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Program and abstracts

of undoped samples (x = 0.1) at temperature 4.2 K. The intensity of this band and its width decreases with increasing oxygen content in the compound and increasing temperature. All experimental data can be explained in terms of long-life self-localized states appearing in a gap at photoexcitation. To clear up the nature of lattice distortion caused by excited carriers a new compound was prepared with static defects stipulated by isostructural inclusion of small amount of admixture atoms. For such samples new peculiarities in photoinduced absorption spectrum and a weak luminescence are detected. The data obtained have enabled us to find a correlation between the the of crystal lattice local distortions and electronic properties of the material which is important for theory of superconductivity. The experimental procedure may be also used as a convenient method to check the quality of materials. Some recommendations are given to improve the characteristics of real HT9C structures and HTSC-based devices.

MC-EP55. XPS STUDY OF $Pb_2Sr_2R_{1-x}Ca_xCu_9O_{8+y}$ (R: Nd, Y; x=0, 0.5) *N. V. Dan'ko, I. I. Kravchenko, V. M. Pan, A. G. Popov, A. I. Senkevich, A .P. Shpak, Institute of Metal Physics, Kiev, Ukraine; V. S. Melnikov, Institute of Geochemistry and Mineral Physics, Kiev, Ukraine* — The present work deals with the influence of compositions on the ions valence states and superconductivity in the $Pb_2Sr_2R_{1-x}Ca_xCu_3O_{8+y}$ phase (Cava phase). The $Cu2p_{3/2}$, Pb4f, Sr3d, Sr3p, Ca2p, O1s core levels were investigated. Ions ratios Cu^{1+} /Cu^{2+} and Pb^{2+} / Pb^{4+} have been determined by computer processing. We have obtained that these ratios depended on the composition and the number of Cu^{4+} and Pb^{4+} ions appeared to excess the values predicted by the known structure model of this phase. The chemical shifts of Sr, Ca core levels appeared to be negative. This feature have been also observed early in another HTSC phases and seems to be connected with the nature of high temperature superconductivity. O1s photoelectron spectrum has shown that the samples surfaces contained some carbonate contaminations and that stability of surface composition took place at the conditions of X-ray irradiation and high vacuum.

MC-EP56. THE TWO-BANDS SUPERCONDUCTIVITY IN THE THALLIUM HIGH-T_c SUPERCONDUCTORS, *Schetkin I. S., Osmanov T. Sh., Abramov N. V., Institute for Problems of Materials Sci., Acad. of Sci. of Ukraine, Kiev, Ukraine* — The results of the investigation of the volt-ampere characteristics (VAC) for the bridges formed on the $Tl_2Ba_2Ca_2Cu_3O_x$ ceramic briquettes which were produced by modifying technology with T_c° = 125 K and the thick-film bridges on the basis of this ceramics with the temperatures superconducting transition for various substrates about T_c = 90—120 K are represented. The bridges have the width about 20—50 μm and the cross-section about S ~ 10^{-3}—10^{-6} cm^2. The presence of the voltage jumps on start section of the VAC which are eroding and are removing to the region of low currents up to complete disappearence when the temperature is increasing, it is consequence of change of the smaller energy gap $\Delta 2$ depending on temperature which correspond to one of groups of electrons (of the first energy band). The temperature dependence of the bigger energy gap $\Delta 1$ which appear in energy spectrum of the second group of electrons (of the second energy band), it is defined from the currents of complete transition to normal state. The temperature dependences of the energy gaps is analogous to BCS theory. Their ratio is about Δ_2 / Δ_1 ~ 0.4—0.6. The estimations of the magnitudes about $2\Delta_2$ ~ 3—3.6 k_BT_c and $2\Delta_1$ ~ 6—8 k_BT_c are corresponding to the results received by another experiments. The temperature dependence of the critical currents have been reestablished according to starting currents of appearence of the voltage on VAC. At T ~ 80 K J ~ $(4—6)\cdot 10^3$ A/cm^2, it is enabling to real use thallium HTSC in SQUID-electronics, production of the noise immunity screens, thick-film microelectronics. The second particularity of the VAC for the bridges with cross-section $S^* < 10^{-5}$ cm^2 is presence of the I-V stages interpreted in framework of the model of phase-slip-centers. Appearences of the intergrain connections are possible.

