an electronic trigger relay which brings about response of polarised relays on the output side irrespective of their setting and also permits changing the width of the received frequency band by changing the response threshold. The output diode serves for absorbing parasitic pulses which occur during switching on and switching off of the circuit. The entire apparatus is fed from the normal a.c. supply via a voltage stabiliser but can also be made to operate from batteries. A wall clock with a special contact system on the face serves for switching on and switching off the equipment. The equipment was tested in experimental operation and proved reliable. The frequency band within which a strictly square topped wave shape is obtained equals  $1000 \pm 40$  c.p.s.; at such a frequency band neither music, nor speech, nor surge disturbances will cause erroneous response. The narrow and stable frequency band has enabled detection of deviation of the frequency of the time signals which occurred

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SOV/49-58-9-11/14

Automatic Reception of Time Signals of the "Makhachkala" Seismic Station

in November, 1956.  
a chassis of 180 x 250 mm.  
There are is one figure.

The equipment is built into

ASSOCIATION: Akademiya Nauk SSSR, Institut fiziki Zemli  
Seysmicheskaya stantsiya "Makhachkala"  
(Ac.Sc. USSR, Institute of Physics of the Earth,  
Seismic Station "Makhachkala")

SUBMITTED: June 22, 1957

Card 3/3

SOV/11-58-11-9/14

AUTHORS: Amirkhanov, Kh.I., ~~Brandt, S.B.~~, Bartnitskiy, Ye.N.

TITLE: The Determination of the Absolute Age of Potash Feldspars by the Argon Method (K opredeleniyu absolutnogo vozrasta kaliyevykh polevykh shpatov argonovym metodom)

PERIODICAL: Izvestiya Akademii nauk SSSR, Seriya geologicheskaya, 1958, Nr 11, pp 110 - 112 (USSR)

ABSTRACT: The authors propose a method to determine the absolute age of potash feldspars by the ratio of  $A^{40}$  and  $K^{40}$  in the permanent zone of a given sample. There is 1 graph, 1 table, 4 references, 1 of which is Soviet, 1 German and 2 American.

ASSOCIATION: Dagestanskiy filial AN SSSR, Makhachkala (The Dagestan Branch of the AS USSR, Makhachkala)

SUBMITTED: June 5, 1958

1. Geology 2. Potassium carbonates 3. Age--Determination  
4. Radioisotopes--Applications

Card 1/1

*Brandt, S.B.*

AUTHORS: Amirkhanov, Kh. I., Member of the AN Azerbaydzhan SSR, 20-2-33/Ko  
Brandt, S. B., Bartnitskiy, Ye. N., Gurvich, V. S., Gasanov, S. A.

TITLE: Problem of the Preservation of Radiogenic Argon in Glauconites (K vo-  
prosu o sokhrannosti radiogennogo argona v glaukonitakh).

PERIODICAL: Doklady AN SSSR, 1958, Vol. 118, Nr 2, pp. 328-330 (USSR).

ABSTRACT: Glauconite was chosen for the determination of the absolute age of sedimentary rocks due to its great structural similarity with mica, especially with biotite. The first samples showed good results, as far as the agreement of the absolute age with the assumed geological age is concerned. Beside data on a good stability of the glauconite structure a weak potassium-linkage to the lattice (reference 4) is indicated. The preservation of potassium and thus also of radiogenic argon apparently depends on the state of dispersion of the micas. In glauconites from Dagestan sometimes very small contents to complete absence of radiogenic argon were determined. The method was described in earlier papers (references 7-9). In order to determine the problem mentioned in the title, the dependence of the separated radiogenic argon on the temperature of heating was investigated. Simultaneously samples for an X-ray structural analysis were produced. The remaining content of argon after 8 and 10 hours of heating at 100-1150°C is gi-

