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Large electrostrain response in binary $Bi_{1/2}Na_{1/2}TiO_3$-$Ba(Mg_{1/3}Nb_{2/3})O_3$ solid solution ceramics

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Abstract: A binary solid solution (1-x)$Bi_{0.5}Na_{0.5}TiO_3$-$x$$Ba(Mg_{1/3}Nb_{2/3})O_3$ ((1-x)BNT-xBMN) was fabricated by the conventional solid state reaction, and compositionally dependent micro-structure and macro-electrical properties were systematically investigated. The BMN substitution was found to induce a transition from dominant ferroelectric to ergodic relaxor phase, resulting in the ferroelectric-to-relaxor phase transition temperature decreasing from 102^{o}C to below room temperature. Accordingly, the optimal piezoelectric property of d_{33}=122 pC/N and the maximum strain of 0.35% with normalized strain of 493 pm/V were achieved at ambient temperature for the compositions with x=0.044 and 0.052, respectively. The piezoelectric and strain properties are dominated by the contributions from the irreversible domain switching and the recoverable ergodic-ferroelectric phase transition, respectively.

Keywords: $Bi_{0.5}Na_{0.5}TiO_3$; phase transition; piezoelectric properties; electrostrain

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