Mixed-valence manganates and misfit cobaltates; Structure and properties of $La_{1-x}Sr_xMnO_3$ and $(Sr_2TlO_3)(CoO_2)_{1.77}$

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For the degree of doctor of philosophy in inorganic chemistry.

The thesis will be defended at 10.15, May 28th 2004 in the hall KB, Chemistry building, Chalmers campus, Göteborg.

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Abstract

Manganates Powder samples with the composition $La_{1-x}Sr_xMnO_{3\pm\delta}$ ($0 \leq x \leq 1$) were synthesised by solid-state reaction of metal oxides and carbonates. The sample characterisation was mainly done by the means of X-ray diffraction, neutron powder diffraction, and magnetisation measurements. It has been shown that, in addition to the increase of the Sr content in $La_{1-x}Sr_xMnO_3$, an increase in temperature promotes the formation of the rhombohedral phase. For $LaMnO_3$, which has two orthogonal forms (Ortho I and II), it was observed that the decrease in oxygen content, obtained by quenching, results in a change from the Ortho I to Ortho II. In the 'high-doped' region ($x > 0.40$), a change from rhombohedral to tetragonal symmetry starts at the composition $La_{0.55}Sr_{0.45}MnO_3$.

Cobaltates Until now, the structure information on thermoelectric Tl/Sr/Co/O misfit layer oxides has been based on data collected from powders only. Single crystals of the misfit layer cobaltate $(Sr_2TlO_3)(CoO_2)_{1.77}$ were synthesized and its crystal structure was determined by the means of X-ray single crystal diffraction and transmission electron microscopy. The synthesis took place by spontaneous crystallization from an oxide melt at high gaseous pressure. The structure is described by two monoclinic subsystems, which share the unit cell parameters a = 4.933(5) Å, c = 11.470(12) Å, and β = 98.00(10)° but are incommensurate in the b-direction: b_1 = 5.009(8) Å and b_2 = 2.830(8) Å, where b_1 is for the subsystem (Sr_2TlO_3) and b_2 for (CoO_2).