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Concerning the

Problem of the Preservation of Radiogenic Argon in Glauconites. 20-2-35/60

ven in table and figure 1. About 20% of radiogenic argon are already lost from glauconite at 100°C. At 500°C argon is entirely separated. Argon is, for instance, much more solidly bound to muscovite and microcline. Its linkage to the crystal lattice of glauconite, however, is very weak. As separation of argon already takes place before the destruction of the glauconite lattice, as the X-ray structural analysis (table 2) proves. When comparing the curves of the separation of radiogenic argon with those of the thermal analysis (reference 12,13) it will be seen that the 2 endothermic effects (between 100 and 200°C, and between 500 and 600°C, respectively) of the latter (separation of the adsorbed water and loss of the water of constitution) are in agreement with the peaks of the curve of the separation of argon. The loss of the adsorbed water apparently entails the loss of 20% argon, whereas that of the water of constitution causes the separation of the argon residue. This also indicates a weak argon- and possibly also a weak potassium-linkage to the glauconite-lattice. Further investigations are necessary. For determining the absolute age of the sediments according to glauconites a sufficient knowledge of the geological history of every individual sample is necessary. Glauconite may possible be used as material for paleo-thermometric investigations.

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Concerning the Problem of the Preservation of Radiogenic Argon in Glauconites. 20-2-35/60

There are 2 figures, 2 tables, and 13 references, 11 of which are Slavic.

ASSOCIATION: Dagestan Branch of the AS USSR (Dagestanskiy filial Akademii nauk SSSR).

SUBMITTED: June 22, 1956.

AVAILABLE: Library of Congress.

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3(8)

SOV/11-59-3-8/17

AUTHORS: Amirkhanov, Kh.I., ~~Brandt, S.B.~~, Bartnitskiy, Ye.N., Gasanov, S.A., and Gurvich, V.S.

TITLE: The Mechanism of Radiogenic Argon Losses in Mica (O mekhanizme poter' radiogennogo argona v slyudakh)

PERIODICAL: Izvestiya Akademii Nauk SSSR, Seriya Geologicheskaya, 1959, Nr 3, pp 104-107 (USSR)

ABSTRACT: The thermic stability of radiogenic (r/g) argon was tested by the above-mentioned authors in dispersed mica. It showed that low-temperature losses (150 - 600 C) of r/g argon were incurred, beginning with grains of the 50-100 micron order. Graphical representations and equations were developed by having used as basis the Langmuir order:

$$\frac{v}{v_M} = \frac{bp}{1 + bp} \quad (1)$$

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SOV/11-59-3-8/17

The Mechanism of Radiogenic Argon Losses in Mica

The coefficient b is subjected to the following temperature dependence:

$$b = \alpha \frac{e^{q/RT}}{p^{1/2}} \quad (2)$$

Here  $\frac{v}{v_M}$  = the relative quantity of the absorbed

gas; p = pressure;  $\alpha$  = numerical coefficient dependent upon the properties of the sorbent and of the gas to be absorbed; q = temperature of sorption. The

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SOV/11-59-3-8/17

## The Mechanism of Radiogenic Argon Losses in Mica

value  $q/R$  has usually the order  $10^3 \left( \frac{10^{11}}{8,32 \cdot 10^7} \right)$ .

For the initial analysis it is possible to use  $\alpha p = 30$ . By using these tolerances, the authors transform (1) and (2), as above, applicably to this case:

$$\frac{A^{40}}{A_M^{40}} = \frac{30e^{1000/T}}{T^{1/2} \left( 1 + \frac{30e^{1000/T}}{T^{1/2}} \right)}$$

The authors arrived at the following conclusions:  
 1) Losses of radiogenic argon from mica up to a temperature of 600 C are incurred as a result of the desorption processes and are well described by the

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SOV/11-59-3-8/17

The Mechanism of Radiogenic Argon Losses in Mica

isotherms of Langmuir; 2) losses of argon in mica resulting from a diffusion become perceptible only after a temperature of 600 C; 3) at normal temperatures, the diffusion coefficient in mica is not to exceed  $10^{-31}$  cm<sup>2</sup>/sec. There are 4 graphs and 6 Soviet references.

