Preparation of PZN-BT-PZT ceramics using A-site element sequential mixing columbite method

Chen-Liang Li[a], Chen-Chia Chou[a] and Dah-Shyang Tsai[b]

[a]Department of Mechanical Engineering, [b]Department of Chemical Engineering, National Taiwan University of Science and Technology, Taipei 106, Taiwan.

Complex $Pb(Zn_{1/3}Nb_{2/3})O_3$ (PZN)-based ceramics have been prepared by three different columbite methods: individual columbite (IC), modified columbite (MC) and A-site elements sequential mixing columbite (ASMC). The sintered ceramics via the IC method, their pyrochlore ratio were always higher than those prepared from the other two methods. Addition of a perovskite phase, such as $BaTiO_3$ and $PbZrTiO_3$, to effectively reduce the pyrochlore content of PZN has been a criterion in evaluating various preparation methods. The perovskite/pyrochlore ratio was decreased effectively by MC process. However, the pyrochlore was not removed completely by MC process to PZN-rich compositions. The presence of a substantial amount of pyrochlore phase in PZN-base ceramics causes a decreasing in the dielectric properties. The transmission electron microscopy (TEM) and energy dispersive spectroscopy (EDS) observation of the MC samples show that the BaO was segregated at triple junctions, implying that stabilization of the perovskite structure of the specimens was not completely achieved due to element segregation. The full perovskite phase was obtained by ASMC method for all compositions, and the dielectric constant of ASMC ceramics was higher than those of IC and MC. Even thought the pyrochlore phase can be removed by all three processes at the same composition, and the dielectric behavior of PZN-base ceramics was markedly affected by processing procedures.

Keywords: Electron microscopy, Ferroelectric, Dielectric properties, Perovskite,

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