PIEZOELECTRIC PROPERTIES OF LOW-TEMPERATURE SINTERED $Pb_{0.95}Ba_{0.05}[(Mg_{1/3}Nb_{2/3})_{0.125}Zr_{0.445}Ti_{0.43}]O_3$ CERAMICS WITH CHEMICALLY-ADDED $LiBiO_2$ SINTERING AID

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Abstract: $Pb(Zr,Ti)O_3$ (PZT)-based piezoelectric ceramics have received great attention for their utilization in advanced electronic components such as ultrasonic mortars, actuators and transformers. Recently, it has strongly been required for fabrication of multilayer piezoelectric devices to use Ag-Pd internal electrode with a lower Pd content or other electrodes such as Ag and Cu. However, because PZT-based ceramics must undergo high-temperature processing (>1100□) to obtain practical piezoelectric properties, these electrodes can not be used. Therefore, low-temperature processing is one of the most important techniques for fabrication of multilayer piezoelectric devices. In this work, low-temperature fabrication of $Pb_{0.95}Ba_{0.05}[(Mg_{1/3}Nb_{2/3})_{0.125}Zr_{0.445}Ti_{0.43}]O_3$ (PBMNZT) ceramics was investigated, and their microstructure, ferroelectric and piezoelectric properties were examined. In order to improve the sinterability and piezoelectric properties, $LiBiO_2$ sintering aid was uniformly added to PBMNZT powders with surface chemical modification using hydrolysis of alkoxides. PBMNZT powders without $LiBiO_2$ could not be fully densified at sintering temperatures lower than 1100□. On the other hand, an addition of LiBiO2 considerably improved the sinterability of PBMNZT powders, and sintering temperature consequently decreased from 1100□ to 850□. And also, 0.7 wt% $LiBiO_2$-added PBMNZT ceramics could be fabricated without deteriorating the piezoelectric properties in the sintering temperatures below 1000□. A high electromechanical coupling factor (kp) of 61.7%, as well as a large field-induced strain of □0.17% (40 kV/cm) was obtained for 950□-sintered specimens with 0.7 wt% $LiBiO_2$ additive.