86427

S/181/60/002/011/011/042
B006/B056

24.7800 (1035, 1142, 1162)

AUTHORS: Bokov, V. A. and Myl'nikova, I. Ye.

TITLE: Ferroelectric Properties of Single Crystals of New Compounds With Perovskite Structure

PERIODICAL: Fizika tverdogo tela, 1960, Vol. 2, No. 11, pp. 2728-2732

TEXT: The essential results of this work were communicated at the Third Conference on Ferroelectricity (Moscow, January 1960). The authors grew perovskite-type single crystals of $PbNi_{1/3}Ta_{2/3}O_3$ (I), $PbMg_{1/3}Ta_{2/3}O_3$ (II), $PbCo_{1/3}Nb_{2/3}O_3$ (III), $PbCo_{1/3}Ta_{2/3}O_3$ (IV), and $PbZn_{1/3}Nb_{2/3}O_3$ (V) and studied the ferroelectric properties of these compounds. First, the crystals were subjected to an X-ray examination which showed that all of them had perovskite structure with cubic elementary cells. Further, the following was found:

Ferroelectric Properties of Single Crystals of New Compounds With Perovskite Structure

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Compound	1	2	3	4	5	6
I	4.01	10.17	9.94	395.4	386.0	2.3
II	4.02	9.80	9.65	383.9	378.0	1.6
III	4.04	8.48	8.45	336.8	335.8	0.3
IV	4.01	10.18	9.87	395.4	383.3	3.1
V	4.04	-	-	-	-	-

1) Cell parameter, kX
2) X-ray density
3) Pycnometrically determined density
4) Theoretical molecular weight
5) Experimental molecular weight
6) Theoretical-experimental deviation, %

All X-ray diagrams exhibited a fine structure. Fig. 1 shows the temperature dependence of ε and tan δ of the compounds II, III, I, and IV, and Fig. 2 that of V. In all cases ε and tan δ have a maximum. As compared to the maximum of ε, that of tan δ is always shifted toward lower temperatures, which is characteristic of ferroelectrics. A study of the dependence of polarization on the direction of the electric field showed that all crystals have a dielectric hysteresis. Compound V has a particularly marked loop with good saturation, and nearly the same good result was obtained for II. Fig. 3 shows pictures of the loops. The authors thank Professor

Ferroelectric Properties of Single Crystals of New Compounds With Perovskite Structure

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G. A. Smolenskiy for his interest and discussions, and N. N. Parfenova for carrying out the chemical analyses. A. I. Agranovskaya is mentioned. There are 3 figures, 2 tables, and 4 Soviet references.

ASSOCIATION: Institut poluprovodnikov AN SSSR Leningrad
(Institute of Semiconductors of the AS USSR, Leningrad)

SUBMITTED: June 1, 1960

Table 2

Соединение	ε_{max}	θ, °C	Δθ, °C
$PbMg_{1/3}Nb_{2/3}O_3$	15000	— 12	86
$PbMg_{1/3}Ta_{2/3}O_3$	7000	— 98	
$PbCo_{1/3}Nb_{2/3}O_3$	6000	— 70	70
$PbCo_{1/3}Ta_{2/3}O_3$	4000	—140	
$PbNi_{1/3}Nb_{2/3}O_3$	4000	—120	60
$PbNi_{1/3}Ta_{2/3}O_3$	2400	—180	
$PbZn_{1/3}Nb_{2/3}O_3$	22000	+140	—

Legend to Table 2: θ - temperature at ε_{max} with f=1 kc/sec; Δθ - difference of these temperatures of the niobates and of the corresponding tantalates.

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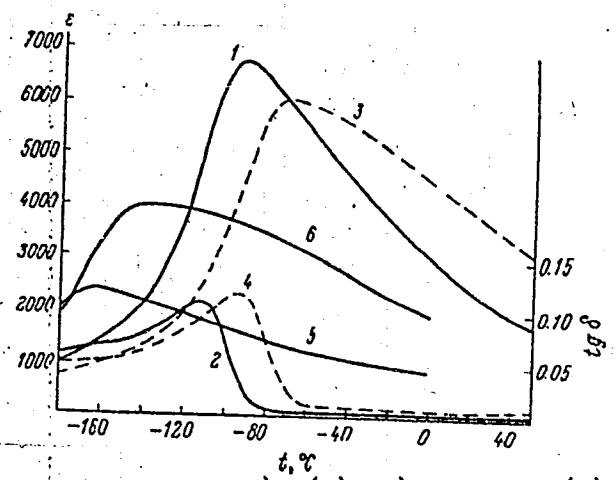
B006/B056



Legend to Fig. 1: 1) ε(t), 2) tan δ = f(t) of II, f = 1 kc/sec
3) ε(t), 4) tan δ = f(t) of III, f = 1 "
5) ε(t) of I , f = 450 kc/sec
6) ε(t) of IV, f = 1 kc/sec

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BOKOV, V.A.

Vacuum table for optical observations at low temperatures. Prib. i tekh.eksp. no.4:143-145 Jl-Ag '60. (MIRA 13:9)

1. Institut poluprovodnikov AN SSSR.
(Vacuum apparatus)

24,7800

S/196/62/000/006/004/018
E194/E154

AUTHORS: Myl'nikova, I.Ye., and Bokov, V.A.

TITLE: The growth of single crystals of $Pb_3NiNb_2O_9$ and $Pb_3MgNb_2O_9$ and their electrical properties

PERIODICAL: Referativnyy zhurnal, Elektrotekhnika i energetika, no.6, 1962, 6, abstract 6 B29. (In the Symposium 'Rost kristallov' (Growth of crystals), T.Z., Moscow, AN SSSR, 1961, 438-446. Discussion, 501-502).

