PR10.05.26 THE SUPERCONDUCTING STRUCTURE FRAGMENTS WITH T_{CI} 180K. G.M. Kuz'micheva, S.I. Mukhina, Academy of Fine, Chemical Technology, Moscow, Russia; A.V. Mitin, Institute for Physical Problems, RAS, Moscow, Russia; E.P. Khlybov, Institute for High Pressure, Physics RAS, Troitzk, Russia

The study of the temperature variation of the electrical resistivity and the current-voltage characteristics of phases in the La-Sr-Ti-O, Ln-Sr-Nb-O, La-Mn-O, Ba-Sr-Pb-O, La-Pb-Re-O, Mg-Ti-O systems suggests that some compositions contain superconducting inclusions. The structure of superconducting inclusions (structure fragments) is coherently connected with structure of the non-superconducting phase and has different composition from one. A similar phenomena was observed in samples of the well-known system $YBa_2Cu_3O_{6+}$ when increased from 0.2 to 0.5. The phases of compositions $(Ln,Sr)_xNbO_3$-, $(La,Sr)xTiO_3$-, $(La,Pb)xReO_3$-, which belong to cubic bronzes of perovskite structure, contain superconducting structure fragments with Tci160 K, í·i 50K and í·i 60K, respectively. The phases $(Ba,Sr)PbO_3$ (perovskite structure) with í·i 70K and $Mg(Mg,Ti)_2O_4$ (spinel structure) with í·i 130K have the cubic symmetry. There are indications of the possible presence of superconducting fragments with Tci180K in the phase $LaMnO_{3+}$ with rhomboedral perovskite structure. The depedence of the critical temperatures of the phases, Tc, and inclusions, í·i,, on formal charge of Ti, Nb, Pb, Re, Mn, Bi, Cu cations is found.

Materials VI
Giant Magnetoresistive Materials

MS10.06.01 STRUCTURAL "TUNING" OF MAGNETISM IN $A_{1-x}A'_xMnO_3$ (A = La, Pr; A' = Ca, Sr, Ba). P.G. Radaelli[a], D.E. Cox[b], M. Marezio[c,d], S-W. Cheong[d], P. E. Schiffer[d], A.P. Ramirez[d], D.N. Agyriou[e] and J.D. Jorgensen[e], [a]Institut Max Von Laue-Paul Langevin, BP156, 38042 Grenoble Cedex FRANCE, [b]Physics Dept., Brookhaven National Lab, Upton, NY, [c]Lab de Cristallographie, CNRS/UJF, BP166, 38042 Grenoble Cedex FRANCE, [d]AT&T Bell Labs, Murray Hill, NJ, [e]Materials Science Div., Argonne National Lab, Argonne, IL 60439

Manganese oxide perovskites with general formula $A_{1-x}A'_xMnO_3$ (A = La, Pr, Y..; A' = Ca, Sr, Ba..) have been the subject of renewed interest, due to the giant magnetoresistance (GMR) exhibited near the ferromagnetic (FM) spin ordering temperature T_C. In fact, for values of the electronic doping x~0.30, the high-temperature paramagnetic state is electrically insulating, whereas the low-temperature FM state is metallic. The Curie temperature can be raised upon application of an external magnetic field, thereby producing the GMR effect. At higher doping levels (x > 0.50) the system is antiferromagnetic at low temperatures, and, in a narrow region of composition around x=0.50, both types of magnetic order occur. The presence of structural anomalies associated with the magnetic transitions in $A_{1-x}A'_xMnO_3$ (x=0.25, x=0.30 and x=0.50) has been evidenced by high-resolution synchrotron x-ray and neutron powder diffraction. In all cases, the lattice parameter anomalies are associated with a significant rearrangement of the Mn-O bond lengths, so that the MnO_6 octahedra are Jahn-Teller-distorted in the insulating state, and almost undistorted in the metallic state. These results provide strong experimental evidence for the importance of static/dynamic Jahn-Teller distortions as a charge carrier localization mechanism. Very recently, it has been shown that, at a constant value of the electronic doping level x, the Curie temperature can be "tuned" by changing the average radius $\langle r_A \rangle$ of the A-site ion or by applying external pressure (dT_C/dP is always *positive*, although its value changes significantly as a function of $\langle r_A \rangle$). To study this effect, the structural phase diagram of the $A_{0.7}A'_{0.3}MnO_3$ system (A = La, Pr; A' = Ca, Sr, Ba) was determined by neutron powder diffraction as a function of temperature, pressure and $\langle r_A \rangle$. In addition to confirming that the overall increase of T_C as a function of $\langle r_A \rangle$ is associated with a reduction of the structural distortion from the cubic symmetry, this study has evidenced the extreme sensitivity of T_C to the average Mn-O distance. In fact, as a function of $\langle r_A \rangle$, <Mn-O> has a *minimum* that coincides with the *maximum* of the Curie temperature. Furthermore, the structure responds to external pressure by a compression of the Mn-O bond lengths, while the Mn-O-Mn bond angles are only slightly pressure-dependent.

MS10.06.02 MAGNETOSTRUCTURAL PHASE TRANSITIONS IN $La_{1-x}Sr_xMnO_3$ WITH CONTROLLED CARRIER DENSITY. Atsushi Asamitsu[1] and Yoshinori Tokura[1,2] [1]Joint Research Center for Atom Technology, Tsukuba 305, Japan [2]University of Tokyo, Tokyo 113, Japan

Magnetic field-induced structural phase transitions as well as thermally induced ones between the orthorhombic (O) and rhombohedral (R) structures have been investigated for perovskite-type manganese oxides, $La_{1-x}Sr_xMnO_3$, with finely controlled carrier density (x=0.160, 0.170 and 0.180). In x=0.170 crystal, the composition of which is tuned so that the structural transition temperature TS (≈285K) is located close to the ferromagnetic transition temperature TC (≈264K). As a result, novel magnetostructural effects have been observed: the TS is lowered by more than 50K with application of an external magnetic field of 7T. We determined the structural phase diagram in the field-temperature plane from measurements of the lattice striction. Utilizing the structural phase diagram, we can switch the crystal structure, reversibly or irreversibly, between the O- and R-phases by applying magnetic field at a fixed temperature. Such a large magnetostructural effect arises from the mutual coupling among the transfer interaction of doped e_g carriers, the local spin moment of t_{2g} electrons, and the lattice distortion. In the case of $La_{1-x}Sr_xMnO_3$ crystal, the transfer interaction of e_g carriers that is responsible for the ferromagnetic double-exchange interaction and hence the induced magnetization M is larger in the R-phase than in the O-phase in a magnetic field. Therefore the gain of the free energy by Zeeman term, -M·H, can drive the field-induced structural transition from the O- to R-phase. Thermodynamical aspects of these phenomena are understood semi-quantitatively in terms of the Landau free energy with coupled order parameters, the magnetization M and the lattice distortion Q.

In x=0.160 or 0.180, on the other hand, the T_S's are not changed conspicuously up to 7T, since their T_S and T_C differ considerably, either $T_S >> T_C$ or $T_S << T_C$, and hence the effective coupling between M and Q is reduced.