

Anisotropy of Ferroelectric Behavior of $(1-x)\text{Bi}_{1/2}\text{Na}_{1/2}\text{TiO}_3 - x\text{BaTiO}_3$ Single Crystals across the Morphotropic Phase Boundary



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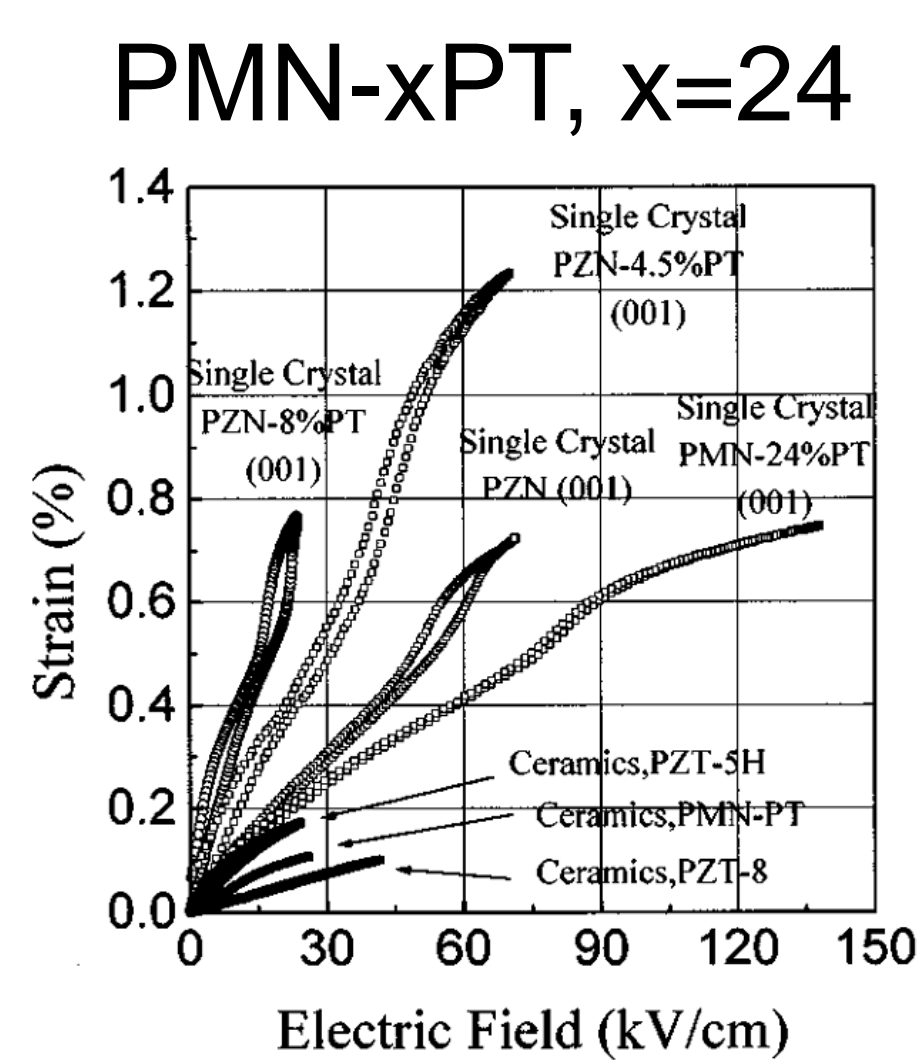
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Motivation