TEXT: The growth of single crystals of $Pb_3NiNb_2O_9$ and $Pb_3MgNb_2O_9$ by the method of crystallization from solution confirmed the possibility of producing a single crystal of such complex composition. Growth conditions of both kinds of crystal were investigated and crystallization conditions favourable to the growth of crystals of isometric form were selected. The electrical properties of the single crystals are in good agreement with the results obtained for polycrystalline specimens of these compounds. Investigations of the electrical properties

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The growth of single crystals ... S/196/62/000/006/004/018
E194/E154

of single crystals of $Pb_3NiNb_2O_9$ confirmed the data of Smolensky and others concerning relaxation and ferroelectric effects in this compound. Investigations with both kinds of monocrystals show that these compounds have no definite point of ferroelectric phase transition. It is supposed that in the region of temperature where the permittivity is maximum the possibility of relaxation of domain boundaries is not excluded. 4 literature references.

[Abstractor's note: Complete translation.]

Card 2/2

30546

24.7800 (1043, 1145, 1153)
15.2450

S/564/61/003/000/022/029
D207/D304

AUTHORS: Myl'nikova, I. Ye., and Bokov, V. A.

TITLE: Preparation and electrical properties of $Pb_3NiNb_2O_9$ and $Pb_3MgNb_2O_9$ monocrystals

SOURCE: Akademiya nauk SSSR. Institut kristallografii. Rost kristallov, v. 3, 1961, 438-446

TEXT: The authors report on the preparation of $Pb_3NiNb_2O_9$ (I) and $Pb_3MgNb_2O_9$ (II) monocrystals and measurements of their dielectric properties. Polycrystals of these compounds were first prepared by a group working under G. A. Smolenskiy (Ref. 1: G. A. Smolenskiy and A. I. Agranovskaya, Zhur. tekh. fiz., 28, no. 7, 1491, 1958; Ref. 2: G. A. Smolenskiy, A. I. Agranovskaya, S. N. Popov, Fizika tverdogo tela, 1, no. 1, 167, 1959) at the Laboratorya ferritov i segnetoelektrikov Instituta poluprovodnikov (Laboratory for Ferrites and Ferroelectrics of the

Card 1/2

Preparation and electrical...

Institute for Semiconductors). The two compounds have a perovskite structure; they exhibit both ferroelectric and relaxation polarization. in (I) the relaxation polarization is more marked and the reverse is true of (II). The temperature and frequency dependences of permittivity (ε) and of tg δ of $Pb_3NiNb_2O_9$ showed: (1) a maximum of ε (ε = 4000) at about -125°C and 450 kc/s ; (2) the relaxation type of polarization and some domain reorientation in strong electric fields. Similar measurements on $Pb_3MgNb_2O_9$ showed: (1) an ε = 14700 maximum at about -15°C and 1 kc/s ; (2) clear rectangular hysteresis loops, especially at low temperatures; (3) gradual transition to ferroelectric state at low temperatures. Dielectric properties of both compounds in monocrystalline form were very similar to those found in polycrystals. Acknowledgment is made to G. A. Smolenskiy, who directed this work. There are 9 figures and 4 Soviet-bloc-references.

Card 2/2

S/181/61/003/003/019/030
B102/B205

9.4300 (1145, 1136, 1150)

AUTHORS: Bokov, V. A. and Myl'nikova, I. Ye.

TITLE: Electrical and optical properties of single crystals of ferroelectrics with blurred phase transition

PERIODICAL: Fizika tverdogo tela, v. 3, no. 3, 1961, 841-855

TEXT: When investigating ferroelectrics of the perovskite type, G. A. Smolenskiy, V. A. Isupov, and A. I. Agranovskaya have found that also other complicated compounds have ferroelectric properties. Of these, the compounds $PbMg_{1/3}Nb_{2/3}O_3$ (I) and $PbNi_{1/3}Nb_{2/3}O_3$ (II) and their mutual alloys have been studied most thoroughly. The two compounds show a relaxative shift of the maxima of the temperature functions of ε and tan δ, which is quite unusual in the case of compounds with ferroelectric properties. I shows no hysteresis loop near the point of saturation, not even in very strong fields, which is also an unusual observation. The authors have now studied the electrical and optical properties of single crystals of compounds I and II, and give a detailed report on their results. The single crystals were ob-

APPROVED FOR RELEASE: 06/09/2000 CIA-RDP86-00513R000206030003-7"

Electrical and ...

tained by crystallization from a solution at decreasing temperature (20-40 deg/hr). The crystals were subjected to chemical and X-ray analyses (using CoK_α radiation in the latter). They were found to possess a perovskite-type structure with the lattice constants a = 4.03 A (II) and a = 4.04 A (I). The pycnometrically determined densities were 8.55 g/cm^3 (II) and 8.12 g/cm^3 (I), and were somewhat smaller than the values obtained by X-ray analysis. The authors examined specimens (0.5 mm)^3 large and foils of ~0.1 mm thickness. ε and tan δ as a function of temperature at $E_=$ = 15 kv/cm and different frequencies is shown for I in Fig. 1 and for II in Fig. 8. The effect of a change of the field strength ($E_=$) was similar to that of a change in frequency: An increase of $E_=$ in the case of I and II led to a decrease of the maxima of ε and tan δ, and in the case of I also to a shift of the maxima toward higher temperatures. At low temperatures, the single crystals of I showed a nearly rectangular, dielectric hysteresis loop which was quickly narrowed down with a rise in temperature. At -30°C it was so narrow that it was no longer possible to determine the coercive force. Whereas the coercive force decreased quickly with rising temperature, and vanished before reaching the zero point, the spontaneous polariza-

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tion likewise decreased with rising temperature; at +80°C, however, it had not yet vanished. The reversal of polarity of a single crystal of I was studied, and the result is schematically represented in Fig. 6. The temperature dependence of the intensity of birefringence of a polarized single crystal of I was also studied. The results are shown in Fig. 7: curve I was plotted on heating, and curves 2 and 3 on cooling (without a field). The maximum value of Δn at -190°C ($5 \cdot 10^{-3}$) is still smaller by one order of magnitude than that of $BaTiO_3$. All specimens of I and II maintained their optical isotropy up to -190°C. Application of a field resulted in birefringence, the relation $\Delta n = \alpha E^2$ being well satisfied at room temperature. The following results have been obtained from a very detailed discussion: I and II are ferroelectrics the phase transition of which covers a wide range of temperature. This is due to variations in concentration which are again due to the fact that the sublattice contains no ions which are orientated in octahedral arrangement. The phase transition to the ferroelectric state takes place by spontaneous polarization in the individual microdomains of the crystal. This leads to the formation of very fine domains which form larger domains only under the action of an electric field.

