

Soviet and Japanese Aerospace Literature

Throughout 1990 the *AIAA Journal* will carry selected abstracts on leading research topics from the Soviet aerospace literature and, as space permits, from similar Japanese literature. The topics will be chosen and the abstracts reviewed for pertinency by *AIAA Journal* editors. This month features High Temperature Superconductors from the USSR and Japan.

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Soviet Aerospace Literature This month: High Temperature Superconductors

A90-30348 Formation of localized magnetic moments in zinc-doped lanthanum-strontium superconductors (Obrazovanie lokalizovannykh magnitnykh momentov v lantan-strontsiyevykh sverkhprovodnikakh pri dopirovanii tsinkom). V. E. KATAEV, E. F. KUKOVITSKII, G. B. TEITEL'BAUM, and A. M. FINKEL'SHTEIN, *Pis'ma v Zhurnal Eksperimental'noi i Teoreticheskoi Fiziki* (ISSN 0370-274X), Vol. 51, Jan. 25, 1990, pp. 115-118.

Results of an electron paramagnetic resonance study of $\text{La}_{1.82}\text{Sr}_{0.18}(\text{Cu}_{1-x}\text{Zn}_x)\text{O}(4)$ are presented. It is shown that the substitution of $\text{Zn}(2+)$ nonmagnetic ions for copper ions leads to the formation of complexes with localized magnetic moments. For zinc concentrations of about 1 at. pct, the number of magnetic moments approaches that of the substituted atoms. This result is important for the verification of microscopic models of high-temperature superconductors.

A90-29022 Effect of a magnetic field on the critical current density of $\text{YBa}_2\text{Cu}_3\text{O}(7-x)$ ceramic (Vliianie magnitnogo polia na plotnost' kriticheskogo toka keramiki $\text{YBa}_2\text{Cu}_3\text{O}(7-x)$). A. D. KIKIN and I. S. KARIMOV, *Zhurnal Tekhnicheskoi Fiziki* (ISSN 0044-4642), Vol. 60, Jan. 1990, pp. 186-190. 9 Refs.

Induction methods for measuring the critical current of high-temperature superconductor are described with particular reference to the superconducting ceramic $\text{YBa}_2\text{Cu}_3\text{O}(7-x)$. For weak magnetic fields, where the well-known Campbell method is inapplicable, a method is proposed whereby the critical current is determined from the magnetic moment, measured by the induction method. This method also makes it possible to determine the critical current of the individual particles of superconducting ceramic powders.

A90-26431 Effect of weak magnetic fields on thin-film superconducting bridges of $\text{YBa}_2\text{Cu}_3\text{O}(7-x)$ (Vliianie slabyykh magnitnykh polei na tonkoplennochnye sverkhprovodiashchie mostiki iz $\text{YBa}_2\text{Cu}_3\text{O}(7-x)$). D. G. EMEL'IANENKOV, I. N. INKIN, V. A. KULIKOV, V. N. LAPTEV, L. V. MATVEETS et al., *Pis'ma v Zhurnal Tekhnicheskoi Fiziki* (ISSN 0320-0116), Vol. 15, Nov. 12, 1989, pp. 40-43.

Results of an experimental study of the effect of a magnetic field on the volt-ampere characteristics of thin-film superconducting bridges of $\text{YBa}_2\text{Cu}_3\text{O}(7-x)$ are reported. It is found that the characteristics of the thin-film structures are significantly affected by a magnetic field orthogonal to the film plane. This effect is observed even in the presence of fields of the order of tenths of an oersted (which corresponds to the geomagnetic field) and therefore must be taken into account in the practical applications of this type of structures (e.g., during the design of SQUIDS).

A90-26434 Energy gap in $\text{YBa}_2\text{Cu}_3\text{O}(x)$ from tunneling data for single crystals (Energeticheskaya shchel' v $\text{YBa}_2\text{Cu}_3\text{O}(x)$ po dannym tunnel'nykh issledovaniy monokristallov). I. B. ALT'FEDER, A. P. VOLODIN, I. N. MAKARENKO, and S. M. STISHOV, *Pis'ma v Zhurnal Eksperimental'noi i Teoreticheskoi Fiziki* (ISSN 0370-274X), Vol. 50, Dec. 10, 1989, pp. 458-461. 11 Refs.

A study was made of the tunneling spectra of $\text{YBa}_2\text{Cu}_3\text{O}(x)$ single crystals with varying oxygen contents obtained by a scanning tunneling microscope for orientations parallel and perpendicular to the basal plane. For the perpendicular orientation, two gap singularities are observed in the tunneling spectra. The dependence of the energy gap on oxygen content is similar to the dependence $T_c(x)$. A systematic inhomogeneity in energy gap distribution in the thickness direction is established.

A90-24711 Effect of a weak magnetic field on the critical current of $\text{YBa}_2\text{Cu}_3\text{O}(7-\delta)$ ceramic (Vliianie slabogo magnitnogo polia na kriticheskii tok keramiki $\text{YBa}_2\text{Cu}_3\text{O}(7-\delta)$). A. A. BUSH, S. N. GORDEEV, A. A. EVDOKIMOV, A. A. ZHUKOV, M. I. LAZER' et al., *Zhurnal Tekhnicheskoi Fiziki* (ISSN 0044-4642), Vol. 59, Nov. 1989, pp. 138-141. 8 Refs.

