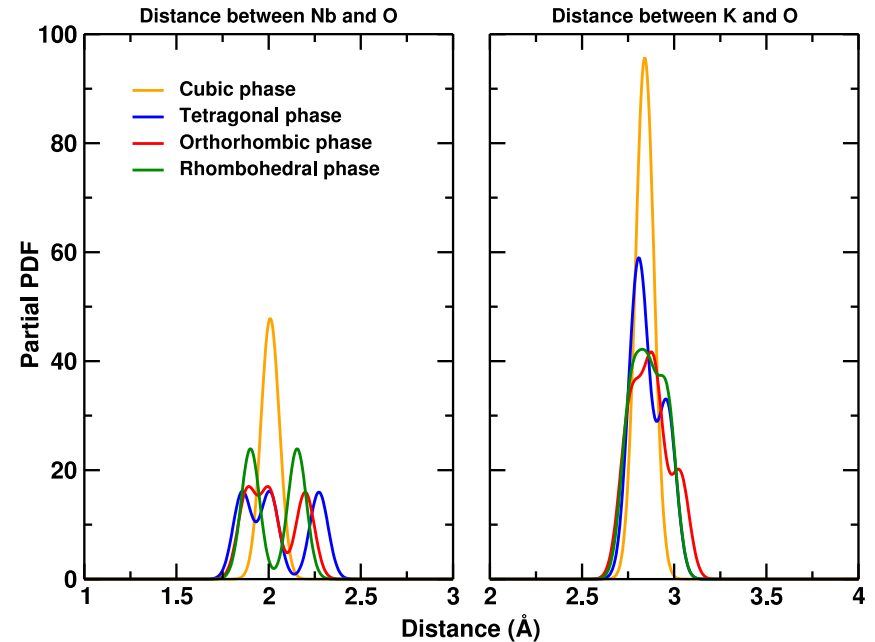


Origin of the Electric Field-Induced Strain in Lead-Free Piezoelectric Ceramics

Scott P. Beckman and Xiaoli Tan
Iowa State University
DMR-Award 1037898

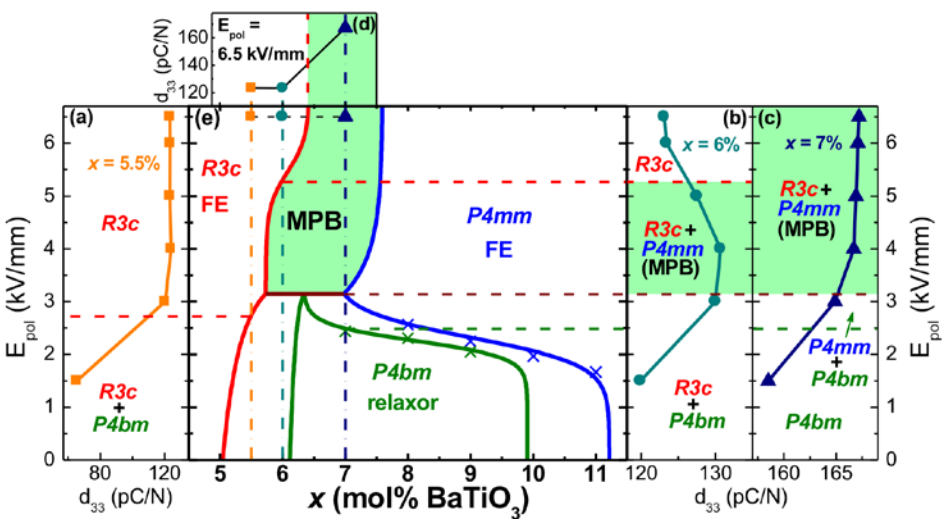
$\text{Pb}(\text{Zr}_{1-x}\text{Ti}_x)\text{O}_3$ has been the most widely used solid solution system for piezoelectric ceramics. However, their high content (>60 wt.%) of Pb has raised serious health and environmental concerns.

The computational effort has focused on the $\text{KNbO}_3\text{-NaNbO}_3$ alloy family.



Pair distribution function for the known phases of KNbO_3

By *in situ* TEM and bulk dielectric measurements we observe that the electric field used to pole as formed ceramics can induce a phase transition. This can both create and destroy MPB. The magnitude of the poling field can be selected to engineer the piezoelectric properties of the ceramic.



$(\text{Bi}_{1/2}\text{Na}_{1/2})\text{TiO}_3\text{-}x\text{BaTiO}_3$ Phase diagram
Composition and Poling field