In the case of II, this process is not completed at ordinary usual field strengths and is unstable. The relaxative properties of the compounds in question are due to relaxation of the domain boundaries; this is analogous to that occurring in several ferroelectric solid solutions. Professor G. A. Smolenskiy is thanked for discussions and his interest in the work, and N. N. Parfenova for chemical analyses. I. G. Izmailzade is mentioned. The main results of the present work were communicated at the third Conference on Ferroelectricity, Moscow, January 1960. There are 12 figures and 16 references: 15 Soviet-bloc and 1 non-Soviet-bloc.

ASSOCIATION: Institut poluprovodnikov AN SSSR Leningrad (Institute of Semiconductors, AS USSR, Leningrad)

SUBMITTED: July 25, 1960

Legend to Fig. 1: 1) 100 cps, 2) 1 kc, 3) 10 kc, 4) 60 kc, 5) 600 kc, 6) 1 Mc.

S/181/61/003/003/019/030
B102/B205

Electrical and ...

Fig. 1

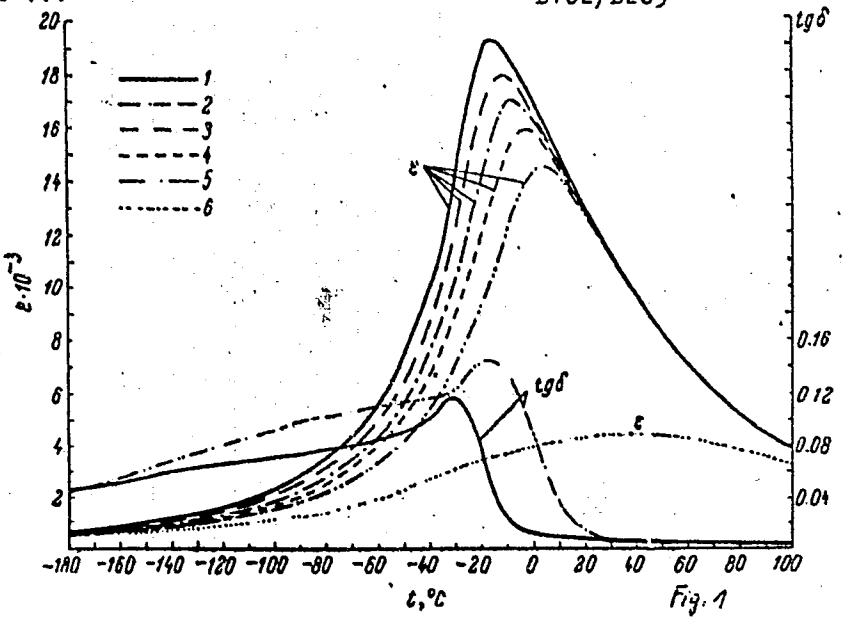

Fig. 1

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Electrical and ...

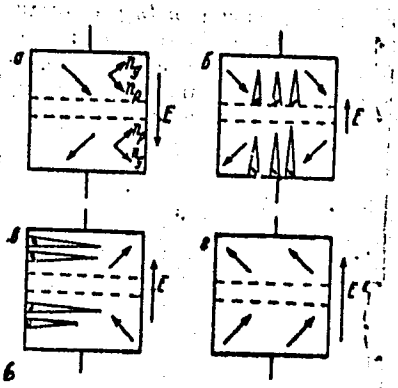

Fig. 6

Fig. 6

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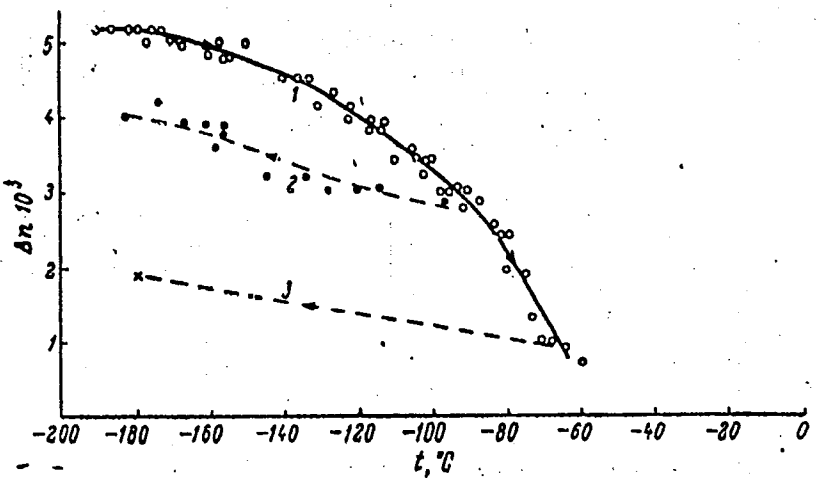
Electrical and ...

Fig. 7



Card 7/8

20793

S/181/61/003/003/019/030
B102/B205

Electrical and ...

Legend to Fig. 8:
1) 100 cps, 2) 1 kc,
3) 10 kc, 4) 60 kc,
5) 600 kc.

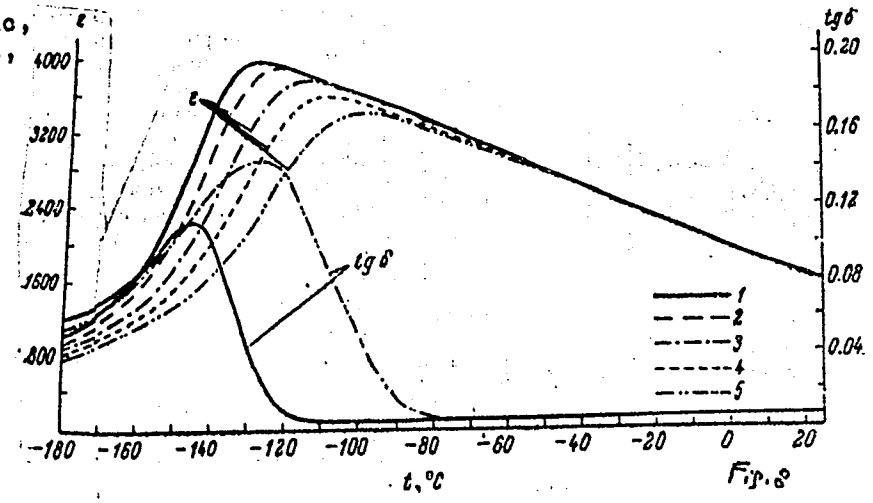


Fig. 8

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S/056/62/042/002/054/055
B108/B138

AUTHORS: Bokov, V. A., Myl'nikova, I. Ye., Smolenskiy, G. A.

