CRYSTAL AND MAGNETIC STRUCTURE OF COBALT OXIDES AT HIGH PRESSURE AND TEMPERATURE

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The study of the crystal and magnetic structure of low-dimensional magnetic compounds is of interest due to their unique physical properties. These include the phenomena of magnetic frustration, ferromagnetism, the formation of exotic magnetic states, etc. From this point of view, $Ca_3Co_2O_6$ is a striking example of a magnetic system with unique magnetic phases due to the geometric topology of its crystal structure [1]. These compounds are interesting model materials for studying the geometry of magnetic interactions along and between one-dimensional structural chains, and on the other hand, there are features in the complex magnetic structure that are highly sensitive to doping and changes in external conditions. The report highlights the results of studies on the effect of manganese doping on the structural and magnetic properties of $Ca_3Co_2O_6$. Detailed studies of the structural and magnetic properties of $Ca_3Co_{2-x}Mn_xO_6$ compounds (x = 0, 0.1, 0.2, and 0.4), using X-ray diffraction and neutron diffraction methods [2]. The magnetic structure of the compound was studied using the DN-12 neutron diffractometer located at the high-flux pulsed reactor IBR-2 (FLNP, Dubna, Russia).

The results of studies on disordered perovskite cobaltites $LaMn_{0.5}Co_{0.5}O_3$ and $YMn_{0.5}Co_{0.5}O_3$ are also presented [3]. In an ideal ordered structure, Co^{2+} and Mn^{4+} ions alternate positions, and superexchange magnetic interactions between cobalt and manganesium ions lead to formation of ferromagnetic ordering. Disordering of cations in perovskite can cause increase of double Mn^{4+}-O-Mn^{4+} or Co^{2+}-O-Co^{2+} exchange interactions, enhancing antiferromagnetic interactions. We present the results of an investigation of the crystal and magnetic structures of orthorhombic $LaMn_{0.5}Co_{0.5}O_3$ and $YMn_{0.5}Co_{0.5}O_3$ compounds using neutron and X-ray diffraction methods in the temperature range 15–300 K and in pressure range up to 30 GPa. The application of high pressures above ~5 GPa leads to a gradual structural phase transition in both materials from an orthorhombic crystal structure with *Pnma* symmetry to *Imma* one, accompanied by anomalies in the behaviour of lattice parameters, unit cell volumes, and some Raman modes under pressure. According to neutron diffraction data at high pressures, the initial ferromagnetic state is suppressed, and there is a noticeable change in Curie temperature from T_C=76 K at ambient pressure down to T_C =38 K at a high pressure of 2.1 GPa.

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