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Tailored dielectric tunability of alkali niobate-based antiferroelectric/relaxor-ferroelectric composites

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High dielectric tunability, low loss and an appropriate level of dielectric permittivity are basic requirements of ferroelectric materials for tunable microwave devices. In this study, $0.96\text{NaNbO}_3\text{-}0.04\text{CaZrO}_3\text{/}0.88(\text{K}_{0.5}\text{Na}_{0.5})\text{NbO}_3\text{-}0.12\text{SrZrO}_3$, antiferroelectric/relaxor-ferroelectric composites were designed to tailor dielectric tunability. By tailoring the microstructure of the composites, a high dielectric tunability of 51.78% with a low loss of 0.015 was achieved at the composition ratio of 15/85. The nonlinear behaviours of the composites were explored by Johnson model; with increasing antiferroelectric phase, the contribution of the polarization to the free energy was increased between the antiferroelectric and relaxor-ferroelectric. Furthermore, the high resistance layer at the grain boundary region greatly inhibited the long-term migration of electrons and defective ions (mainly oxygen vacancies) in

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