TITLE: Ferroelectric antiferromagnetics

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 42, no. 2, 1962, 643-646

TEXT: The authors proved the assumed existence of perovskite-type ferroelectric antiferromagnetics at the compounds $Pb(Fe_{2/3}W_{1/3})O_3$ and $Pb(Fe_{1/2}Nb_{1/2})O_3$ (the ions in parentheses are located at the octahedral sites). The electric properties were measured at single crystals and the magnetic properties at finely ground crystal powder. Results for the first compound are shown in the Fig. The second compound has similar properties. The temperatures of ferroelectric phase conversion are 178°K for $PbFe_{2/3}W_{1/3}O_3$ and 387°K for $PbFe_{1/2}Nb_{1/2}O_3$ (maximum of ε). The phase conversion temperatures from paramagnetic into antiferromagnetic state are 363°K for $PbFe_{2/3}W_{1/3}O_3$ and 143°K for $PbFe_{1/2}Nb_{1/2}O_3$. However, all these

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phase conversions are rather washed out so that the given temperatures are only approximate. The Néel temperature of these compounds is much lower than in orthoferrites since the former contain a considerable number of unmagnetic ions at the octahedral sites. The experimental and calculated Néel temperatur s of $PbFe_{2/3}W_{1/3}O_3$ (363 and 406°K, respectively) are in good agreement. For $PbFe_{1/2}Nb_{1/2}O_3$ these values (143 and 276°K, respectively) differ considerably owing to the segregation of ions of one kind in the sublattice in the case of high "dilution" of the solid solution. The relatively small effective magnetic moment of the Fe^+ ions in $PbFe_{2/3}W_{1/3}O_3$ (μ_{eff} = 4.2 μ_B, calculated 5.92 μ_B) is due to the inexact extrapolation of the linear part of the $1/\chi(T)$ curve. For $PbFe_{1/2}Nb_{1/2}O_3$, μ_{eff} = 5.4 μ_B. A residual magnetic moment could not be observed owing to the high coercive force. There are 1 figure, 1 table, and 5 references: 2 Soviet and 3 non-Soviet. The two references to English-language publications read as follows: J. Tsubokawa, J. Phys. Soc. Japan, 15, 2243, 1960; M. A. Gillo, J. Phys. Chem. Solids, 13, 33, 1960.

Ferroelectric antiferromagnetics

S/056/62/042/002/054/055
B108/B138

ASSOCIATION: Institut poluprovodnikov Akademii nauk SSSR (Institute of Semiconductors of the Academy of Sciences USSR)

SUBMITTED: December 17, 1961

Legend to the Fig.: temperature dependences of (1) χ, (2) $1/\chi$, (3) ε, (4) $\tan\delta$.

Card 3/3

BOKOV, V. A.; SMOLENSKIY, G. A.

"On the coexistence of magnetic and electric ordering in crystals."

Report presented at the 9th Annual Conference on Magnetism and Magnetic Materials, Atlantic City, New Jersey, 12-15 Nov 63.

Institute of Semiconductors, Academy of Sciences of USSR, Leningrad

ACCESSION NR: AP4028463 S/0181/64/006/004/1240/1242

AUTHORS: Tutov, A. G.; Mywl'nikova, I. Ye.; Parfenova, N. N.; Bokov, V. A.; Kizhayev, S. A.

TITLE: New compounds in the systems Bi_2O_3-Me_2O_3(Fe^{3+}, Al^{3+}, Ga^{3+}, Mn^{3+})

SOURCE: Fizika tverdogo tela, v. 6, no. 4, 1964, 1240-1242

TOPIC TAGS: Bi_2O_3-Fe_2O_3, Bi_2O_3-Al_2O_3, Bi_2O_3-Ga_2O_3, Bi_2O_3-Mn_2O_3, orthorhombic crystal, unit cell, cell parameter, magnetization, paramagnetic, antiferromagnetic

ABSTRACT: The authors have undertaken a study of compounds combining Bi_2O_3 with the sesquioxides of Fe, Al, Ga, and Mn because of the lack of data on these substances. Among iron compounds they obtained $Bi_2O_3 \cdot 2Fe_2O_3$. In the Al and Ga compounds they synthesized an isomorphous series. Chemical analyses were not made (because of small quantities produced) but similar formulas were assumed ($Bi_2O_3 \cdot 2Al_2O_3$ and $Bi_2O_3 \cdot 2Ga_2O_3$). For Mn, results indicate a composition of $Bi_2O_3 \cdot 2Fe_2O_3$.4. The specific gravity of the latter crystal (by picnometer is 7.33, of the Fe

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ACCESSION NR: AP4028463

mineral 6.81. Single crystals were obtained of all these compounds. Ceramic samples were also obtained of the Fe compound. The specific gravity of these samples is 6.53. The Al and Ga compounds formed transparent, rectangular, light green prisms. The Fe and Mn minerals proved to be orthorhombic, with cell parameters of a = 7.88 Å, b = 8.40 Å, c = 6.00 Å and a = 7.47 Å, b = 8.52 Å, c = 5.75 Å respectively. Magnetization of the Fe compound, measured in a field reaching a maximum of 8000 oersteds, rises with temperature and passes through a maximum at 265K before descending. No residual magnetization was observed. This suggests that at 265K the mineral undergoes a transition from the paramagnetic to the antiferromagnetic state. "In conclusion, the authors express their thanks to Professor G. A. Smolenskiy for his interest in the work." Orig. art. has: 1 figure.