MC-EP57. TEMPERATURE DEPENDENCE OF ELECTRIC RESISTANCE OF BOUNDARY LAYER YBaCuO/In IN THE RANGE OF 300 TO 4.2 K, *Y. A. Frolov, A. A. Chupikov, Kharkov Institute of Physics and Technology, Kharkov* — Electron spectrum of YBaCuO with metallic hole conductivity changes, as a result of implantation of electrons by neighbouring In, to semiconducting one. The temperature dependence of electric resistance of the YBaCuO/In boundary layer shows distinct peculiarities at 207 K and 155 K. At 92 K the dielectrization of the layer is lost that is, probably, due to the change of free charge carrier concentration. The similar effect observed at 60 K is related, probably, to the presence of small quantities of the second phase. The reliable registration of these peculiarities in the temperature dependence of electric resistance of the boundary layer allows one to conclude that HTSC electron spectrum modification by electron implantation of the correctly selected donor coating can be used for registration of lesser changes in HTSC electronic spectrum than in the case when measured is the electric resistance of the initial HTSC.

MC-EP58. THE VARIATIONS OF ELECTRIC PROPERTIES $YBa_2Cu_3O_{7-x}$ AT LOW-TEMPERATURE (30 K) REACTOR NEUTRON IRRADIATION, *A. R. Pustovoit, B. A. Borisov, R. F. Konopleva, G. D. Porsev, V. A. Chekanov, S. O. Bohanov, M. V. Chudakov, Leningrad Nuclear Physics Institute of Ac. Sci., Gatchina* — Investigating the variations of resistive and superconducting properties of HTSC ceramics during its irradiation by reactor neutrons at temperature 30 K we found these variations to be inmonotonous. Tc, the transition temperature, increases from the initial value 92.3 K to its maximum value 95 K at fast (E > 1 MeV) neutron fluence, F, ~10^{18}, then decreases with the rate dT/dF = $-2.5\cdot 10^{-18}$ Kcm^2/n, and the resistivity at 100 K, ρ_{100}, after passing a wide minimum at F=10^{16}—10^{17} n/cm^2, grows with the rate dp/dF ~ $6\cdot 10^{-23}$ Ohm·cm^3/n. We suppose that at low fluence the irradiation leads to an ordering of oxygen in Cul-O plane due to radiation induced diffusion, while at large F dominates its disordering effect connected with the formation of radiation defects.

MC-EP59. EFFECTS OF GAMMA-RAY IRRADIATION AND ANNEALING ON CERAMIC Y-Ba-Cu-O AND Bi-Pb-Sr-Ca-Cu-O SUPERCONDUCTORS, *L. F. Makarenko, V. A. Gurinovich, F. P. Korshunov, V. K. Shesholko, Institute of Physics of Solids and Semiconductors, Minsk, I. F. Kononyuk and V. A. Lomonosov Institute of General and Inorganic Chemistry, Minsk* — Superconducting $YBa_2Cu_3O_{7-\delta}$ and $(Bi_{1-x}Pb_x)_2Sr_2Ca_2Cu_3O_y$ ceramics with critical parameters, T_c = 92 K, ΔT = 0.5 K, J_c = 300—500 A/cm^2 and T_c = 107—108 K, ΔT = 4—5 K, J_c = 1000—1500 A/cm^2, respectively, were exposed to Co-60 gamma-ray irradiation. It was established that the rate of deterioration of the investigated materials depended on impurity phase content, environmental atmosphere and irradiation temperature. The degradation of Bi-based ceramics containing the 2212-phase proceeded most rapidly. The behavior of the samples containing Ca_2PbO_4 phase was similar to the single-phased one. The Y-based material preheated at temperature above 950 °C was very sensitive to gamma-irradiation. Additional annealing of this material at 920—930 °C in oxygen gave rise to its enhanced radiation stability. The radiation effect decreased when irradiation was performed in evacuated ampules or at lowered temperatures. It was concluded that radiation induced degradation was not due to radiation damage of the HTSC materials but was the result of radiation enhanced sorption of volatile impurities into grain boundaries.

