Atomic Structure of Pyrochlore Bismuth Zinc Niobate Thin Films

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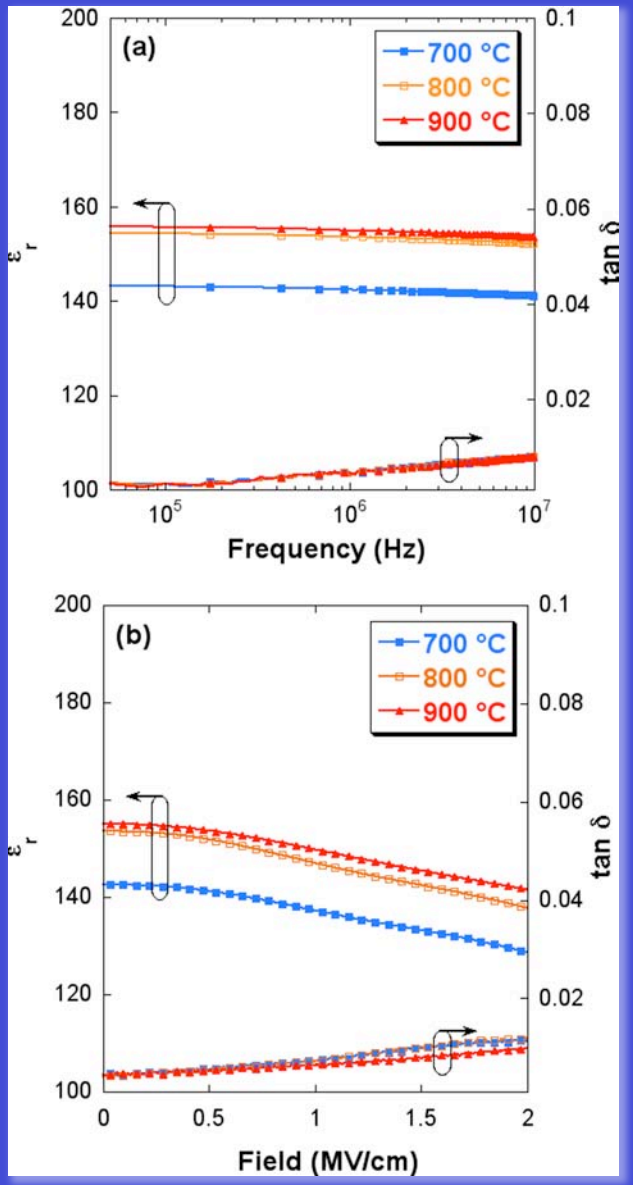
The unusual dielectric properties of pyrochlore bismuth zinc niobate (BZN), in particular its low dielectric loss, high dielectric constant and electric field tunability are believed to be closely related to the displacive and chemical disorder within the unit cell.

$Bi_2Ti_2O_7$ (BTO) has the cubic pyrochlore structure with disordered displacements of both the Bi and O' sites, similar to bismuth zinc niobate. This makes BTO a model material for understanding structure-property relationships in bismuth pyrochlore dielectrics. In contrast to BZN, however, BTO is not a thermodynamically stable phase. We obtained nearly phase-pure BTO films by sputtering at low temperatures and subsequent crystallization anneals.

Although BTO showed off centering of Bi cations, its dielectric properties were distinctly different from BZN. The films were not tunable and the losses were higher than for BZN.



Dielectric properties of $Bi_2Ti_2O_7$ as a function of post-growth annealing temperature: (a) The dielectric losses increase and the dielectric constant decreases with frequency. (b) The dielectric constant only shows a small tunability under an electric field.