ASSOCIATION: Institut poluprovodnikov AN SSSR, Leningrad (Institute of Semiconductors AN SSSR)

SUBMITTED: 23Nov63 DATE ACQ: 27Apr64 ENCL: 00

SUB CODE: PH NO REF SOV: 004 OTHER: 001

Card 2/2

ACCESSION NR: AP4030631

S/0048/64/028/004/0614/0619

AUTHOR: Smolenskiy, G.A.; Bokov, V.A.; Mitsek, A.I.

TITLE: Regarding the existence of magnetic and electric ordering in crystals [Report, Symposium on Ferromagnetism and Ferroelectricity held in Leningrad 30 May to 5 June 1963]

SOURCE: AN SSSR. Izv.,Ser.fiz.,v.28, no.4, 1964, 614-619

TOPIC TAGS: ferromagnetic ferroelectric materials, perovskite structure, ferromagnetic ordering, ferroelectric ordering, $BiFeO_3$, $YMnO_3$, $YbMnO_3$

ABSTRACT: The authors point out that there is no basic principle forbidding the simultaneous appearance of ferroelectric and ferromagnetic ordering in the same crystal, and they discuss recent work, both their own and others', indicating the existence of such double ordering in some substances. Two of the authors have given a thermodynamic discussion of simultaneously ferromagnetic and ferroelectric materials (G.A.Smolenskiy, Fizika tverdogo tela,4,No.5,1095,1962; A.I.Mitsek and G.A.Smolenskiy,Ibid.No.12,3581,1962). These substances are characterized by a combined electromagnetic susceptibility tensor relating both the polarization and the magne-

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ACCESSION NR: AP4030631

tization to the electric and the magnetic field. Possible interaction mechanisms between polarization and magnetization are: interaction of both with the elastic deformations of the crystal; the influence of electric charge distribution on the formagnetic exchange interaction; the influence of electric charge distribution on the electron orbits, and therefore on the spin-orbit coupling. Particularly favorable for the simultaneous appearance of ferromagnetic and ferroelectric properties are complex crystals with the perovskite structure containing transition metals and ions having an unshared 6s electron pair. $Pb(Fe_{2/3}W_{1/3})O_3$ and $Pb(Fe_{1/2}Nb_{1/2})O_3$ were investigated and found to be ferroelectric as well as antiferromagnetic. Some of the ferric ions do not participate in the antiferromagnetic ordering and so behave paramagnetically, leading to an increase in the susceptibility with decreasing temperature even below the Neel point. Calculations of the Neel point (G.A.Smolenskiy, V.A. Isupov, N.N.Kraynik and A.I.Aranovskaya,Izv.AN SSSR,Ser.fiz.25,1333,1961), on the assumption that a ferric ion participates in the antiferromagnetic ordering only when it has at least two magnetic nearest neighbors, gave results in reasonable agreement with experiment for $Pb(Fe_{2/3}W_{1/3})O_3$. There have been indications, particularly from its behavior in certain solid solutions, that the antiferromagnetic $BiFeO_3$ might be ferroelectric. The low resistivity of this substance, however, can

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ACCESSION NR: AP4030631

give rise to errors. High frequency electrical measurements on $BiFeO_3$-$LaFeO_3$ solid solutions showed that $BiFeO_3$ is not ferroelectric. The ferroelectric materials $YMnO_3$ and $YbMnO_3$ were found to be antiferromagnetic, with Neel points below the temperature of liquid nitrogen. Orig.art.has: 40 formulas, 3 figures and 1 table.

ASSOCIATION: none

SUBMITTED: 00 DATE ACQ: 30Apr64 ENCL: 00

SUB CODE: GP, EM NR REF SOV: 011 OTHER: 004

Card 3/3

IL'IN, Georgiy Sergeyevich; BOKOV, V.A., red.

[Ceramic piezoelectric elements] Keramicheskie p'ezo-elementy. Leningrad, 1963. 19 p. (Leningradskiy dom nauchno-tekhnicheskoi propagandy. Seriia: Elektricheskie metody obrabotki materialov, no.2) (MIRA 17:9)

L 10110-65 EWT(1)/EPA(s)-2/EEC(t)/EEC(b)-2 Pt-10/Pl-4 IJP(c)/AFWL/SSD/
AS(mp)-2/RAEM(c)/ESD(gs)/ASD(a)-5/RAEM(e)/ESD(t)/RAEM(t) GG
ACCESSION NR: AP4046616 S/0181/64/006/010/3038/3044

AUTHOR: Bokov, V. A.; Kizhayev, S. A.; My*l'nikova, I. Ye.; Tutov, A. G.

TITLE: Antiferroelectric and magnetic properties of $PbCo_{1/2}W_{1/2}O_3$

SOURCE: Fizika tverdogo tela, v. 6, no. 10, 1964, 3038-3044

TOPIC TAGS: single crystal growth, lead cobalt tungstate crystal, perovskite type structure, ferroelectric crystal, antiferroelectric crystal, paramagnetic crystal, phase transition

ABSTRACT: $PbCo_{1/2}W_{1/2}O_3$ single crystals were grown from solution in molten PbO, and their crystal structure, and electric and magnetic properties were determined and compared to those of $PbNb_{1/2}W_{1/2}O_3$, which is the only known stable antiferroelectric of the $A^{2+}B^{5+}_{1/2}W_{1/2}O_3$ series of compounds. The x-ray powder patterns indicated a perovskite-type structure with a rhombic unit cell at room temperature and a cubic cell at 50C, with ordered distribution of Co^{2+} and W^{6+} ions. The temperature dependence of the dielectric constant of large single crystals showed a maximum at 32C, corresponding to the transition from the

Card 1/3

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ACCESSION NR: AP4046616

paraelectric (cubic) phase to the antiferroelectric (rhombic) phase. This maximum shifted toward lower temperatures on application of an increasing constant electric field. The observed double hysteresis loops in the antiferroelectric phase, i.e., at low temperatures (below -100C) when strong electric fields are applied, was correlated with an induced transition from the antiferroelectric into the ferroelectric state. The double hysteresis loop was gradually transformed into a normal loop when temperature was decreased further to -193C. The transition point into the ferroelectric state in the absence of a field was determined to be -206C. The "critical" field, at which the hysteresis loop disappears, was shown to decrease with decreasing temperature. The transition into the ferroelectric state in a strong electric field is possible because of a small difference in the free energies of both states. The antiferroelectric state is more stable in $PbNi_{1/2}W_{1/2}O_3$ than in $PbCo_{1/2}W_{1/2}O_3$, since no double loop was obtained in the former. The temperature dependence of the specific magnetic susceptibility of $PbCo_{1/2}W_{1/2}O_3$ could not be correlated with the appearance of antiferroelectricity, although a deviation from the Curie-Weiss law was noted below -100C. The absence of magnetic-phase transitions was deduced, at least in the temperature range above -196C. Orig. art. has: 6 figures.

