

Specific heat studies of the phase transitions in multiferroic $\text{Sr}_{1-u}\text{Ba}_u\text{Mn}_{1-y}\text{Ti}_y\text{O}_3$ system ($0 \leq u \leq 0.65$, $0 \leq y \leq 0.1$)

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The $\text{Sr}_{1-u}\text{Ba}_u\text{Mn}_{1-y}\text{Ti}_y\text{O}_3$ manganites are promising multiferroic materials, in which a strong coupling between magnetically ordered phase and ferroelectric phase, related probably to the fact that the same Mn ions are responsible for the two orderings, appears. The specific heat studies of these multiferroics were performed by the relaxation and DSC methods over the temperature range 2 – 450 K. Anomalies accompanying the antiferromagnetic-paramagnetic and ferroelectric-paraelectric phase transitions were measured. The magnetic contribution was determined by extracting the lattice contribution (estimated by mixing the Debye and Einstein models) from the total specific heat measured and it was analyzed. Anomalies accompanying the antiferromagnetic-paramagnetic and ferroelectric-paraelectric phase transitions were measured. Analysis of the specific heat anomaly at the magnetic transition was done using the advanced theory of the continuous transitions, in which the presence of higher order terms in the free energy is considered, and the parameters of the critical behavior of the system were estimated. The shape of this anomaly suggests that arguably, despite earlier predictions, the transition loses the continuous character and becomes the first-order process for the Ti-containing samples. For majority of the compositions, the anomaly accompanying the first-order high-temperature ferroelectric transition was found to be smeared and not well pronounced, which was tentatively ascribed to a wide temperature range of coexistence of the para- and ferroelectric phases and a small difference between entropies of both phases.

References:

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