10-Physical and Chemical Properties of Materials in Relation to Structure (Superconductors, Fullerenes, etc)

PS-10.01.33 DISORDERED INTERSTRATIFIED STRUCTURES OF SINGLE CRYSTALS HIGH-TEMPERATURE SUPERCONDUCTORS Bi2212, Bi2201, and Bi-2223 By O.V. Frank-Kamenetskaya, T.I. Ivanova, A.S. Bookin, I.V. Rozdestvenskaya, S.V. Misokin, M.Yu. Vlasov and Yu.I. Krytser, Department of Crystallography of St.-Petersburg University, Moscow Geological Institute, Russia.

Two different types of disordered two-compound interstratified structures in Bi-2212 single crystals were discovered by analysis of X-ray basal reflection profiles based on the theory of X-ray diffraction by microcrystalline systems with a layered structure (O.Tchoubar, V.Brite, X-Ray Diffraction of Disordered Layered Structures, Berlin, 1990). Profiles of 001 (I = 6, 10, 12) single crystal basal reflections (scanning along 0 = 0°) were received in four-circle diffractometer Syntex P2 (Mo-radiation, graphite-monochromator). Three single crystals of Bi-2212 obtained in various growth and oxygen annealing conditions were investigated. The single crystal electron probe microanalysis shows the existence of admixture layers of structure related Bi-2212 superconductive phases and various Bi/Sr- and Bi/Cu-ratio in Bi-2212 layers. The structures of the first type are determined by disordered alternation of Bi-2212 layers with layers of newly discovered (A.Sun, S.P. Zh., 1992, 8, 9, 19, 364 (ruea)) Bi-441013 phase. Probability of occurrence of Bi-44103 layers is 5%. The second type structures are characterized by alternation of Bi-2212 layers with different Bi/Sr- and Bi/Cu-ratio and different c-constant respectively. The probability of occurrence of admixture layers is 30-40%. Tendency to segregation of such kind of layers is distinct feature of these structures.

PS-10.01.32 EFFECT OF THE OXYGEN PRESSURE DURING ANNEALING on CRYSTAL STRUCTURE and PROPERTIES OF SINGLE CRYSTALS of Bi-SUPERCONECTOR. By M.Yu.Vlasov*, T.N.Lazimkina, O.V.Frank-Kamenetskaya, Yu.L.Kreiser and V.V.Krytonosov, Department of Crystallography of St.-Petersburg University, Russia.

The cupola-like dependence between Tc and the density of holes in structures of Bi-2212 and Bi-2223 phases (M.A.Green et al, Physica C, 1990, 165, 1, 55; H.Bartley et al, Jpn.J.of Appl.Phys, 1990, 29, 1, 126) permits to expect the existence of nonmonotonous dependence between oxygen content, Tc and c lattice parameter of these phases. There are some data published for single crystals of Bi-phases which do not contradict this proposition. The present study has been undertaken to investigate the dependence of the lattice parameter of Bi-2212 and Bi-2201 phases on oxygen content which had been altered by annealing of these crystals at different oxygen partial pressure. Single crystals of Bi-2212 and Bi-2201 phases have been prepared by the method of spontaneous crystallization from solution. Fourteen of them sized 1×1×0.1 mm have been annealed under oxygen pressure from 0.001 to 15 bar at temperature 350°C for the exposition time of 40, 45, 50, and 60 hours. Electron microprobe analysis data (Cameca-4DV) have revealed the cation homogeneity of all single crystals studied. The temperature of transition to superconductive state has been determined by the dependence of magnetic susceptibility on temperature, the transition of alternating magnetic field has been ∫. The c lattice parameter has been determined from the position of basal reflections (0006 and 0008 for Bi-2212; 0016, 0022 and 0024 for Bi-2201). All reflections have been measured with DORX X-ray diffractometer. As the result the anomalous dependencies of the c parameter on the oxygen pressure during annealing have been revealed for both Bi-2212 and Bi-2201 phases. This permits to propose the existence of phase transition normal-metal-superconductor-normal-metal in studied single crystals. The antite correlation between ρ-ω and c-ω dependencies (minimum of c-parameter corresponds to maximum of Tc value) has been stated for Bi-2212 single crystals. The position and the nature of extremum depend on the Sr/Cu cation ratio. The increase of Tc value with the increase of oxygen partial pressure in Bi-2201 occurs as vel as in perovskite-like phases in La-Sr-Cu-O and YBa2Cu3O7 systems, until it leads to the structure compression. Opposite directed changes of the c lattice parameter with increase in oxygen content may be explained by analogy with 1-2-3 phase by localization or addition of oxygen atoms in various crystallographic structure positions. The influence of oxygen atoms redistribution, connected with order-disorder transition, on the c-parameter cannot be excluded.

PS-10.01.33 STRUCTURAL DESIGN OF ORGANIC CONDUCTORS AND SUPERCONDUCTORS WITH MERCURY-CONTAINING ANIONS. By O.A. D’yachenko, S.V. Konovailikhin, V.V. Gritsenko, A.I. Ulyubovskiy and Lyubovskii R.E. Institute of Chemical Physics in Chernogolovka, Russian Academy of Sciences, Russia.

The study of organic conductors based on bis-catechol-ethanol-ethanolulidene (CE) with mercury-containing anions is a promising direction of investigation in the field of synthetic organic metals and superconductors. The X-ray crystallographic structure determinations have been carried out on the electroconducting compounds: [(Cu2Hg2)2Br2] (1), Tc = 1.8 K, P = 12 kbar; [(CuHg)2] (2), Tc = 2.8 K, P = 1 kbar. The cation Tc-intermediate compounds have been obtained for (Cu2Hg2)2Br2 (1), Tc = 4.3 K, (CuHg)2Br2 (2), Tc = 4.3 K, (CuHg)2Br2 (3), Tc = 6.0 K, [(Cu2Hg2)2Br2] (4), Tc = 8.0 K, [(Cu2Hg2)2Br2] (5), Tc = 9.0 K. The study of the cation-anion interactions on the superconducting properties of the compounds has been carried out. The composition of the compounds has been determined by the method of high-temperature neutron diffraction. The composition of the compounds has been determined by the method of high-temperature neutron diffraction. The composition of the compounds has been determined by the method of high-temperature neutron diffraction.