OXYGEN VACANCY ORDER AND MAGNETIC PROPERTIES OF $La_{1-x}Sr_xMnO_{3-d}$ ($0 \geq d \geq 0.5$)

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9.7 cm

Manganese perovskites $AMnO_{3-d}$ attain unique electronic and magnetic properties that depend on selection of the A-site ions, Mn valences, and orbital orderings, as well as the oxygen content and vacancy ordering. We have studied composition-structure-properties for new compositions $La_{1-x}Sr_xMnO_{3-d}$ ($x \geq 0.5$). In addition to interesting mix-conducting and thermoelectric properties, the oxygen non-stoichiometric materials exhibit novel magnetic properties. The oxygen deficient x=0.5 was found to form randomly distributed vacancies for 3>3-d>2.68 and vacancy ordered antiferromagnetic phase for 2.50. No Sr/La ions ordering, in contrast to the $La_{1-x}Ba_xMnO_{3-d}$ system, was found due to instability of $La_{0.5}Sr_{0.5}MnO_{2.5}$ at T>600°C. Similar properties were found for x=0.3-0.6. For x=0.8-1 we have discovered several oxygen vacancy ordered phases, 3-d=2.714, 2.60, 2.55, and 2.50 that enhance magnetic interactions. Vacancy ordering was found to produce charge and orbital orderings, creating unique crystal and magnetic structures, some of which have been previously observed for parent compounds of HTSC (La,Ba)CuO_{3-d}. These findings have revealed common vacancy ordering relationships in perovskites for which highly distorted, pyramidally-coordinated Mn^{3+} (Cu^{2+}), and symmetric, octahedrally-coordinated Mn^{4+} (Cu^{3+}) ions are present simultaneously.

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