The critical current density of $\text{YBa}_2\text{Cu}_3\text{O}(7-\delta)$ ($\delta = 0.1-0.2$) specimens, synthesized by the conventional ceramic process, was measured by the four-probe method in the static regime. Three magnetic field regions are identified which correspond to three different types of behavior of the critical current density. The intragrain critical current density at 77 K is estimated at 5×10 to the 5th A/sq cm.

A90-14488 Critical current density of high-temperature superconducting ceramics based on yttrium and thallium produced by the method of selfpropagating high-temperature synthesis (Plotnost' kriticheskogo toka VTSP keramik na osnove ittrila i tallia, poluchennykh metodom SVS). A. D. KIKIN, A. G. PERESADA, I. S. KARIMOV, and M. D. NERSESIAN, *Zhurnal Tekhnicheskoi Fiziki* (ISSN 0044-4642), Vol. 59, Aug. 1989, pp. 29-31. 11 Refs.

Experiments were carried out to determine the critical current density in high- T_c superconductors based on Y and Tl ceramics produced by the method of selfpropagating high-temperature synthesis. At 77 K in a zero magnetic field, the critical current densities of $\text{YBa}_2\text{Cu}_3\text{O}(7-x)$ and $\text{Tl}_2\text{Ba}_2\text{Ca}_2\text{Cu}_3\text{O}(x)$ are 150 and 63 A/sq cm, respectively, in agreement with data in the literature. The $J_c(H)$ curves are identical for the two ceramics and indicate the formation of Josephson junctions at grain boundaries. Based on the $J_c(T)$ dependence, the junctions formed in $\text{YBa}_2\text{Cu}_3\text{O}(7-x)$ ceramic are shown to be of the S-I-S type.

A90-24709 Microwave absorption characteristics of $\text{RBa}_2\text{Cu}_3\text{O}$ (7-x) superconducting ceramic in a magnetic field ($R = Y, \text{Ho}, \text{Er}$) (Osobennosti mikrovolnovogo pogloshcheniia sverkhprovodiashchei $\text{RBa}_2\text{Cu}_3\text{O}/7\text{-x}$ keramiki v magnitnom pole $/R = Y, \text{Ho}, \text{Er}/$). S. N. SMIRNOV, *Zhurnal Tekhnicheskoi Fiziki* (ISSN 0044-4642), Vol. 59, Nov. 1989, pp. 114-119. 14 Refs.

The microwave absorption characteristics of $\text{RBa}_2\text{Cu}_3\text{O}(7\text{-x})$ ceramic specimens were investigated in a magnetic field at 77 K under superconducting conditions. It is shown that microwave absorption in this ceramic is generally related to remagnetization. For small fields, it is due to the presence of Josephson contacts and occurs in the form of both stationary and nonstationary absorption. In the case of large fields, both the Josephson mechanism and absorption resulting from the motion of vortices contribute to the field-dependent absorption.

A90-24187 The dc electrical characteristics of the superconducting ceramic $\text{YBa}_2\text{Cu}_3\text{O}(7\text{-delta})$ (Elektricheskie kharakteristiki sverkhprovodiashchei keramiki $\text{YBa}_2\text{Cu}_3\text{O}/7\text{-delta}$ na peremennom toke). E. G. MIRONOV, B. A. GIZHEVSKII, and N. M. CHEBOTAEV, *Pis'ma v Zhurnal Tekhnicheskoi Fiziki* (ISSN 0320-0116), Vol. 15, Dec. 26, 1989, pp. 51-54.

New results are reported concerning the dependence of the resistance of the high-temperature superconductor $\text{YBa}_2\text{Cu}_3\text{O}(7\text{-delta})$ on the magnitude and frequency of the measurement current. It is shown that the presence of residual resistance in the specimens studied can be viewed as due to differences in I_c in the ac and dc cases; I_c decreases rapidly as the frequency of the current passing through the specimen increases.

A90-24185 The possibility of using coaxial lines made of high-temperature superconductors for interconnections (O vozmozhnosti ispol'zovaniia koaksial'nykh linii iz VTSP diia mezhsoedinenii). R. A. SURIS and N. V. FOMIN, *Pis'ma v Zhurnal Tekhnicheskoi Fiziki* (ISSN 0320-0116), Vol. 15, Dec. 26, 1989, pp. 33-36.

The feasibility of constructing coaxial lines for LSI interconnections out of high-temperature superconductors is evaluated theoretically. The maximum length of the communications line is determined, and the advantages of using superconducting waveguides (instead of conventional metallic ones) in such applications are explored.

A90-24178 Elastic reflection of medium-energy electrons from the surface of a high-temperature superconductor ceramic (Uprugoe otrazhenie elektronov srednei energii ot poverkhnosti VTSP-keramiki). M. V. GOMOIUNOVA, A. K. GRIGOR'EV, I. I. PRONIN, and A. E. RODNIANSKII, *Pis'ma v Zhurnal Tekhnicheskoi Fiziki* (ISSN 0320-0116), Vol. 15, Dec. 12, 1989, pp. 65-69. 9 Refs.

Experimental results are reported on angular distributions of medium-energy electrons elastically reflected from the surface of $\text{YBa}_2\text{Cu}_3\text{O}(7\text{-x})$ ceramic. The results were obtained using highangularresolution Auger spectroscopy and electron-energy-loss spectroscopy.

