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Review

Applications of low temperature calorimetry in material research

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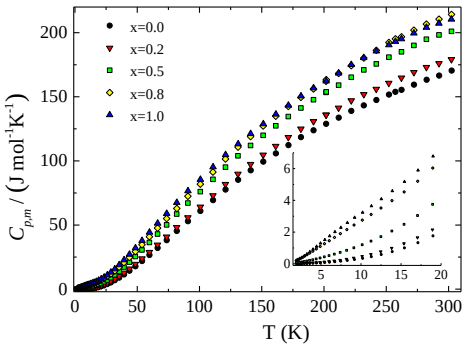
Graphical abstract



Low temperature calorimetry has been used not only to obtain heat capacity, entropy, enthalpy and Gibbs free energy, but also to investigate and understand lattice vibrations, metals, superconductivity, electronic and nuclear magnetism, dilute magnetic systems and structural transition involved in material research.

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ABSTRACT

Low temperature calorimetry is an experimental method of heat capacity measurements, and heat capacity is one of the most important and fundamental thermodynamic properties of substances. The heat capacity can provide an average evaluation of the thermal property of a sample since it is a bulk property of substances. In the other hand, the condensed states of substances could be mainly controlled by the molecular motions, intermolecular interactions, and interplay among molecular structures. The physical property reflected in a material may be closely related to the energy changes in these three factors, which can be directly observed in a heat capacity curve. Therefore, low temperature calorimetry has been used not only to obtain heat capacity, entropy, enthalpy and Gibbs free energy, but also to investigate and understand lattice vibrations, metals, superconductivity, electronic and nuclear magnetism, dilute magnetic systems and structural transitions. In this review, we have presented the concept of low temperature calorimetry and its applications in the related field of material researches, such as nano-materials, magnetic materials, ferroelectric materials, phase change materials and other materials.

1. Introduction