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Texturing behaviours of $(K_{0.47}Na_{0.51}Li_{0.02})(Nb_{0.8}Ta_{0.2})O_3$ piezoelectric ceramics produced using $NaNb_{1-x}Ta_xO_3$ templates

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Abstract

Textured $(K_{0.47}Na_{0.51}Li_{0.02})(Nb_{0.8}Ta_{0.2})O_3$ (KNLNT20) piezoelectric ceramics were prepared using $NaNb_{1-x}Ta_xO_3$ templates. The highest degree of grain orientation (97%) and piezoelectric constant (342 pC/N) were obtained upon adding 3 wt% of the $NaNb_{0.8}Ta_{0.2}O_3$ (NNT20) template and sintering at 1150°C for 1 h. Back-scattered scanning electron micrographs of the textured KNLNT20 samples sintered at 1150°C for 1 h indicated the presence of templates similar in size to the original ones within the cores of the textured grains. The peak value of the dielectric constant corresponding to the NNT20 core decreased after prolonged holding at 1150°C, owing to a decrease in the size of the NNT20 core because of the interdiffusion of K, Na, and Li ions between the NNT20 core and KNLNT20 shell. This interdiffusion also decreased the piezoelectric constant, d_{33} value of the textured KNLNT20 samples by inducing a change in the chemical composition of the shell region.

Keywords: $(K_{0.47}Na_{0.51}Li_{0.02})(Nb_{0.8}Ta_{0.2})O_3$; lead-free piezoelectrics; texturing; residual template

1. Introduction

Ever since Saito *et al*. [1] reported that textured $(K,Na)NbO_3$ (KNN)-based ceramics show excellent piezoelectric properties, which are comparable to those of $Pb(Zr,Ti)O_3$