A90-24177 Investigation of the diamagnetic response of the superconducting metal oxide $\text{YBa}_2\text{Cu}_3\text{O}(7\text{-delta}) + \text{xHfO}_2$ (Issledovanie diamagnitnogo otklika sverkhprovodiashchego metallooksida $\text{YBa}_2\text{Cu}_3\text{O}/7\text{-delta} + \text{xHfO}_2$). P. N. MIKHEENKO and V. N. VARIUKHIN, *Pis'ma v Zhurnal Tekhnicheskoi Fiziki* (ISSN 0320-0116), Vol. 15, Dec. 12, 1989, pp. 38-41. 5 Refs.

Experimental results are reported on the mechanical properties and diamagnetic response of the $\text{YBa}_2\text{Cu}_3\text{O}(7\text{-delta}) + \text{xHfO}_2$ system for different values of x . It is shown that the introduction of HfO_2 to the superconducting metal oxide improves the elastic and mechanical properties of the system, the degree of granule contact, and the transport properties.

A90-22864 Electromagnetic self-emission of high-temperature superconductor thin-film bridge structures (Sobstvennoe elektromagnitnoe izluchenie VTSP tonkoplennokhnykh mostikovykh struktur). L. E. AMATUNI, A. A. AKHUMIAN, R. B. AIRAPETIAN, K. I. KONSTANTINIAN, R. M. MARTIROSIAN et al., *Pis'ma v Zhurnal Eksperimental'noi i Teoreticheskoi Fiziki* (ISSN 0370-274X), Vol. 50, Oct. 25, 1989, pp. 355-358. 13 Refs.

Narrow-band emission at a frequency of 21 GHz with an intensity up to 3×10 to the -11th W was detected experimentally in high-temperature superconductor bridge structures. This emission is due to the coherent motion of magnetic-field vortices through the superconducting granular film under the effect of a transport current.

A90-22861 High-temperature superconductivity in the Y-Ba-Cu-F-O system (Vysokotemperaturnaia sverkhprovodimost' v sisteme Y-Ba-Cu-F-O). D. SH. TSAGAREISHVILI, D. G. TATISHVILI, G. G. GVELESIANI, I. B. BARATASHVILI, G. V. TSAGAREISHVILI et al., *Akademiia Nauk Gruzinskoi SSR, Soobshcheniia* (ISSN 0132-1447), Vol. 135, Aug. 1989, pp. 397-399. 5 Refs.

The high-temperature superconductor $\text{Y}_2\text{BaCu}_7\text{F}_{40}(\text{y})$ with a transition temperature of 101 K was synthesized using ceramic technology. Experimental results indicate that the commencement of the diamagnetic response roughly coincides with the commencement of the resistive transition. However, in contrast to the latter, the superconducting diamagnetic transition is stretched out somewhat and its width is greater than 20 K, which suggests the presence in the specimen of various superconducting phases with different transition temperatures.

A90-23471 Optical emission of $\text{YBa}_2\text{Cu}_3\text{O}(7\text{-delta})$ and copper specimens in the case of irradiation by slow electrons and laser vaporization (Opticheskoe izluchenie obratzov $\text{YBa}_2\text{Cu}_3\text{O}/7\text{-delta}$ i medi pri obluchenii medlennymi elektronami i v usloviakh lazernogo ispareniiia). I. IA. FUGOL', I. I. RYBALKO, V. M. ZHURAVLEV, D. KUZNER, and N. SCHVENTNER, *Fizika Nizkikh Temperatur* (ISSN 0132-6414), Vol. 15, Dec. 1989, pp. 1301-1310. 22 Refs.

A comparative analysis was made of the emission spectra of the laser plasma and cathodoluminescence of $\text{YBa}_2\text{Cu}_3\text{O}(7\text{-delta})$ and Cu specimens. An identification of plasma luminescence indicated the presence of the emission lines of Y, Y(+), Ba, Ba(+), and Cu as well as continuous emission of molecular and cluster Cu-O fragments with a maximum at 2.7 eV. It is shown that the main intensity of the wideband luminescence of Y-Ba-Cu-O at 2.7 and 3.7 eV is associated with radiative transitions in defect centers at oxygen vacancies of the type F and F(+). The narrow-band emission at 3.36 and 2.95 eV, sensitive to the superconducting transition, is traced to the charge-sensitive oxygen chemisorption centers.

A90-22815 Effect of 'trapped' magnetic flux on the critical current in $\text{YBa}_2\text{Cu}_3\text{O}(7\text{-delta})$ film (Vliianie 'zakhvachennogo' magnitnogo potoka na kriticheskii tok v plenochnom $\text{YBa}_2\text{Cu}_3\text{O}/7\text{-delta}$). L. S. TOPCHIAN, G. A. KHARADZE, T. SH. KVIRIKASHVILI, B. V. BRODSKII, I. A. BAGLAENKO et al., *Pis'ma v Zhurnal Tekhnicheskoi Fiziki* (ISSN 0320-0116), Vol. 15, Nov. 26, 1989, pp. 82-86. 9 Refs.

An investigation is made of the volt-ampere characteristics of 6000-A-thick films of the high-temperature superconductor $\text{YBa}_2\text{Cu}_3\text{O}(7\text{-delta})$ synthesized on a single-crystal SrTiO_3 substrate via pulsed laser deposition in an oxygen environment. The results obtained point to the effect of 'trapped' persistent currents in intergranular regions on the critical transport current. Their superposition can lead to a decrease in the magnetic field strength in certain intergranular regions and to an increase in the percolation part of the critical current in the decreasing magnetic field.

