Piezoelectric, Dielectric, Structural And Phase Transition Behavior Of Ti-Substituted $0.4Pb(Yb_{0.5}Nb_{0.5})O_3$-$0.6PbZrO_3$ Solid Solution System

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The complex $A(B'B'')O_3$ perovskites are important class of ferroelectrics and piezoelectric materials. Among these perovskites, the lead-based complex perovskites with chemical formular $Pb(B'B'')O_3$ have been of great academic interest because they display interesting phase transition behaviors and posess many industrial applications. Their physical properties such as piezoelectric, dielectric and pyroelectric constants vary drastically with the chemical composition and geometrical distribution of B-site cations in the perovskite crystal lattice [1].

Such an example is the mixed phases such as $PbZrO_3$-$PbTiO_3$[PZT], $Pb(Mg_{1/3}Nb_{2/3})TiZrO_3$, $PbYb_{0.5}Nb_{0.5}O_3$-$PbTiO_3$[PYN-PT] [2] and so on.

In this study, we made solid solutions from ordered antiferroelectric PYN and PZ and ferroelectric PT. The purpose of this work is to find out the crystal structure change, dielectric and piezoelectric properties of $(PYN_{0.4}PZ_{0.6})_{1-x}PT_x$ ceramic system for $0 \leq x \leq 0.6$. Structural analysis by XRD, dielectric constants, P-E hysteresis loop and piezoelectric constants(d_{33}) measurements have been conducted to investigate the phase transition phenomena of this system.

The crystal structure changes from the pseudocubic for $x \leq 0.2$ to the tetragonal for $x > 0.2$. Our dielectric constant measurement reveals diffuse phase transition(DPT) behavior but with no frequency dependence apparent transition temperature at the applied frequencies between 100Hz and 1MHz. The Curie temperature(T_c) gradually increases with PT substitution. The remanent polarization and d_{33} gradually increase with increasing PT concentration. They attain the maximum values at $x=0.5$.

References

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[2] H. Lim, H. J. Kim and W. K. Choo: Jpn. J. Appl. Phys. **34**, 5449 (1995).