Card 2/3

L 10410-65

ACCESSION NR: AP4046616

ASSOCIATION: Institut poluprovodnikov AN SSSR, Leningrad (Institute of Semiconductors, AN SSSR)

SUBMITTED: 21Apr64 ATD PRESS: 3116 ENCL: 00

SUB CODE: SS, EM NO REF SOV: 009 OTHER: 003

Card 3/3

BOKOV, V.A.; ROMANOV, V.P.; CHEKIN, V.V.

Mossbauer effect on Sn^{119} nuclei due to the ferroelectric phase transition in the solid solution $Ba(Ti_{0.8}, Sn_{0.2})O_3$. Fiz. tver. tela 7 no.6:1886-1888 Je '65. (MIRA 18:6)

1. Fiziko-tekhnicheskiy institut nizkikh temperatur, Khar'kov i Institut poluprovodnikov AN SSSR, Leningrad.

L 6463-66 EWT(1)/EWP(e)/EPA(s)-2/EWT(m)/EWP(i)/EPA(w)-2/EWP(t)/EWP(b) DIAAP/
ACC NR: AP5025259 IJP(c) JD/WH SOURCE CODE: UR/0386/65/002/004/0186/0189

AUTHOR: Chekin, V. V.; Romanov, V. P.; Verkin, B. I.; Bokov, V. A.

ORG: Physicotechnical Institute of Low Temperatures, Academy of Sciences UkrSSR (Fiziko-tekhnicheskiy institut nizkikh temperature Akademii nauk UkrSSR)

TITLE: Change in the probability of the Mossbauer effect on Sn^{119} impurity nuclei in the ferroelectric phase transition in $BaTiO_3$

SOURCE: Zhurnal eksperimental'noy i teoreticheskoy fiziki. Pis'ma v redaktsiyu (Prilozheniye), v. 2, no. 4, 1965, 186-189

TOPIC TAGS: Mossbauer effect, ferroelectric effect, phase transition, barium titanate, impurity center, tin containing alloy

ABSTRACT: This is a continuation of earlier work (FTT v. 7, 1886, 1965), where it was assumed that the phase transition in solid solutions of the $Ba(Ti_{0.8}Sn_{0.2})O_3$ system is considerably spread out. In the present study, the authors have investigated the probability of the Mossbauer effect on Sn^{119} impurity nuclei in the $Ba(Ti_{0.99}Sn_{0.01})O_3$ system near the ferroelectric phase-transition temperature. The introduction of so small an amount of tin impurity into barium titanate does not change its ferroelectric properties noticeably, but at the same time makes it possible to measure the resonance absorption of 23.8-kev γ quanta by the Sn^{119} impurity nuclei. The samples were prepared by standard ceramic technology, using tin oxide enriched with Sn^{119} to 65.1%. The measurements were made with a setup in which the absorber was driven at constant

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L 6463-66
ACC NR: AP5025259

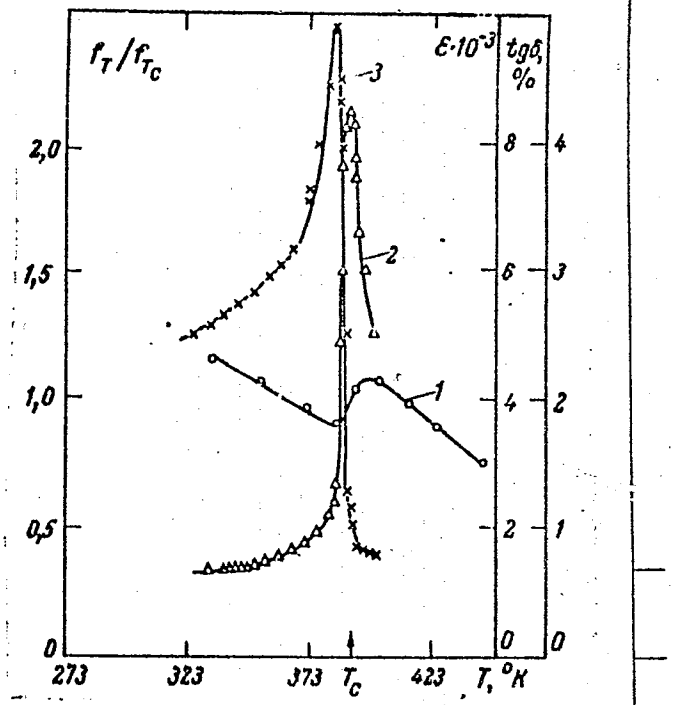

Fig. 1. Temperature dependence of the relative Mossbauer effect probability (1), dielectric constant (2), and dielectric loss tangent for the system $Ba(Ti_{0.99}Sn_{0.01})O_3$.

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speed by means of a mechanical cam drive. The γ-quantum source was magnesium stannide ~18 mg/cm² thick. Measurements were made of the temperature dependence of the relative Mossbauer-effect probability (1), of the dielectric constant (2), and of the dielectric loss tangent (3) for the system $Ba(Ti_{0.99}Sn_{0.01})O_3$ (Fig. 1). The relative probability of the effect was determined from the ratio of the areas of the absorption spectra at the given temperature to the area of the spectrum at the Curie temperature, the value of which (T_C = 390K) was chosen to correspond to the maximum of the dielectric constant. It is seen from the figure that the relative Mossbauer-effect probability decreases quite sharply on approaching the Curie point from the paraelectric region, passes through a minimum, and then begins to grow with decrease in temperature in the usual manner. This singularity can be attributed to the temperature dependence of the frequency of the anomalous optical branch. A comparison of the results with earlier measurements (Bokov, Romanov, and Chekin, FTT v. 7, 1886, 1965) confirms the previously advanced hypothesis that the phase transition in solid solutions of the $Ba(Ti_{0.8}Sn_{0.2})O_3$ system is considerably "smeared." Authors thank Professor G. A. Smolenskiy for continuous interest in the work, Candidate of Technical Sciences I. E. Myl'nikov for preparing the samples, and L. I. Kazakevich for help with the measurements. Orig. art. has: 1 figure.