A90-22812 Signal and noise characteristics of $\text{YBa}_2\text{Cu}_3\text{O}(7\text{-x})/\text{Al}_2\text{O}_3$ bridges in the millimeter-wave range (Signal'nye i shumovye kharakteristiki mostikov $\text{YBa}_2\text{Cu}_3\text{O}/7\text{-x}/\text{Al}_2\text{O}_3$ v millimetrovom diapazone voln). A. A. VEREVKIN, V. A. IL'IN, I. U. N. INKIN, V. N. LAPTEV, V. I. MAKHOV et al., *Pis'ma v Zhurnal Tekhnicheskoi Fiziki* (ISSN 0320-0116), Vol. 15, Nov. 26, 1989, pp. 70-74. 10 Refs.

The monochromatic signal response and noise characteristics of $\text{YBa}_2\text{Cu}_3\text{O}(7\text{-x})$ bridges on Al_2O_3 substrates were studied experimentally. Also studied were the parameters (the volt-watt sensitivity and minimum detectable power) of microwave detectors based on such bridges. The characteristics of these devices are shown to be considerably better than those of analogous structures described by Wiener-Awnear et al. (1988), and the volt-watt sensitivity of the detectors investigated approaches (at the same temperature) that of integrated Josephson detectors with Nb junctions.

A90-22806 Visualization of processes of the penetration and trapping of magnetic flux in high-temperature superconductors (Vizualizatsiia protsessov proniknoveniia i zakhvata magnitnogo potoka v vysokotemperaturnykh sverkhprovodnikakh). A. A. POLIANSKII, V. K. VLASKOVASOV, M. V. INDENBOM, and V. I. NIKITENKO, *Pis'ma v Zhurnal Tekhnicheskoi Fiziki* (ISSN 0320-0116), Vol. 15, Nov. 26, 1989, pp. 1-4. 6 Refs.

A novel photographic visualization method using Bicontaining films with YIG on a CaGe-garnet substrate was developed for investigating magnetic-flux penetration into a high-temperature superconductor at arbitrary temperatures up to the Curie point of the magnetic film. This method makes it possible to reveal sample defects and irregularities, and to determine their superconducting parameters (H_c , T_c , etc.). By a proper selection of the film parameters, it is possible to improve the spatial resolution of the method and to expand the range of its magnetic-field sensitivity.

A90-22401 Superconducting receivers of millimeter waves (Sverkhprovodnikovye priemnye ustroistva millimetrovykh voln). A. N. VYSTAVKIN, V. P. KOSHELETS, and G. A. OVSIANNIKOV, *Radiotekhnika i Elektronika* (ISSN 0033-8494), Vol. 34, Dec. 1989, pp. 2465-2483. 105 Refs.

Research and development efforts on superconducting microwave receivers are reviewed. Attention is given to devices whose sensitivity in the millimeter-wave range is determined by quantum fluctuations of the electromagnetic field. It is shown that quasi-limiting parameters have already been achieved in Josephson parametric amplifiers. In addition, prospects for the use of high-temperature superconductors as nonlinear elements in microwave receivers are examined.

A90-14487 The even Hall effect in the superconducting phase $\text{YBa}_2\text{Cu}_3\text{O}(7\text{-delta})$ (Chetnyi effekt Kholla v sverkhprovodiashchei faze $\text{YBa}_2\text{Cu}_3\text{O}/7\text{-delta}$). I. A. V. KOPELEVICH, V. V. LEMANOV, E. B. SONIN, and A. L. KHOLKIN, *Pis'ma v Zhurnal Eksperimental'noi i Teoreticheskoi Fiziki* (ISSN 0370-274X), Vol. 50, Aug. 25, 1989, pp. 188-191. 6 Refs.

An observation of the even Hall effect in the superconducting phase of $\text{YBa}_2\text{Cu}_3\text{O}(7\text{-delta})$ ceramic is reported. The effect is explained in terms of the directional vortex motion concept. A physical picture of supercritical current flow is proposed.

A90-22772 Symmetry of electron states in antiferromagnetics (Simmetriia elektronnykh sostoianii v antiferromagnetikakh). S. A. BRAZOVSKIĬ and I. A. LUK'IANCHUK, *Zhurnal Eksperimental'noi i Teoreticheskoi Fiziki* (ISSN 0044-4510), Vol. 96, Dec. 1989, pp. 2088-2095. 14 Refs.

The symmetry of electron states in an antiferromagnetically ordered crystal is investigated using the elements of the two-value corepresentation method for magnetic groups in a form corresponding to microscopy-theory methods. Symmetry restrictions on the quasi-particle spectra, on their interaction with the magnetic field, and on the interband matrix elements are found. The results obtained are illustrated for a two-dimensional system corresponding to the CuO₂ plane in weakly doped high-temperature superconductors.

A90-19201 Superconducting optoelectronic detector of thermal radiation (Sverkhprovodnikovyi optoelektronnyi priemnik teplovogo izlucheniia). O. S. ESIKOV and E. A. PROTASOV, *Pis'ma v Zhurnal Tekhnicheskoi Fiziki* (ISSN 0320-0116), Vol. 15, Oct. 26, 1989, pp. 11-14.

The paper describes the design principle and characteristics of a superconducting detector which does not require the passage of a transport current through the sensing element (SE), making electrical contacts unnecessary. A detector unit has been realized that consists of an SE based on a YBa₂Cu₃O(7- δ) superconducting film, a bismuth-containing garnet magneto-optical film placed in a variable magnetic field perpendicular to the plane of the film. The unit is housed in a specially constructed liquid-nitrogen cryostat. Measurements showed that a heat flux with a power of 10 to the -8th to 10 to the -9th W could be registered with this unit; the sensitivity was limited by photodetector fluctuations due to the instability of the circuits of the counting device.