ASSOCIATION: Dagestanskiy filial AN SSSR, g. Makhachkala (The Dagestan Branch AS USSR, Makhachkala)

SUBMITTED: June 5, 1958.

Card 4/4

3(5)

AUTHORS:

SOV/7-59-6-8/17  
Amirkhanov, Kh. I., Brandt, S. B., Bartnitskiy, Ye. N.,  
Voronovskiy, S. N.

TITLE:

On the Diffusion of Radiogenic Argon in Sylvites

PERIODICAL:

Geokhimiya, 1959, Nr 6, pp 538 - 545 (USSR)

ABSTRACT:

The diffusion constants of radiogenic argon, the activation energy of diffusion, the electrical conductivity of frequencies of 0 - 20 megacycles and their activation energy were measured on two different types of sylvite - red and pink - of the Solikamsk deposit in the temperature range of from 20 to 700°C. The diffusion mechanism of radiogenic argon was found to differ from the conductivity mechanism and the eigendiffusion of K<sup>+</sup>. The activation energy of diffusion is at equal temperature higher than the activation energy of conductivity. Activation energy is not likely to decrease at low temperature (under 200°C). It is not possible to make spatial diffusion responsible for argon losses occurring in the course of geological evolution. The diffusion constant amounts to 10<sup>-30</sup> cm<sup>2</sup>/sec extrapolated to a temperature of 300°K. Diffusion according to pair vacancies and Schottky-defects is assumed to be the most probable diffusion mechanism. Argon losses by desorption at low temperature on one

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On the Diffusion of Radiogenic Argon in Sylvites SOV/7-59-6-8/17

of the two sylvites may be explained by mosaic-structure.  
There are 5 figures and 11 references, 5 of which are Soviet.

ASSOCIATION: Dagestanskiy filial Akademii nauk SSSR, Makhachkala  
(Dagestan Branch of the Academy of Sciences USSR, Makhachkala)

SUBMITTED: April 18, 1959.

Card 2/2



5(0)

## AUTHORS:

Amirkhanov, Kh. I., Academician,  
AzerbSSR, Brandt, S. (D.), Bartnitskiy, Ye. N.

SOV/20-125-6-48/61

## TITLE:

The Diffusion of Radiogenic Argon in Feldspars (Diffuziya  
radiogennogo argona v polevykh shpatakh)

## PERIODICAL:

Doklady Akademii nauk SSSR, 1959, Vol 125, Nr 6, pp 1345-1347  
(USSR)

## ABSTRACT:

It is known that considerable losses of radiogenic argon  $A^{40}$  formed in feldspars by the radioactive transformation of  $K^{40}$  occur in the last mentioned mineral. The linear approximations in the references 1,2 distort the separation mechanism of  $A^{40}$ . The authors give in this paper investigation results of the separation kinetics of  $A^{40}$  in two Precambrian feldspar samples (Ref 3). The figures 1 and 2 give the results. The diffusion equation for a spherical case (1) as well as the known dependence of the steady diffusion on the temperature (2) are used for the interpretation of the obtained curves. Figure 1 (sample Nr 1) shows that the heating curves have at 800 and 1100° horizontal sections of considerable length contrary to the dependence (1). The slope of the curve increases against

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The Diffusion of Radiogenic Argon in Feldspars

SOV/20.125-6-48/61

the dependence 2 periodically, in intervals which are separated from one another by curves with a horizontal section, not gradually with the temperature. A part of the sample Nr 1 was pulverized in an agate mortar in order to clarify the nature of these horizontal sections. Portions of 1.5 g each were subjected to differently long heating. The determination results of the  $A^{40}$  which remained in these portions are indicated in figure 1 by crosses. The horizontal section is not shifted on the vertical line, but only prolonged in the direction of the ordinate axis. Thus its existence is caused by the structural peculiarities, not by the grain size. The beginning of the section is determined by the quantity  $D_0/r_0^2$  in line with the equation (1). The process occurring at 800 and 1100° can be interpreted as rapidly dying down diffusion which exhausts the  $A^{40}$ -content in a certain stage. This stage is characterized by values of E and  $D_0$  typical of it. Therefore the curves have to be interpreted according to  $A^{40}$  which belongs to each single phase. Thus the sample Nr 1 has three phases (Fig 3: I and II - the numbers of the phases). Figure 4 shows an analogous sub-

