

NdSr2Cu4N4O10 is a pervoskite type compound isostructural with LaSr2Cu4N4O10 which contains a CuO2-La-CuO2 sandwich as well as N2O3 octahedra. The structure is therefore analogous to the YBa2Cu3O7 structure in which the linear Cu-O chains have been replaced by NiO3 octahedra. NdSr2Cu4N4O10 was prepared by firing stoichiometric mixtures of Nd2O3, SrCO3, CuO and N2O3 in air at 1370°C for 16 hours. Attempts to introduce superconductivity in NdSr2Cu4N4O10 by substitution of Ca for Nd was unsuccessful.

The structure of NdSr2Cu4N4O10 was studied by time of flight neutron powder diffraction. Rietveld refinements were performed in space groups P4/mmm, P4/mn and P4/nmm. The N2O3 octahedra are set on the a,b plane, and initial refinements showed that the octahedra are displaced from ideal corner sharing in such a way that neighboring octahedra are rotated in opposite directions around the c-axis. No superlattice reflections were observed and the final refinement was performed in space group P4/mmm with oxygen in the NiO3 layers statistically distributed over the 4n (1/2,0) positions. The rotation angle around the c-axis for the NiO3 octahedra was found to be 14.4°.

Although no super lattice peaks were found in the neutron data, electron diffraction indicates that the structure locally has P4/nmm symmetry. Bond lengths and bond valency sums for NdSr2Cu4N4O10 will be compared with the corresponding quantities for high temperature superconducting cerates.

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PS-10.01.18 ZEISS DISPERSOR OF THREE-DIMENSIONAL MAGNETIC ORDERING IN Gd2CuO4+

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We have studied the magnetic ordering of Gd2CuO4+ by neutron diffraction on isotopically enriched single crystals. Below T = 6.4 K Gd magnetic moments order ferromagnetically with the wave vector k = (0,0,0). Ferromagnetic Gd layers parallel to a,b plane are antiferromagnetically stacked along [001]. Cu2+ ions in Gd2CuO4+ order at Tc = 285 K to a La2CuO4 type antiferromagnetic structure with the propagation vector k = (4/5,4/5,0). Fig. 1 illustrates the magnetic structure of Gd2CuO4+ at 1.5 K. We have investigated the temperature dependence of the intensity of a few magnetic reflections from room temperature down to 1.5 K. The intensity of (4/5,4/5,1) magnetic reflection (Fig. 2) increases continuously with decreasing temperature up to 40 K below which it starts to decrease and shows a maximum at about 20 K. There is a further sharp anomaly at about 7 K at which the intensity of the reflection becomes practically zero. These neutron results are in agreement with the temperature variation of the magnetic susceptibility which also shows anomalies at 7 and 20 K. Search for magnetic reflection at Q = (4/5,4/5,0), (4/5,4/5,2) and (4/5,4/5,3) and other incommensurate positions at 7 K did not reveal any magnetic intensity. These results indicate that at this temperature three-dimensional ordering of the Cu 3d sublattice disappears. Low temperature anomalies in the temperature variation of the intensity of (4/5,4/5,1) reflection obviously result from the interaction of the Cu 3d and Gd 4f sublattices which order with different and incommensurate wave vectors. Above the ordering temperature of Cu sublattice the antiferromagnetic CuO2 planes polarize antiferromagnetic gadolinium planes. But as the ordering temperature of Gd sublattice is approached, ferromagnetic exchange interaction becomes dominant in the Gd planes. At 7 K presumably due to this frustration effect, the copper sublattice loses its three dimensional order. We believe that two dimensional ordering of the Cu2+ must still persist due to very strong exchange coupling but the three-dimensional ordering vanishes in a narrow temperature range just above the Gd ordering temperature. At the temperature is further lowered, the copper sublattice recovers its three dimensional ordering because the antiferromagnetically stacked ferromagnetic planes now have resultant zero field on copper. To our knowledge this type of frustration induced disappearance of magnetic ordering is quite unique and has not been observed in any other magnetic system.

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PS-10.01.19 STRUCTURAL FLUCTUATIONS IN METALLIC SODIUM. By H. Abe, K. Unshima, S. Hoshino, T. Suzuki and K. Kakurai, Institute of Applied Physics, University of Tsukuba, Japan, Institute for Solid State Physics, The University of Tokyo, Japan.

Metallic sodium undergoes martensitic phase transformation from hcc to hcc structure at 37 K (Ms). We have performed neutron elastic and inelastic scattering experiments from metallic sodium to understand detailed structural informations over a temperature range of 19 to 300 K. The spherical single crystal was prepared in liquid paraffin above the melting point (97°C) and gradually cooled down to room temperature. The size of the specimen was 18 mm in diameter and the mosaic spread was 20°. The data were collected with the use of a triple-axis spectrometer at the beam line 5C of JRR-3M, JAERI. Phonon dispersion curves from 200 K to Ms were measured along high symmetry directions. There were no peculiar temperature changes for T(1110) branch. The temperature dependence of integrated intensity and full width at half maximum (FWHM) was obtained from the (110)hcb Bragg reflection. They have increased drastically at Ms due to the structural change which took place, after an incubation time of the order of few hours. We also observed peculiar Huang scattering around the Bragg reflection. Above Ms (70-80 K), both the integrated intensity and FWHM were decreased where Huang scattering disappeared. It is thought that these phenomena are important to understand the phase transformation in metallic sodium.