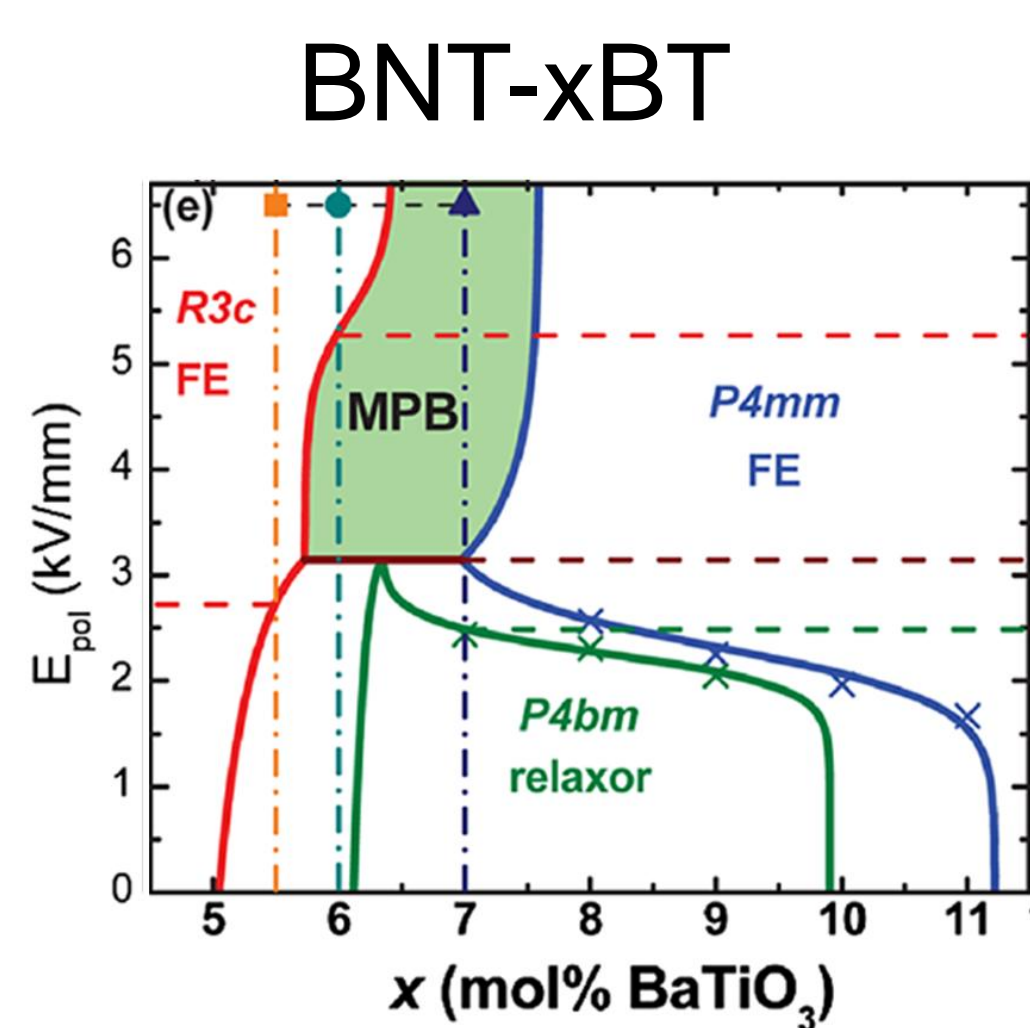
- Clarify phase diagram in BNT-xBT systems
- Concept of PMN-xPT valid for BNT-xBT systems?
- Understand influence of direction on domain switching
- Domain wall mobility in single crystals

Introduction



Enhanced piezoelectric properties of single crystal in comparison to ceramics.