A90-18117 A study of current steps on the volt-ampere characteristics of YBaCuO-YBaCuO Josephson junctions (Issledovanie stupenek toka na VAKh dzhozefsonovskikh kontaktov YBaCuO-YBaCuO). S. I. BOROVITSKIĬ, V. D. GELIKONOVA, E. S. DEMIDOV, A. M. KLUSHIN, and P. V. PAVLOV, *Zhurnal Tekhnicheskoi Fiziki* (ISSN 0044-4642), Vol. 59, Oct. 1989, pp. 191, 192. 6 Refs.

Results of an experimental study of YBaCuO-YBaCuO Josephson contacts are reported in which small-angle current steps were observed at the nitrogen temperature. The spacing and slope of the steps are examined in relation to the critical temperature and current amplitude and frequency. An analysis of the results obtained indicates that the temperature dependences of weak coupling parameters in ceramics may differ significantly.

A90-18114 Effect of the thermal history of XBa₂Cu₃O(7- δ) (X = Y, Eu) ceramic materials on their conducting properties (Vliianie termicheskoi predystorii keramicheskikh materialov XBa₂Cu₃O(7- δ) /X = Y, Eu/ na ikh provodiashchie svoistva). I. G. GUSAKOVSKAIA, S. I. PIRUMOVA, A. E. UKSHE, V. V. TKACHEV, and L. O. ATOVMIAN, *Zhurnal Tekhnicheskoi Fiziki* (ISSN 0044-4642), Vol. 59, Oct. 1989, pp. 172-174. 6 Refs.

Specimens of YBa₂Cu₃O(7- δ) and EuBa₂Cu₃O(7- δ) ceramics were investigated by calorimetric and resistometric analyses. In particular, an attempt is made to relate the experimentally observed nonsuperconducting kinetic phase transition in these ceramics to the unstable increase of the superconducting transition temperature from 90 to 130 K. The effect of heat treatments on the stability of the superconducting properties of these ceramics is discussed.

A90-17194 Imperfections of the crystal structure of Y-Ba-Cu-O superconducting ceramic following shock compression (Nesovershenstvo kristallicheskoi struktury sverkhprovodiashchei keramiki Y-Ba-Cu-O posle udarnogo szhatiia). A. V. KHUDIakov, I. U. N. MALOVITSKIĬ, P. P. SAFRONOV, E. A. KOTOV, E. B. ABRAMOVA et al., *Pis'ma v Zhurnal Tekhnicheskoi Fiziki* (ISSN 0320-0116), Vol. 15, Oct. 12, 1989, pp. 25-27.

Cylindrical (20 mm in diameter, 160 mm long) specimens produced by the shock compression of a superconducting Y-Ba-Cu-O powder were characterized by a variety of methods, including differential thermal analysis, X-ray diffraction analysis, gravimetry, and resistance measurements. The experimentally observed scatter of the critical temperature along the length of the specimens in the range 88-91 K and the broadening of the superconducting transition are attributed to the imperfections in the crystal structure of the specimens resulting from the shock loading.

A90-14478 Characteristics of magnetization relaxation during the initial time interval and the effect of a magnetic field on flow creep in Bi₂Sr₂Ca₁Cu₂O(x) single crystals (Osobennosti relaksatsii namagnichennosti na nachal'nom vremennom intervale i vliianie magnitnogo polia na krip potoka v monokristallakh Bi₂Sr₂Ca₁Cu₂O(x)). V. V. MOSHCHAL'KOV, A. A. ZHUKOV, L. I. LEONIUK, V. D. KUZNETSOV, and V. V. METLUSHKO, *Pis'ma v Zhurnal Eksperimental'noi i Teoreticheskoi Fiziki* (ISSN 0370-274X), Vol. 50, July 25, 1989, pp. 81-84. 5 Refs.

An experimental investigation of the magnetic characteristics of Bi₂Sr₂Ca₁Cu₂O(x) single crystals revealed the effect of magnetization relaxation during the initial time interval, which is attributed to the viscous flow of Abrikosov vortices at currents higher than the critical current. This relaxation becomes logarithmic with the transition to thermally activated flow creep. The field dependence of the logarithmic relaxation rate is investigated in detail at different temperatures.

A90-22771 Effect of exchange on spin polaron behavior in the Emery model (of high temperature superconductors) (Vliianie obmena na povedeniiespinovogo poliarona v modeli Emery). A. A. GOLUB, O. I. U. MASHTAKOV, and V. I. KOTRUTSE, *Zhurnal Eksperimental'noi i Teoreticheskoi Fiziki* (ISSN 0044-4510), Vol. 96, Dec. 1989, pp. 2082-2087. 13 Refs.

The paper examines the effect of exchange interaction on the behavior of a hole on oxygen in the Emery model of a high-temperature superconductor. It is shown that the spin state produced by the hole can be a purely ferromagnetic polaron only up to a certain (small) energy-normalized jump of the critical value of the exchange constant.

