$Pb(Zn,Mg)_{1/3}Nb_{2/3}O_3$-$PbTiO_3$ Relaxor Ferroelectric System : (II) Dielectric Properties

($Pb(Zn,Mg)_{1/3}Nb_{2/3}O_3$-$PbTiO_3$ 완화형 강유전계 : (II) 유전특성)

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The main purpose of the present study was to investigate the effects of the addition of constitutive metal oxides (PbO, MgO, and ZnO) on the dielectric properties of $Pb(Zn,Mg)_{1/3}Nb_{2/3}O_3$-$PbTiO_3$ system. The excess addition of constitutive oxides was made to fully stabilize perovskite phase.

Sintered 0.9(PZN-PMN)-0.1PT specimen with approximately 100 % perovskite phase was successfully obtained by the addition of 5 wt % excess PbO. In this case, however, dielectric constant at the Curie temperature was significantly reduced. This is due to the presence of intergranular phase derived from a liquid phase during sintering. The thickness of a thin intergranular PbO-rich layer was estimated using the series mixing model and the compositional fluctuation model of relaxor ferroelectrics. It was approximately 3 nm for the PZMN-0.1PT system with 5 wt% excess PbO. The excess addition of MgO (~5 mol %) fully stabilizes perovskite phase and increases dielectric constant at the Curie temperature (120 °C) to ~21,000. The increase in dielectric permittivity of the 0.9(PZN-PMN)-0.1PT system was attributed to the enhanced grain growth in the presence of excess MgO. The enhanced characteristics of a diffused phase transition (DPT) in the presence of ZnO was interpreted in terms of the substitution of Zn atoms for Nb atoms in the B-site of perovskite structure. This conclusion was drawn from the results of complex impedance patterns of 0.9(PZN-PMN)-0.1PT specimens with and without excess additives.