SUB CODE: SS/ SUBM DATE: 21Jun65/ ORIG REF: 003/ OTH REF: 002

nw

Card 3/3

L 57038-65 EWT(l)/EPA(s)-2/EWT(m)/EEC(t)/T/EWP(t)/EWP(b)/EWA(c) Pt-7/Pl-4
UJP(c) JD/JG/GG
ACCESSION NR: AP5016122 UR/0048/65/029/006/0929/0932

AUTHOR: Bokov, V.A.; Kizhayev, S.A.; Myl'nikova, I.Ye.; Tutov, A.G.; Ostroumov, A.G.

TITLE: Antiferroelectric and ferroelectric phase transitions in $PbCo_{0.5}W_{0.5}O_3$ [Report, 4th All-Union Conference on Ferroelectricity held in Rostov-on-the-Don 12-18 Sept 1964]

SOURCE: AN SSSR. Izvestiya. Ser.fizicheskaya, v.29,no.6,1965, 929-932

TOPIC TAGS: ferroelectric material, antiferroelectric material, antiferromagnetic material, perovskite structure, lead compound, cobalt compound, tungsten compound, single crystal

ABSTRACT: The authors have grown single crystals of $PbCo_{0.5}W_{0.5}O_3$ by cooling a solution in PbO from 1200 to 800°C at the rate of 5°C/hour. X-ray diffraction measurements with powders of the single crystals gave values of the lattice constants in agreement with those obtained for polycrystalline material by V.C.Filip'ev and Ye.G.Fesenko (Kristallografiya 9,293,1964). The material has the perovskite structure

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and the symmetry is rhombohedral at 26°C and cubic at 50°C. The dielectric constant was found to have a maximum at 32°C. This maximum exhibited slight temperature hysteresis and was shifted toward lower temperatures by application of an electric field. The dielectric constant curve had a knee at 68°K and the loss tangent was maximum at 58°K. With thin (50 micron) plates, double hysteresis loops were observed below -100°C in fields of the order of 150 kV/cm. The hysteresis loops were single at liquid nitrogen temperatures. It is concluded that the material undergoes a phase transition from the paraelectric to the antiferroelectric state at 32°C and from the antiferroelectric to the ferroelectric state at 68°K. The appearance of minor hysteresis loops above the ferroelectric transition temperature is discussed. The magnetic susceptibility was measured. Deviations from the Curie-Weiss law indicate that the material becomes antiferromagnetic at sufficiently low temperatures. Orig.art.has: 4 figures.

ASSOCIATION: none

SUBMITTED: 00 ENCL: 00 SUB CODE: SS, IC

NR REF SOV: 005 OTHER: 000

Card 2/2

L 10760-66 EWT(1)/EWT(m)/T/EWP(t)/EWP(b) IJP(c) JD/JW/GG
ACC NR: AP5022747 SOURCE CODE: UR/0181/65/007/009/2868/2871

AUTHOR: Kizhayev, S. A.; Tutov, A. G.; Bokov, V. A.

ORG: Institute of Semiconductors AN SSSR, Leningrad (Institut poluprovodnikov AN SSSR)

TITLE: Structure and magnetic properties of $TlMnF_3$

SOURCE: Fizika tverdogo tela, v. 7, no. 9, 1965, 2868-2871

TOPIC TAGS: thallium compound, manganese compound, fluoride, x ray analysis, crystal structure, magnetic property

ABSTRACT: Data are given from x-ray and magnetic studies of a new compound, $TlMnF_3$. The specimens were produced by mixing saturated aqueous solutions of thallium fluoride and manganese fluoride at 20°C. CuK_α and CrK_α were used for the x-ray studies with photographic and ionization recording. It was found that the new compound has a perovskite structure. The lattice has a cubic cell with a parameter $a = 4.250 \pm 0.001$ angstroms. The interplanar spacing and radiation intensities of $TlMnF_3$ are tabulated for various Miller indices. The magnetic susceptibility of the compound is plotted as a function of temperature from 65 to 520°K. This curve shows a maximum at 85°K which is apparently due to a transition to the antiferromagnetic state. The authors are

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ACC NR: AP5022747

grateful to G. A. Smolenskiy for interest in the work, and also thank V. B. Mironov, A. N. Lazarev and A. S. Barsukov for furnishing the specimens. Orig. art. has: 1 figure, 5 formulas, 2 tables.

SUB CODE: 20,07/ SUBM DATE: 23Apr65/ ORIG REF: 001/ OTH REF: 005

Card 2/2

L 15742-66 EWT(m)/EWP(w)/T/EWP(t)/EWP(b) IJP(c) JD

ACC NR: AP6000897 SOURCE CODE: UR/0181/65/007/012/3695/3698

AUTHORS: Bokov, V. A.; Myl'nikova, I. Ye.; Kizhayev, S. A.; Bryzhina, M. F.; Grigoryan, N. A.