A90-19206 Detection properties of thin-film superconducting bridges made of YBa₂Cu₃O(7-x) (Detektiruushchie svoistva tonkoplennoknykh sverkhprovodiashchikh mostikov iz YBa₂Cu₃O(7-x)). V. A. KULIKOV, L. V. MATVEETS, A. I. U. SEREBRIAKOV, V. N. LAPTEV, V. I. MAKHOV et al., *Pis'ma v Zhurnal Tekhnicheskoi Fiziki* (ISSN 0320-0116), Vol. 15, Oct. 26, 1989, pp. 74-77.

The properties of thin-film YBa₂Cu₃O(7-x) bridges under the effect of 8-mm radiation are investigated experimentally. The nonstationary Josephson effect is demonstrated along with the synchronization of weak couplings inside the bridge. A high volt-watt sensitivity of these bridges at liquid-nitrogen temperature was found which indicates the feasibility of realizing sensitive detectors of microwave radiation with further optimization of the film properties and the electrodynamic matching.

A90-19202 Stability of the superconducting phase of YBa₂Cu₃O(x) (Ostabil'nosti sverkhprovodiashchei fazy YBa₂Cu₃O(x)). E. N. SOBOL', *Pis'ma v Zhurnal Tekhnicheskoi Fiziki* (ISSN 0320-0116), Vol. 15, Oct. 26, 1989, pp. 15-20. 10 Refs.

The kinetics of the low-temperature decay of the superconducting phase of YBa₂Cu₃O(x) is analyzed; a mechanism of stable decomposition is proposed; and conditions for increasing the stability of high-temperature superconductors (HTSCs) are discussed. It is found that instability associated with gasification of condensed oxygen can be one of the causes of the relatively low stability of an HTSC with a transition temperature above 90 K. The creation of coherent interphase boundaries and the optimization of temperature and pressure conditions could be factors in enhancing the stability of such systems.

A90-18094 Correlation of critical temperature with the vibrational spectra of high-temperature superconductors (Korrelatsiia kriticheskoi temperatury s kolebatel'nymi spektrami vysokotemperaturnykh sverkhprovodnikov). A. A. BUSH, I. S. DUBENKO, M. F. LIMONOV, I. U. F. MARKOV, A. G. PANFILOV et al., *Pis'ma v Zhurnal Eksperimental'noi i Teoreticheskoi Fiziki* (ISSN 0370-274X), Vol. 50, Sept. 10, 1989, pp. 250-253. 13 Refs.

An empirical relation between an increase in T_c and an increase in the frequencies of the vibrational spectra of different high-temperature superconductors of perovskite type is established. Taking this relation into account, a new system (Y_{1-x}Sc_x)(Ba_{1-y}Sr_y)₂Cu₃O(δ) is proposed, in which an increase in T_c is observed at intermediate concentrations.

A90-17200 Fractal geometry of high-temperature superconductors (Fraktal'naia geometriia vysokotemperaturnykh sverkhprovodnikov). A. B. MOSOLOV, *Pis'ma v Zhurnal Tekhnicheskoi Fiziki* (ISSN 0320-0116), Vol. 15, Oct. 12, 1989, pp. 64-68. 9 Refs.

Results of a study of the microstructure geometry of superconducting composites prepared from cryochemically produced powders of YBa₂Cu₃O(x) and Ag are reported. It is found that the structure of the superconducting cermets is characterized by fractal geometry, which could be important in describing the electrophysical (e.g., transport) and mechanical properties of such materials.

A90-17195 Dispersion of surface spin waves in a layered superconductor-ferrite structure (Dispersiia poverkhnostnykh spinovykh voln v sloistoi strukture sverkhprovodnik-ferrit). B. M. LEBED' and S. V. IAKOVLEV, *Pis'ma v Zhurnal Tekhnicheskoi Fiziki* (ISSN 0320-0116), Vol. 15, Oct. 12, 1989, pp. 27-29.

The propagation of surface spin waves in superconductor-ferrite films, grown epitaxially on gallium-gadolinium garnet substrates, was investigated experimentally in the frequency range 2-6 GHz at 91 + or - 13 K. Two characteristic regions on the surface spin wave curves are identified, and changes in the surface spin wave dispersion behavior are related to the type of the structure. The results obtained can be used in controlling the dispersion of surface spin waves.

A90-17193 Implementation of the ion-beam fabrication of high-temperature superconductor films using a hollow-cathode reflection-discharge ion source (Realizatsiia ionno-luchevogo metoda polucheniia plenok VTSP s ispol'zovaniem ionnogo istochnika na osnove otrazhatel'nogo razriada s polym katodom). I. U. G. IG-NATENKO, I. U. E. KREINDEL', P. V. LERKH, G. A. MESIATS, and V. P. PONOMAREV, *Pis'ma v Zhurnal Tekhnicheskoi Fiziki* (ISSN 0320-0116), Vol. 15, Oct. 12, 1989, pp. 18-21. 6 Refs.

The possibility of obtaining thin superconducting films by the ion-beam method using a standard reflection-discharge ion source with a cold hollow cathode and standard YBa₂Cu₃O(7-x) targets is demonstrated experimentally. The experimental setup is shown, and the structure and properties of the superconducting films are briefly discussed.

A90-17190 Superconducting composite wires produced by high-speed dip-coating in the metal oxide system Bi-Sr-Ca-Cu-O (Kompozitnye sverkhprovodiashchie provoda, poluchennye skorostnym luzheniem v metalloksidnoi sisteme Bi-Sr-Ca-Cu-O). A. D. GROZAV, L. A. KONOPKO, and N. I. LEPODA, *Pis'ma v Zhurnal Tekhnicheskoi Fiziki* (ISSN 0320-0116), Vol. 15, Oct. 12, 1989, pp. 1-5. 7 Refs.

