ORTHORHOMBIC TO TETRAGONAL PHASE TRANSITIONS IN ENVIRONMENTAL FRIENDLY PIEZOCERAMICS

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Abstract

Nowadays, new environmentally friendly, lead-free piezoelectric materials have been developed to replace the classic lead-based materials, PZT. Presently, the family of lead-free ceramics showing the most promising piezoelectric properties is based on potassium sodium niobate: $K_{0.5}Na_{0.5}NbO_3$ (noted KNN) [1, 2]. Because of the toxicity of lead oxide, researches on lead-free piezoelectric ceramics focusing on substituting these toxic oxides have recently attracted much attention. Important developments were reported with $(K_{0.5}Na_{0.5})NbO_3$ (noted KNN) based ceramics, which showed that they are promising candidates for lead-free piezoelectric materials [3, 4].

The goal of this paper is to present some new results on $GdXO_3$ (where X= Al, Co, Cr, Fe, Mn) doped KNN ferroelectrics. Pure KNN and KNN doped with 1 mol% $GdXO_3$ were produced by the conventional solid state synthesis. The conventional processing steps have been chosen in order to obtain reproducible high quality samples without using complex techniques such as hot pressing or special powder handling. The variation of the real part of the dielectric constant and dielectric loss are presented (TEGAM model 3550). The ceramics obtained were structurally characterized using x-ray diffraction (PANalytical X'Pert Pro MPD), with emphasis on the shifting of orthorhombic to tetragonal crystal symmetry at room temperature. The more possible polarization states arising from the coexistence of two phases (orthorhombic and tetragonal) at room temperatures can improve the piezoelectric properties of KNN ceramics.

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