MC-EP60. SUPERCONDUCTING RESISTIVE TRANSITION AND VORTEX-PAIR EXCITATION OF BULK

$Bi_2Sr_2CaCu_2O_8$ CRYSTALS, *V. R. Sobol, V. Ch. Kruplevich, S. N. Barilo, Institute of Physics of Solids and Semiconductors, Byelorussian Academy of Sciences, Minsk* — The measurements of temperature dependence of the resistive transition in $Bi_2Sr_2CaCu_2O_8$ bulk single crystals in external magnetic field up to 7T were made. The starting compounds of Bi_2O_3, $CaCO_3$, $SrCO_3$, CuO taken in the ratio 2:1:2:2 in metal and 10—30 wt% NaCl-RCl were melted in a Al_2O_3 crucible homogenized for 30 hours at 900 °C and then cooled at a rate of 0.5 °C/hour. The samples formed as a parallelepipeds typically with dimensions 5×5×12 mm consisted of thin single crystal plates with the c-axis normal to the plate and disoriented in about three degrees. Resistivity data were taken with a standard ac phase sensitive technique with 0.1—5 mA excitation current at 37 Hz. An external magnetic field was oriented both parallel and perpendicular to the c-axis. The dissipation observed at the superconducting transition is explained quantitatively in terms of the Kosterlitz-Thouless (RT) theory of vortex-antivortex pair excitations within the Cu-O planes. This conclusion is made from the observation of an exponential square-root singularity in the resistivity. The KT coupling parameter, RT phase transition temperature of 82.2 K and mean-field transition T = 84.7 K were obtained from the magnetoresistance data.

MC-EP61. MORPHOLOGY, DOMAIN STRUCTURE AND SUPERCONDUCTING PROPERTIES OF YBCO SINGLE CRYSTAL, *R. I. Yasnitsky, R. V. Lutsiv, A. V. Nosan, A. I. Otko, V. V. Tkachuk, M. V. Matviiv, Lviv State University* — The YBCO single crystal have grown from melt-solution on the basic of eutectic $BaCuO_2$-CuO for different starting compositions and cooling rates. The primary field crystalisation for YBCO was found.Single crystals were both thin plate and volume crystals with maximal dimension 5.0×5.0×0.1 mm and 4.0×3.0×1.5 mm respectively. Spirals and growing steps on the (001) surface, growing defects due to crystallization of the residual melt after decantation were observed. Very thin plates were obtained with nonequilibrium dendrite morphology and with zigzag-like gabit at the cooling rate above 50 K/h. Hopper-like morphology is seen on the (100) and (010) surfaces for volume crystals. Domain structure forming due to structural phase transition from tetra- into ortophase was observed. There were cross–like domain configuration formed in weak anizotrophy state area, irregular shaped pseudodomains, ferroelastic domain structure, "chess-board" like domain structure. The superconducting properties depend of the growing place in the melt. Single crystals growing in the melt are semiconductors. The crystals growing in the cavity and on the grow surface of melt had superconducting transmission temperature 40—80 K without additional annealing in oxygen.

MC-EP62. RECOVERY OF SUPERCONDUCTIVITY PARAMETERS IN IRRADIATED HTSC CERAMICS, *V. F. Yakovlev, I. M. Neklyudov, Yu. T. Petrusenko, A. N. Sleptsov, V. N. Borisenko, A. M. Bovda, V. T. Petrenko, Institute of Physics and Technology, Kharkov, Ukraine* — The recovery of the temperature of superconducting transition (T_c), critical current density (I_c) and electrical resistivity in the normal state (R) in ceramics samples YBaCuO and BiPbSrCaCuO subjected to low-temperature irradiation (T = 80 K) with electrons of energies between 10 and 30 MeV have been studied. The recovery stages of radiation-induced changes of T_c, I_c and R have been revealed in the temperature range 100—400 K. The correlation between recovery spectra of these parameters has been deduced. Two distinct temperature ranges characterized by different recovery rates of the superconductivity parameters have been found. In the first range (100—220 K) the recovery rates of T_c, I_c and R do not differ appreciably. In the second range (above 220 K), the difference increases with elevation of the annealing temperature. In this case, the I_c recovery rate significantly exceeds those of T_c and R. It has been demonstrated that the recovery of superconductivity parameters is determined by both the annihilation of radiation defects and the formation of their clusters. The comparison of the kinetics of annealing of radiation defects in ceramics and in YBaCuO single crystals has been carried out.