Thin (less than 10 microns) mirror-smooth coatings were obtained on copper wire (100-400 microns in diameter) by pulling the wire at 5-150 mm/s through a bath of molten BiSrCaCu₂O(x) ceramic at 900-1000 C. The coated wires exhibited superconducting properties in the range 90-45 K after a heat treatment in air at 800 C for 10 min. It is suggested that the superconducting properties of the wire could be improved by optimizing the heat treatment.

A90-17189 A method for preparing needle-shaped specimens of YBa₂Cu₃O(7-x) single crystals for field-ion microscopy (Metod prigo-tovleniya obraztsovostrii iz monokristallov YBa₂Cu₃O(7-x) dlia issle-dovaniia v polevom ionnom mikroskope). E. F. TALANTSEV, V. A. IVCHENKO, and N. N. SIUTKIN, *Pis'ma v Zhurnal Tekhnicheskoi Fiziki* (ISSN 0320-0116), Vol. 15, Sept. 26, 1989, pp. 76-79. 5 Refs.

Results of a field-ion microscopy study of YBa₂Cu₃O(7-x) single crystals are reported, and a method for preparing needle-shaped specimens of this material by mechanical chipping is described. The single crystals were synthesized by a method proposed in an earlier study (Arbuzov et al., 1989) and had a critical temperature of not lower than 92 K for a transition width of not more than 0.5 K. Ion-field images of the atomically smooth surfaces of the single crystal superconductor are shown.

A90-17099 Measuring the critical current density of bulk high-temperature superconductors in the pulsed mode (Izmerenie plotnosti kriticheskogo toka massivnykh vysokotemperaturnykh sverkhprovod-nikov v impul'snom rezhime). V. M. DMITRIYEV, O. R. PRIKHOD'KO, and E. V. KHRISTENKO, *Fizika Nizkikh Temperatur* (ISSN 0132-6414), Vol. 15, Oct. 1989, pp. 1088-1091.

A method for measuring the critical current of high-temperature superconductors with a large cross sectional area over a wide temperature range is proposed which is based on passing pulsed electric current through the specimen. The temperature dependences of the critical currents of high-temperature superconducting ceramics, YbBa₂Cu₃O (6.5) and TlBa₂Cu₃O(6.5), are determined. It is shown that, for current pulses of 10 ms or less, the experimental conditions can be considered isothermal.

A90-14500 Superconducting ceramic coatings produced by plasma spraying (Sverkhprovodiashchie keramicheskie pokrytiia, poluchennye plazmennym napyleniem). K. S. ALEKSANDROV, A. D. VASIL'EV, S. A. ZVEGINTEV, A. A. LEPESHEV, M. I. PETROV et al., *Zhurnal Tekhnicheskoi Fiziki* (ISSN 0044-4642), Vol. 59, Aug. 1989, pp. 157-159.

Superconducting ceramic coatings were produced on titanium substrates by the plasma spraying of fine (30-80 microns) Y1Ba₂Cu₃O(7-delta) powders over a sublayer of CuO, ZrO₂, Al₂O₃, and TiO₂. X-ray and differential thermal studies of the coatings indicate that the temperature of formation of the superconducting phase in the coatings is lower than that in bulk ceramic samples. The quenching of the ceramic at rates greater than 100 C/s during plasma spraying is shown to lead to the formation of an amorphous phase.

A90-14480 Low-field microwave absorption in high-T_c superconductor single crystals based on bismuth - Threshold effect in a vortex array (Nizkopolevoe mikrovolnovoe pogloshchenie v monokristallakh VTSP na osnove vismuta - Porogovye efekty vikhrevoi reshetki). V. E. BURSIA, A. A. BUSH, V. S. VIKHNIN, I. V. GLADYSHEV, and L. S. SOCHAVA, *Pis'ma v Zhurnal Eksperimental'noi i Teoreticheskoi Fiziki* (ISSN 0370-274X), Vol. 50, Aug. 10, 1989, pp. 124-126. 6 Refs.

The existence of a threshold magnetic field is demonstrated for some characteristic effects in the low-field absorption of high-T_c superconductor single crystals. In the microwave absorption spectrum, a new type of signal is shown to exist which corresponds to the threshold field. The formation of the new signal in low-field absorption and threshold effects with respect to the magnetic field are shown to be associated with the transition from individual to collective vortex pinning.

A90-14466 Atomic configurations of vacancies in high-temperature superconductors (Atomnye konfiguratsii vakansii v vysokotemperaturnykh sverkhprovodnikakh). V. V. KIRSANOV and N. N. MUSIN, *Pis'ma v Zhurnal Tekhnicheskoi Fiziki* (ISSN 0320-0116), Vol. 15, Aug. 26, 1989, pp. 42-45. 8 Refs.

Computer simulations of point defects in high-temperature superconductors are being carried out in an effort to elucidate the nature of radiation defects in such materials. The method of molecular dynamics was used to determine the atomic configuration of copper vacancies in La (1.85) Ba(0.15)CuO₄.

A90-17098 Tunneling spectroscopy of the high-temperature superconducting compound YBa₂Cu₃O(7-delta) (Tunnel'naia spektroskopiiia vysokotemperaturnogo sverkhprovodiashchego soedineniia YBa₂Cu₃O(7-delta)). B. A. AMINOV, N. B. BRANDT, MIN' TKHU NGUEN, IA. G. PONOMAREV, M. V. SUDAKOVA et al., *Fizika Nizkikh Temperatur* (ISSN 0132-6414), Vol. 15, Oct. 1989, pp. 1081-1083. 10 Refs.

