

Phase Modification of Potassium Nitrate by Potassium Salts

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Potassium nitrate (KNO_3) is of great interest as a lead-free ferroelectric material for use in FeRAM, but the temperature range of ferroelectric phase is limited. For enlarging the temperature range, modification of the ferroelectric phase of potassium nitrate has been attempted using a variety of potassium salts, namely KCl, KBr, KI, KClO_3 , and KClO_4 . The phase transition temperature of ferroelectric to paraelectric is lowered when KNO_3 containing 1~10% by mole fraction of these potassium salts, viz. solid solutions. The linear expansion due to phase transition is still observable in HTXRD measurements. Lattice expansions during heating or cooling are presented. The extent of modification, however, is found to be dependent both on the concentration, and the type of the anion. The solid solubilities of KNO_3 -based limited solid solutions are correlative with their guest ion radii. Some evidence of KNO_3 ferroelectric phase being stabilized down to room temperature by solid solutions, as a result of substituting of NO_3^- radicals by Cl^- , Br^- , I^- , ClO_3^- , and ClO_4^- radicals, were observed. HTXRD studies show that the doping guest ion to a visible distortion of the lattice structure of KNO_3 , which implies that NO_3^- radical was substituted by those guest ion.