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Relationship between transition temperature and magnetic entropy changes in manganite materials

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A theoretical consideration for entropy changes in a magnetic solid is given in a general manner and has been taken into account for such $La_{0.7}Ca_{0.3-x}Ba_xMnO_3$ (x = 0.12, 0.24, 0.3) compounds. The total entropy changes, in which the total entropy is decomposed into the magnetic, lattice, and electron entropies, are discussed in detail. In connection with the experimental data of $La_{0.7}Ca_{0.3-x}Ba_xMnO_3$ (x = 0.12, 0.24, 0.3) compounds that their Curie temperature (T_C) increases and the maximum entropy change, $\left|\Delta S_M^{\max}\right|$, decreases with the barium addition, we suggest that the decrease in $\left|\Delta S_M^{\max}\right|$, related to the increase of T_C temperature, originates from decrease of spin-lattice interaction in the sample. In other words, an increase in the lattice entropy leads to the corresponding reduction of magnetic entropy as T_C is increased. On the basis of the theoretically expressions given, we propose that contributions of the lattice entropy to the total entropy change can be ignored in magnetic substances with very low transition temperatures, but not for ~300 K transition-temperature materials.

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