CuO 첨가에 따른 $0.4Pb(Mg_{1/3}Nb_{2/3})O_3$-$0.25PbZrO_3$-$0.35PbTiO_3$ 세라믹스의 압전특성과 미세조직의 변화

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Effect of CuO Additions on Microstructures and Piezoelectric Properties of the $0.4Pb(Mg_{1/3}Nb_{2/3})O_3$-$0.25PbZrO_3$-$0.35PbTiO_3$ Ceramics

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Abstract : Lead oxide based ceramics, represented by PZT, are the most widely used materials for piezoelectric actuators, sensors, and transducers due to their excellent piezoelectric properties. In particular, high-performance multilayered piezoelectric ceramics for advanced electronic components have drawn great attention. In order to develop piezoelectric ceramics capable of being sintered at low temperature for multilayer piezoelectric device applications, the effect of CuO additions on the microstructures and electromechanical properties of the $0.4Pb(Mg_{1/3}Nb_{2/3})O_3$-$0.25PbZrO_3$-$0.35PbTiO_3$ ceramics was investigated. The samples with CuO addition were synthesized by ordinary sintering technique. X-ray diffractions indicated that all samples formed a single phase perovskite structure. The addition of CuO improved the sinterability of the samples and caused an increase in the density and grain size at low temperature. The optimum sintering temperature was lowered by CuO additions. Excellent piezoelectric and electromechanical responses, d_{33} ~ 663 pC/N, k_P ~ 0.72, were obtained for the samples of high density with 0.1 wt% CuO addition sintered at 1050 °C for 4 h in air. These results show that the piezoelectric properties of PMNZT ceramics can be improved by controlling the microstructure and this system is potentially a good candidate as multilayer piezoelectric device for a wide range of electro-mechanical transducer applications.

Key Words : PMNZT, CuO, piezoelectrics, microstructure, sintering.