ORG: Institute of Semiconductors, AN SSSR, Leningrad (Institut poluprovodnikov AN SSSR)

TITLE: Structure and magnetic properties of $BiMnO_3$

SOURCE: Fizika tverdogo tela, v. 7, no. 12, 1965, 3695-3698

TOPIC TAGS: bismuth compound, manganese compound, magnetic property, temperature dependence, Curie point, ferromagnetic material, solid solution, ferroelectricity

ABSTRACT: The authors synthesized the $BiMnO_3$ in the form of small whiskers, using a technique described elsewhere (FTT v. 6, 1240, 1964), and measured its magnetic properties at temperatures from 55K to room temperature at $H_{max} = 9.5$ kOe. They found $BiMnO_3$ to be a ferromagnet

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ACC NR: AP6000897

with a Curie point at 110K. The large ferromagnetic moment of $BiMnO_3$ is attributed to positive exchange interaction in the chains Mn^{3+} -- O -- Mn^{3+}. The authors also synthesized solid solutions $Bi_{1-x}Ca_xMnO_3$ with x = 0.4, 0.3, and 0.2, using a standard ceramic technique. An investigation of the magnetic properties of these solid solutions at temperatures from 77K to room temperature has shown that increasing $CaMnO_3$ concentration the paramagnetic Curie temperature decreases. The solid solution $Bi_{0.6}Ca_{0.4}MnO_3$ has a maximum magnetic susceptibility at 155K. The drop in the paramagnetic Curie point with increasing x is related to a decrease in the distances between ions of the manganese in all three directions. The existence of the compound $BiMnO_3$ and of solid solutions on its basis offers, in the authors' opinion, another possibility of obtaining ferroelectric-ferromagnets. Authors thank G. A. Smolenskiy for encouraging this work and for a discussion of the results. Orig. art. has: 2 figures

SUB CODE: 20, 11/ SUBM DATE: 23Jul65/ ORIG REF: 006/ OTH REF: 002

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L 21219-66 EWT(m)/EWP(w)/T/EWP(t) IJP(c) JD/JG
ACC NR: AP6003809 SOURCE CODE: UR/0181/66/008/001/0265/0267

AUTHORS: Kizhayev, S. A.; Bokov, V. A.; Kachalov, O. V.

ORG: Institute of Semiconductors AN SSSR, Leningrad (Institut poluprovodnikov AN SSSR)

65
60
B

TITLE: Magnetic properties of $YMnO_3$

SOURCE: Fizika tverdogo tela, v. 8, no. 1, 1966, 265-267

TOPIC TAGS: yttrium, compound, ferromagnetism, magnetic susceptibility, single crystal, magnetic moment, temperature dependence, neutron diffraction, antiferromagnetism

ABSTRACT: In view of the lack of convincing data allowing to conclude the existence of weak ferromagnetism and in $YMnO_3$, the authors measured its magnetic properties using single-crystal samples, at low temperatures. The magnetic susceptibility was measured with a magnetic balance by the Faraday method in the temperature interval from 4.2 to 300K at a maximum field of 13.6 kOe. The apparatus employed was described in detail by N. M. Kreynes (Dissertation, IFP,

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M., 1959). The synthesis of the single crystals was described by the authors earlier (FTT v. 5, 3607, 1963). The specific susceptibility decreased slowly with increasing temperature, and no spontaneous magnetic moment was observed at low temperatures. Nor were anomalies observed, characteristic of antiferromagnetic phase transitions, on the temperature dependence of the reciprocal magnetic susceptibility. Neutron diffraction has disclosed, however, the presence of antiferromagnetic ordering at 4.2K. Judging from the values of the lattice parameter, the temperature of the antiferromagnetic ordering should lie in the liquid-nitrogen range. It is concluded on the basis of the data that $YMnO_3$ is not a weak ferromagnet, but a compensated antiferromagnet. The authors thank G. A. Smolenskiy for interest, A. S. Borovik-Romanov for the opportunity of performing the magnetic measurements at low temperature, I. Ye. Myl'nikova for supplying the single crystals, and N. M. Kreynes for reviewing the manuscript and valuable remarks. Orig. art. has: 2 figures.

SUB CODE: 20/ SUBM DATE: 30Jul65/ ORIG REF: 004/ OTH REF: 007

L 38887-66 EWP(e)/EWT(m)/EWP(w)/T/EWP(t)/ETI IJP(c) AT/WH/JD/HW/JG

ACC NR: AP6018577 SOURCE CODE: UR/0181/66/008/006/1957/1959

AUTHOR: Kizhayev, S. A.; Bokov, V. A.

ORG: Institute of Semiconductors, AN SSSR, Leningrad (Institut poluprovodnikov AN SSSR)

TITLE: Magnetic properties of $PbCo_{0.5}W_{0.5}O_3$ and $BaNi_{0.5}W_{0.5}O_3$

SOURCE: Fizika tverdogo tela, v. 8, no. 6, 1966, 1957-1959

TOPIC TAGS: lead compound, barium compound, phase transition, ferroelectricity, antiferroelectricity, magnetic moment, magnetic susceptibility, ferromagnetism, antiferromagnetism, magnetic susceptibility

ABSTRACT: This is a continuation of earlier work (Izv. AN SSSR, ser. fiz. v. 29, 929, 1965) where it was found that $PbCo_{0.5}W_{0.5}O_3$ (I) has two phase transition points connected with electric ordering, becoming antiferroelectric at 305K and ferroelectric at 68K. The present study was made on this substance at low temperatures and also on $BaNi_{0.5}W_{0.5}O_3$ (II) at liquid-hydrogen temperatures, since the latter had no magnetic phase transitions above room temperature. The measurements were made with apparatus described by N. M. Kreynes (Dissertation, Institute of Physics Problems, Moscow, 1959). In the case of I the magnetic susceptibility goes through a maximum at 9K. At this temperature a spontaneous magnetic moment is produced, amounting to 0.15 G-cm^2/g at 4.2K. In the case of II, the susceptibility has a maximum at 55K and no spontaneous magnetic moment was observed. It is concluded from the magnetic mea-

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surements that II becomes antiferromagnetic at 55K, and I becomes at 9K antiferromagnetic with weak ferromagnetism. The Neel temperatures of II and I are 17 and 9K, respectively. The results show that I below 9K is simultaneously ferroelectric and weakly ferromagnetic. This points to the existence of a new type of perovskites with both electric and magnetic ordering simultaneously. The authors thank G. A. Smolenskiy for interest in the work and a discussion of the results, A. S. Borovik-Romanov and N. M. Kreynes for the opportunity to make the measurements at low temperatures, and I. Ye. Myl'nikov for preparing the samples. Orig. art. has: 2 figures and 1 table.

SUB CODE: 20/ SUBM DATE: 04Jan66/ ORIG REF: 002/ OTH REF: 004