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## The Diffusion of Radiogenic Argon in Feldspars

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division of the sample Nr 2. The slope of the curves in the figures 3 and 4 increases gradually for each phase with the increase of  $t$ . This makes their analysis in the terms of the equations (1) and (2) possible which confirms the rightness of the authors' interpretation. A raster was constructed from the equation (1) for different  $D$ -values in order to determine the value of  $D_t$ . The  $D_t$ -values were detected by applying this raster to the curves of the figures 3 and 4. 2 adjacent  $D_t$ -values from the equation (2) were determined. The obtained  $D_t$ - and  $E$ -values as well as the  $D_{273}$ -values, extrapolated according to the equation (2), were compiled in the table 1. This shows that each single phase is characterized only by the  $E$ -value typical of it. The separation of  $A^{40}$  is carried out at the mentioned temperatures by diffusion. The diffusion can, however, practically not influence the maintenance of  $A^{40}$  as it is shown by the  $D_{273}$ -values for each phase. All losses of  $A^{40}$  in the course of the geological time are due to the separation from the "zero"-phase only. The variety of the feldspars is not exhausted by the two samples, though the figure and the

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The Diffusion of Radiogenic Argon in Feldspars

SOV/20-125-6-48/61

configurations of the phases differ in the two samples. There are 4 figures, 1 table, and 3 references, 1 of which is Soviet.

ASSOCIATION: Dagestanskiy filial Akademii nauk SSSR (Dagestan Branch of the Academy of Sciences USSR)

SUBMITTED: December 29, 1958

Card 4/4

3 (8)

AUTHORS:

Amirkhanov, Kh. I., Academician of the SOV/20-126-1-44/62  
AS AzerbSSR, Bartnitskiy, Ye. N., Brandt, S. B., Voytkevich,  
G. V.

TITLE:

On the Migration of Argon and Helium in Certain Rocks and  
Minerals (O migratsii argona i geliya v nekotorykh porodakh  
i mineralakh)

PERIODICAL:

Doklady Akademii nauk SSSR, 1959, Vol 126, Nr 1,  
pp 160-162 (USSR)

ABSTRACT:

The A- and He-separation from one and the same sample was investigated in order to define precisely the loss mechanism of the two radiogenic gases mentioned in the title. The authors used for this purpose carbonaceous schist, hornblende, and Precambrian pyroxene. They used the mass-spectroscopic method of isotopic dilution (Ref 1) which was somewhat modified for this purpose. The measuring results are given in figures 1-3. The diffusion coefficients D and in several cases the activation energy E can be determined from these curves. The formula of the spherical diffusion (2) was used for the calculation of D. The quantity of the radiogenic A<sup>40</sup> was measured by the usual

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On the Migration of Argon and Helium in Certain  
Rocks and Minerals

SOV/20-126-1-44/62

method; the  $\text{He}^4$ -quantity according to the formula (1). Figure 1 shows curves for the carbonaceous schist, figure 2 for hornblende from granite-pegmatite, figure 3 for pyroxene. Equal D-values of argon and helium for hornblende and pyroxene prove that the migration of the radiogenic gases is caused by other reasons, not by the nature of the atoms  $\text{A}^{40}$  and  $\text{He}^4$ . It is possible that the nodal vacancies (holes) shift in the crystalline lattice of the mineral. Their quantity increases with the temperature rise. They seize and "transport" the atoms of radiogenic gases. A certain difference of the D-value for A and He in the carbonaceous schists is apparently due to the occurrence of several phases in these rocks in which the gases may be differently distributed. The boundary layers between the individual phases are apt to cause considerable losses in  $\text{A}^{40}$  and  $\text{He}^4$  as well in the case of low temperatures. The E- and D-values for pyroxene prove that the radiogenic gases are fully preserved in this rock. The authors draw from the aforesaid facts the conclusion that the absolute age is to be determined by the argon- and helium

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On the Migration of Argon and Helium in Certain  
Rocks and Minerals

SOV/20-126-1-44/62

method only in the case of samples which were first  
investigated for the preservation of the radiogenic gases.  
There are 3 figures and 1 Soviet reference.