MC-EP63. EFFECT OF ELECTRON IRRADIATION ON SUPERCONDUCTIVITY IN HIGH TEMPERATURE SUPERCONDUCTORS, *Yu. T. Petrusenko, I. M. Neklyudov, V. F. Yakovlev, Institute of Physics and Technology, Kharkov, Ukraine* — The data survey on the kinetics of superconductivity parameters evolution in HTSC single crystals and ceramics under irradiation with high energy electrons (1—30 MeV) and in the course of post-irradiation annealing is presented. The effects of low doses are considered, viz., the enhancement of the intragrain critical current and the increase of the temperature of superconducting transition. It is shown that under electron irradiation there exist two ranges of fluences characterized by different degradation rates of Tc and R. In this case, for the perfect single crystal YBaCuO the functional dependence between T_c and R variations is a linear one, and for the electrons of energies between 10 and 30 MeV it may be described by the common relationship. In the course of annealing of the irradiated HTSC samples we observed the distinct structure of the recovery of superconducting parameters with the main stages at 190, 270 and 350 K. Two temperature ranges were observed: 100—220 K and higher than 220 K, characterized by different recovery rates of R and T_c. Possible mechanisms of the degradation and recovery of superconductivity parameters in irradiated HTSC samples are also discussed in this report.

MC-EP64. A BARREL-SHAPE FORM OF C_{60} AND LAYERED METAL-DOPED C_{60} SOLID, *L. A. Chernozatonskii, Center of Acoustic Microscopy, Institute of Chemical Physics, Moscow* — As a consequence of intermolecular collisions or internal strain, we suggest a "barrel"-type shape of the C_{60} molecules instead of a spherical (fullerene) form. The stretched C_{60} (D_{6h} symmetry) version has the same number of hexagonal and pentagonal faces, like C_{60} fullerene, but differs from the latter by a 6-fold symmetry axis and a mirror plane perpendicular to this axis. Nowadays in C_{60} solid molecules with diameter less then C_{60} fullerene one were observed by means of high resolution transmission electron microscopy and scanning tunneling microscope images obtained by RJ. Wilson showed clearly elongated clusters "with an apparent height 2A° greater than for the spherical C_{60}" closer to that of the proposed C_{60} barrelene, which has height 2A° greater than C_{60} fullerene. We have demonstrated how the C_{60} solid doped (A, B) metal atoms forms AB_2C_{60} layered hexagonal structure with three-level quasimetallic layers which are separated by quasi-dialectric layers of C_{60} barrel-shaped molecules. We qualitatively reconstructed energy level scheme and described fullerene-barrelene transition reaction for doped C_{60} crystal during decreasing of temperature to zero. We also considered C_{60} fullerene-barrelene mixed solids and compared them with founded by A.Zakhidov et al. orthorhombic C_{60} crystal. We discussed a possible mechanism of high-T_c superconductivity in these compounds connected with strong layered electron-phonon interaction via electric polarization along the conducting planes of the nonmirror symmetry.

MC-EP65. THE TRANSITION TEMPERATURE OF COMPOSITE HIGH-T_c SUPERCONDUCTORS WITH A WEAK FERROMAGNETIC COUPLING, *V. A. Cherenkov, The Research and Development Centre "Stabilization", Moscow, Russia* — The composite materials - superconductors - ferromagnetic superconductors - are representing a great interest for the cryogenic electronics radiotechniques. It is the main IS-element. A superconducting state in multilayer structures with ferromagnetic weak coupling SFS-structure is investigated. The superconducting transition temperature Tc (N) is outlined.

MC-EP66. GLASS MAGNETIC PHASE IN A NEW HIGH-T_c SUPERCONDUCTORS, *V. A. Cherenkov, The Research and Development Center "Stabilization", Moscow,*