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

PS-10.01.31 DISORDERED INTERSTRATIFIED STRUCTURES OF SINGLE CRYSTAL HIGH-TEMPERATURE SUPERCONDUCTORS Bi-2212, By V.A.Drits*, O.V.Frank-Kamenetskaya, T.I.Ivanova, A.S.Bookin, I.V.Rozdestvenskaya, S.V.Moshkin, M.Yu.Vlasov and Yu.L.Kretser, 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 microdivided systems with a layered structure (C.Tchoubar, V.Drits, X-Ray Diffraction by Disordered Lamellar Structures, Berlin, 1990).
Profiles of 00l (l= 8,10,12) single crystal basal reflections (scanning along c*) were received in four-circle autodiffractometer 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 superconductive phases and various Bi/Sr- and Bi/Cu-ratio in Bi-2212 layers. The structures of first type are described by disordered alternation of Bi-2212 layers with layers of newly discovered (A.Bush, SPhChT, 1992, 5, 9, 364 (russ)) Bi-4413 phase. Probability of occurence of Bi-4413 layers is 5%. The second type structures are characterised by alternation of Bi-2212 layers with different Bi/Sr- and Bi\Sr-ratio and different c-constant respectively. The probability of occurence of admixture layers is 30-40 %. Tendency to segregation of each 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-SUPERCONDUCTOR. By M.Yu.Vlasov*, T.N.Kaminskaya, O.V.Frank-Kamenetskaya, S.V.Moshkin, Yu.L.Kretser and V.V.Krivonosov, 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 (W.A.Groen et al,Physica C, 1990, 165, 1, 55; H.Hattory et al, Jpn.J.of Appl.Phys,1990, 29, 1, L26) permits to expect the existence of nonmonotonous dependences 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 c lattice parameter of Bi-2212 and Bi-2201 phases on the 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 1×1×0.1mm have been annealed under oxygen pressure from 0.0001 to 150 atm and temperature 350 - 550C; the exposition time has been 40-80 hours. Electron microprobe analysis data (Camscan-4DV) have revealed the cation homogeneity of all single crystals studied.
The temperature of transition to superconducting state has been determined by the dependence of magnetic susceptibility on temperature, the tension of alternating magnetic field has been ~1e.
The c lattice parameter has been determined from the position of basal reflections (0036 and 0038 for Bi-2212; 0016, 0022 and 0024 for Bi-2201). All reflections have been measured with DRON X-ray diffractometer.
As the result the nonmonotonous dependences of the c parameter on the oxygen pressure during annealing have been revealed for both Bi-2212 and Bi-2201 phases. This permits us to propose the existence of phase transition normal metal-superconductor-normal metal in studied single crystals. The antibate correlation between Tc -pO_2 and c-pO_2 dependences (minimum of c-parameter corresponds to maximum of Tc value) has been stated for Bi-2212 single crystals. The position and intensity of extremum depend on the Sr/Ca cation ratio. The increase in Tc value with the increase in oxygen partial pressure in Bi-2212 occurs, as well as in perovskite-like phases in La-Sr-Cu-O and Y(TR)-Ba-Cu-O systems, until it leads to the structure compression along Z axis.
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 of additional 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.Dyachenko*, S.V.Konovalikhin, V.V.Gritsenko, R.N.Lyubovskaya and Lyubovskii R B. Institute of Chemical Physics in Chernogolovka, Russian Academy of Sciences, Russia.

The study of organic conductors based on bis-(ethylenedithio)tetrathiafulvalene (ET) 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 of the electroconducting compounds: $(ET)_4[Hg_{2.78}Cl_8]$ (1), T_c = 1.8 K, P= 12 kbar (Dyachenko,O.A., Takhirov,T.G., Atovmyan, L.O., Zhilyaeva, E.I. & Lyubovskaya,R.N. Inter.Conf.Advanced Methods in X-ray and Neutron Structure Analysis of Materials, Karlovy Vary, Czechoslovakia, 1987, 59.), $(ET)_4[Hg_{2.89}Br_8]$ (2), T_c= 4.3 K (Lyubovskaya, R.N., Zhilyaeva, E.I., Pesotskii, S.I., Lyubovskii, R.B., Atovmyan, L.O., Dyachenko, O.A. & Takhirov,T.G. JETP Lett., 1987, 46, 188-191), $(ET)_2[Hg_{1.41}Br_4]$ (3), T_c= 2.0 K (Dyachenko, O.A.& Lyubovskaya, R.N. Inter. Conf. on Science and Technology of Synthetic Metals (ICSM'90), Tubingen, Germany, 1990,254) , $(d_8\text{-}ET)_4[HgBr_2 \cdot Hg_2Br_6]$ (4), T_c(onset)= 3.0 K at 0.3 kbar, $(ET)_8[Hg_4Cl_{12}(PhCl)_2]$ (5), which is metallic to 1.3