J. Appl. Phys., **82** (1997) 1804

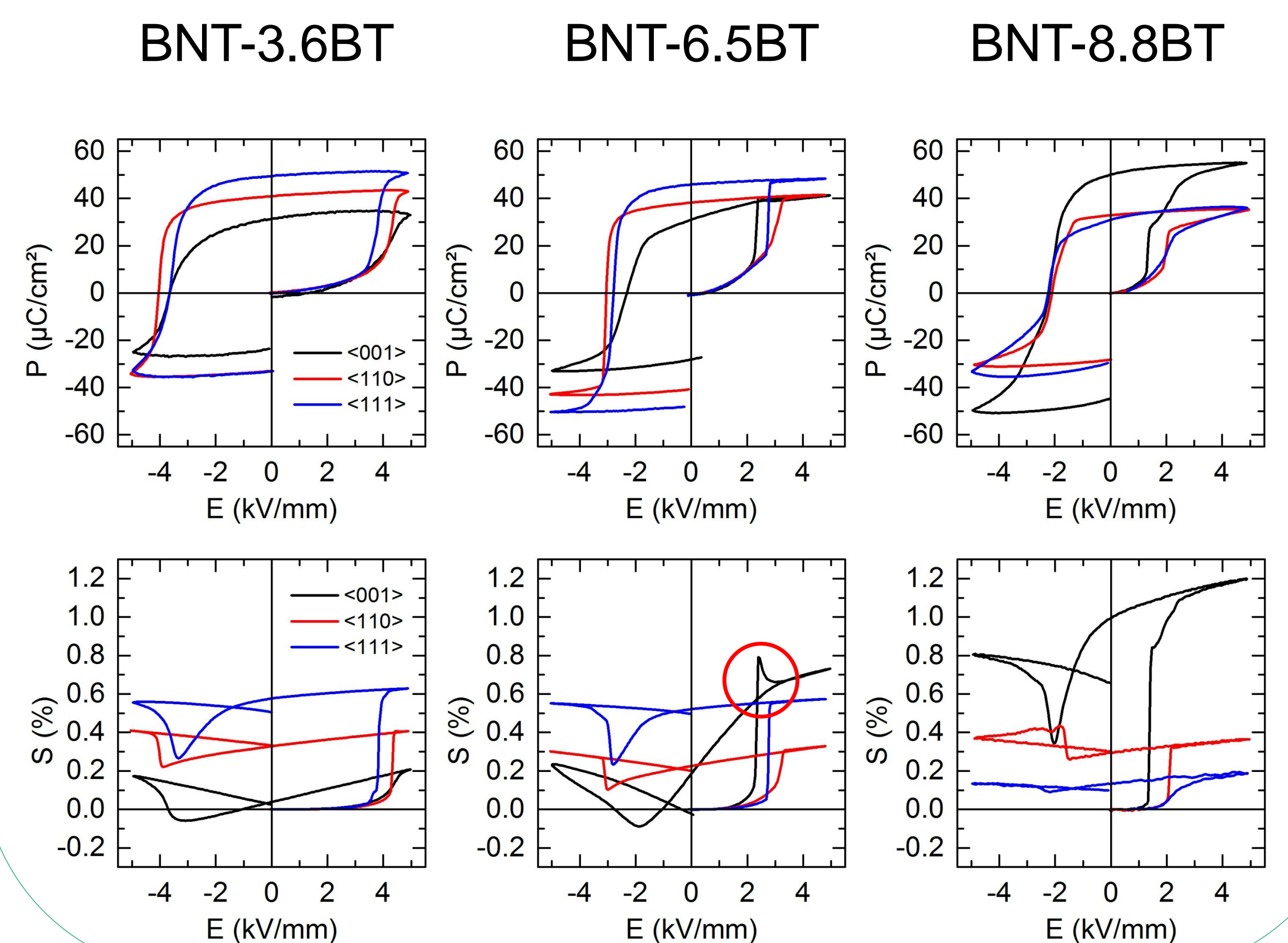


Choose different concentrations to find the same effect as in PMN-xPT.