The volt-ampere characteristics of tunneling point junctions based on YBa₂Cu₃O(7-delta) have been investigated in the helium and nitrogen temperature ranges. Singularities are identified which correspond to an energy gap. The temperature dependence of the gap is found to be consistent with a relation following from the BCS theory.

A90-15668 Calculation of superconducting transition temperatures for compounds of the Bi-Sr-Ca-Cu-O system as well as for YBa₂Cu₃O₆ (Raschet temperatur sverkhprovodiashchego perekhoda dlia soedinenii sistemy Bi-Sr-Ca-Cu-O i soedineniia YBa₂Cu₃O₆). K. A. OSIPOV and O. K. BELOUSOV, *Akademiia Nauk SSSR, Doklady* (ISSN 0002-3264), Vol. 308, No. 5, 1989, pp. 1181-1184. 15 Refs.

Calculations are presented which support the idea that electron-ion interaction plays the dominant role in the superconductivity mechanism of oxide compounds. This interaction can be the main cause of electron pairing. It is possible that the superconductivity here is determined by the formation of electron clusters that are variable in composition and binding energy due to electric field gradients in the compound.

A90-15658 Magnetic and kinetic properties of Y1Ba₂Cu₃O(7-delta) (Magnitnye i kineticheskie svoistva soedineniia Y1Ba₂Cu₃O(7-delta)). V. D. KUZNETSOV, I. I. NOVIKOV, O. G. ZAMOLODCHIKOV, V. V. METLUSHKO, A. N. BORZIAK et al., *Akademiia Nauk SSSR, Doklady* (ISSN 0002-3264), Vol. 308, No. 4, 1989, pp. 862-866. 15 Refs.

Results of quantum magnetometer measurements on the high-temperature superconductor Y1Ba₂Cu₃O(7-delta) are presented. An analysis is made of the behavior of the magnetization of this compound as a function of external magnetic field, the influence of the shape and state of the specimen on the magnetization, critical currents, and the damping of the magnetic moment.

A90-15164 Theory of collective flux creep (in high temperature superconductors). M. V. FEIGEL'MAN, V. B. GESHKENBEIN, A. I. LARKIN, and V. M. VINOKUR, Academy of Sciences (USSR), Moscow. Physical Review Letters (ISSN 0031-9007), Vol. 63, Nov. 13, 1989, pp. 2303-2306. Research supported by NASA. 22 Refs. (NSF PHY-82-17853).

The nature of flux creep phenomena in the case of collective pinning by weak disorder is discussed. The Anderson concept of flux bundle is explored and developed. The dependence of the bundle activation barrier U on current j is studied and is shown to be of power-law type: U(j) is proportional to j exp -alpha. The values of exponent alpha for the different regimes of collective creep are found.

A90-14486 Superstructure observation on the surface of a Bi₂Sr₂CaCu₂O(x) single crystal (Nabliudenie sverkhstruktury na poverkhnosti monokristalla Bi₂Sr₂CaCu₂O(x)). I. B. ALT'FEDER, A. P. VOLODIN, V. A. GRAZHULIS, A. M. IONOV, and S. G. KARABASHEV, *Pis'ma v Zhurnal Eksperimental'noi i Teoreticheskoi Fiziki* (ISSN 0370-274X), Vol. 50, Aug. 25, 1989, pp. 182-184. 7 Refs.

The surface of Bi₂Sr₂CaCu₂O(x) high-T_c superconductor single crystals was investigated by low-temperature scanning tunneling microscopy and by slow-electron diffraction analysis. The single crystals examined had been produced by directional solidification. A superstructure with a period of 2.8-3 nm and relief variations of 0.1-2 nm was observed in the ab plane along the a-direction.

A90-14471 Thin-film SQUID with an operating temperature of 77 K (Plenochnyi sverkhprovodnikovyi kvantovyi interferometr s rabochei temperaturoi 77 K). S. I. BONDARENKO, A. V. LUKASHENKO, A. A. SHABLO, S. V. GAPONOV, L. V. MALYSHEVA et al., *Pis'ma v Zhurnal Tekhnicheskoi Fiziki* (ISSN 0320-0116), Vol. 15, Sept. 12, 1989, pp. 80-82. 6 Refs.

Experimental results are presented on a SQUID prepared on the basis of Y1Ba₂Cu₃O(7-x) films via laser vapor deposition on an SrTiO₃ substrate. The sensitivity of this device can attain a value of 10 to the -6th Oe at a temperature of 77 K.

A90-14463 Planar defects and grain boundary disclinations in the superconducting compound YBaCuO (Planarnye defekty i zernogranichnye disklinatsii v sverkhprovodiashchem soedinenii YBaCuO). E. V. SADANOV and V. A. KSENOFONTOV, *Pis'ma v Zhurnal Tekhnicheskoi Fiziki* (ISSN 0320-0116), Vol. 15, Aug. 26, 1989, pp. 7-10. 5 Refs.

Planar defects separating variously oriented regions of the crystal were observed in the structure of the YBa₂Cu₃O(7-x) high-temperature superconductor. Also observed were rotation-type linear grain-boundary defects, which were centers of the elastic perturbation of the lattice. Both types of defects can have a substantial effect on the energy properties of superconducting materials.