ASSOCIATION: Dagestanskiy filial Akademii nauk SSSR (Dagestan Branch of  
the Academy of Sciences, USSR)

SUBMITTED: December 29, 1958

Card 3/3

AMIRKHANOV, Khabibula Ibragimovich; BRANDT, Sergey Borisovich;  
BARTNITSKIY, Yevgeniy Nikolayevich; KLEYZMER, I.A., tekhn.red.

[Radiogenic argon in minerals and rocks] Radiogennyi argon v  
mineralakh i gornyykh porodakh. Predisl.D.I.Shcherbakova.  
Makhachkala, Akad.nauk SSSR, Dagestanskiy filial, 1960. 200 p.  
(MIRA 14:4)

(Argon) (Radioargon dating)



LI PU [Li P'u]; CHEN YU-CHI [Ch'eng Yu-ch'ih]; TU GON-CHZHI;  
TUGARINOV, A.I.; ZYKOV, S.I.; STUPNIKOVA, N.I.; POLEVAYA,  
N.I.; BRANDT, S.B.

Absolute age of rocks in the Chinese People's Republic.  
Geokhimiia no.7:570-585 '60. (MIRA 13:11)  
(China--Rocks--Age)

AMIRKHANOV, Kh.I.; BRANDT, S.B.; BARTNITSKIY, Ye.N.

E.K. Gerling's method of determining the activation energy of  
radiogenic gases in minerals. Geokhimiya no.7:646-649. '60.  
(MIRA 13:11)

(Argon)

(Helium)

(Diffusion)

S/169/61/000/008/003/053  
A006/A101

**AUTHORS:** Amirkhanov, Kh. I., Brandt, S. B., Bartnitskiy, Ye. N., Gurvich, V. S., Gasanov, S. A.

**TITLE:** On the problem of preservation of radiogenic argon in glauconites

**PERIODICAL:** Referativnyy zhurnal, Geofizika, no. 8, 1961, 4-5, abstract 8A37  
("Tr. 6-y sessii Komis. po opredeleniyu absolyutn. vozrasta geol. formatsiy", 1957, Moscow, AN SSSR, 1960, 202-207)

**TEXT:** The basic premise of using glauconites to determine the absolute age by the K-argon method, is the similarity of its structure with the mica structure. The authors studied the dependence between the quantity of radiogenic argon liberated from glauconite and the heating temperature within a range of 100 - 1,500°C. Argon was determined by the method of isotopic dilution. The data obtained are compared with the known E. K. Gerling curves showing argon liberation from mica and microclines. At 100°C the glauconite loses about 20% argon, whereas argon liberation from microcline and muscovite begins at 400 and 600°C respectively. At 500°C, 100% argon are liberated from glauconite, whereas 8 hour heating of microcline at 1,200°C entails only 76% argon loss. ✓

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S/169/61/000/008/003/053  
A006/A101

On the problem of preservation of radiogenic ...

Debyeograms show that argon loss occurs prior to the beginning of destruction of the glauconite lattice. The peaks on the argon liberation curve (at 100 and 500°C) coincide with two endothermic effects on the glauconite thermogram; they correspond to the separation of adsorbed and constitution water. All this indicates a weak bonding of argon in the glauconite lattice and requires a careful study of the geological history of each specimen when interpreting the K-argon ages of glauconite. The weak bonding of argon in glauconite may possibly be caused by small grain sizes (5 - 100  $\mu$ ) of the latter, since processes of ion and atom loss and substitution occur mainly on the crystal surfaces.

I. Chernushev ✓

[Abstracter's note: Complete translation]

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