PRL **109**, 107602 (2012)

Results: Polarisation and Strain

Poling cycle at room temperature with $f = 100$ MHz and $E = 5$ kV/mm



Crystals

From company FEE:
grown by Top Seeded
Solution Growth method



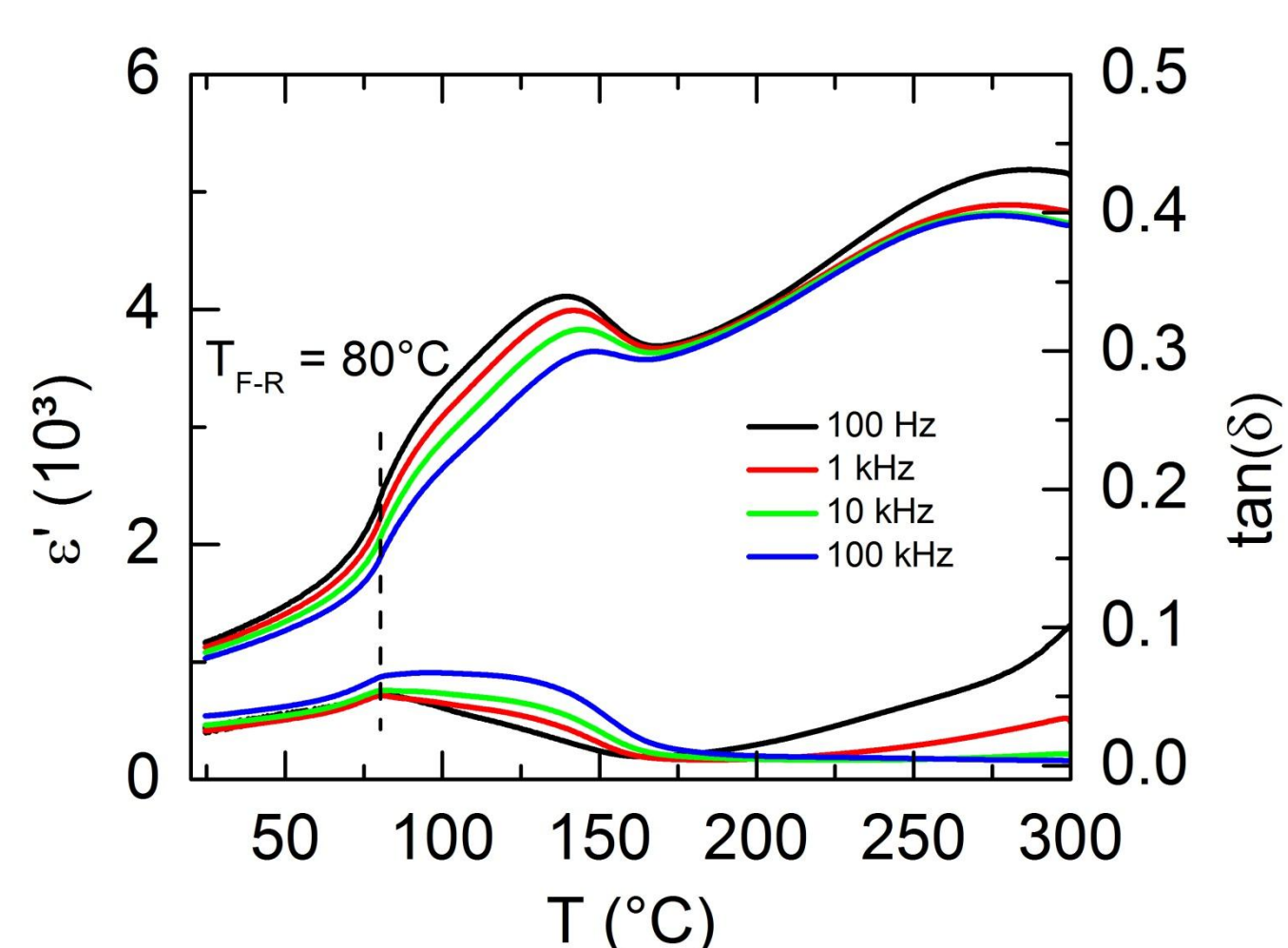
BNT-3.6BT



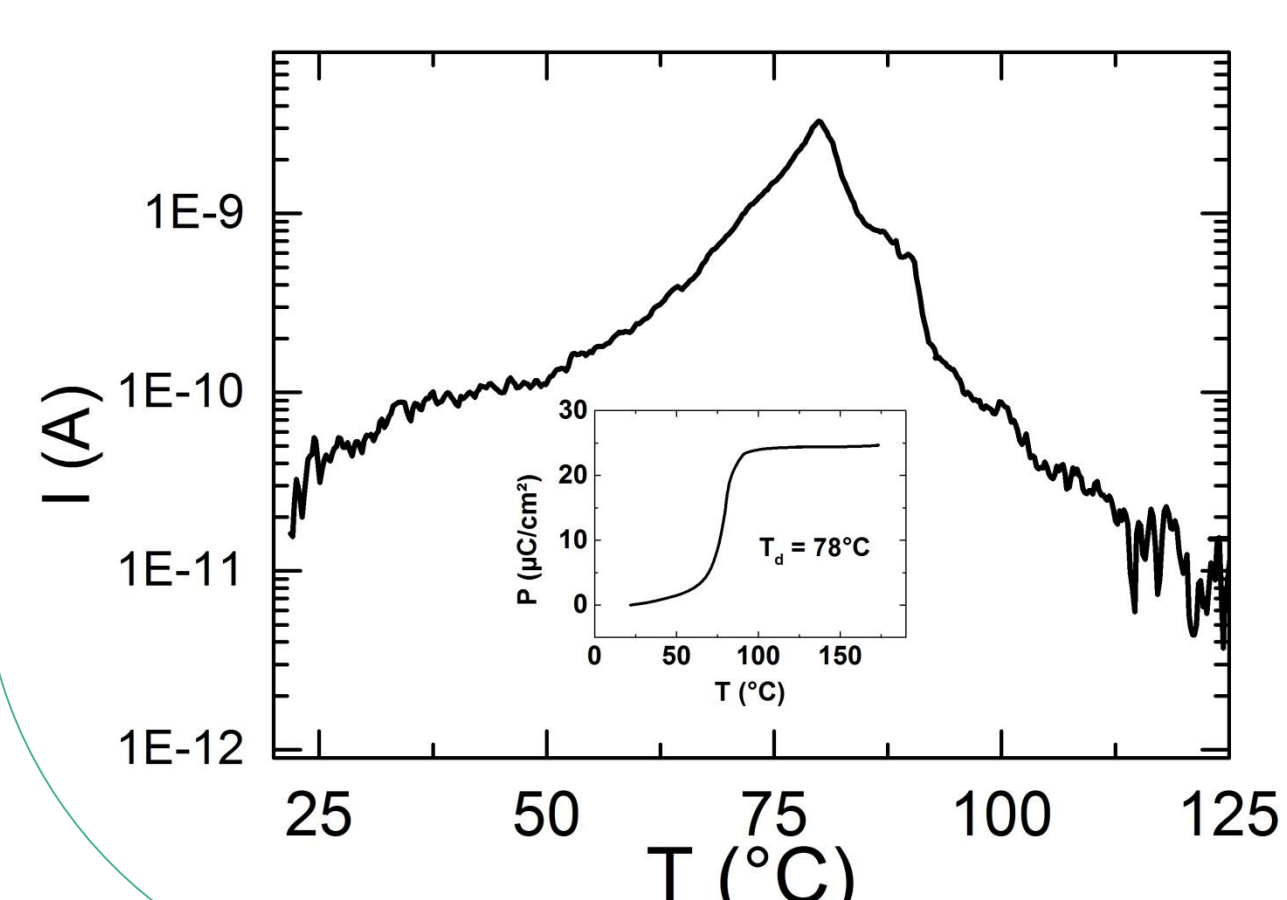
BNT-6.5BT

Results: Temperature dependence in BNT-6.5BT in <001>

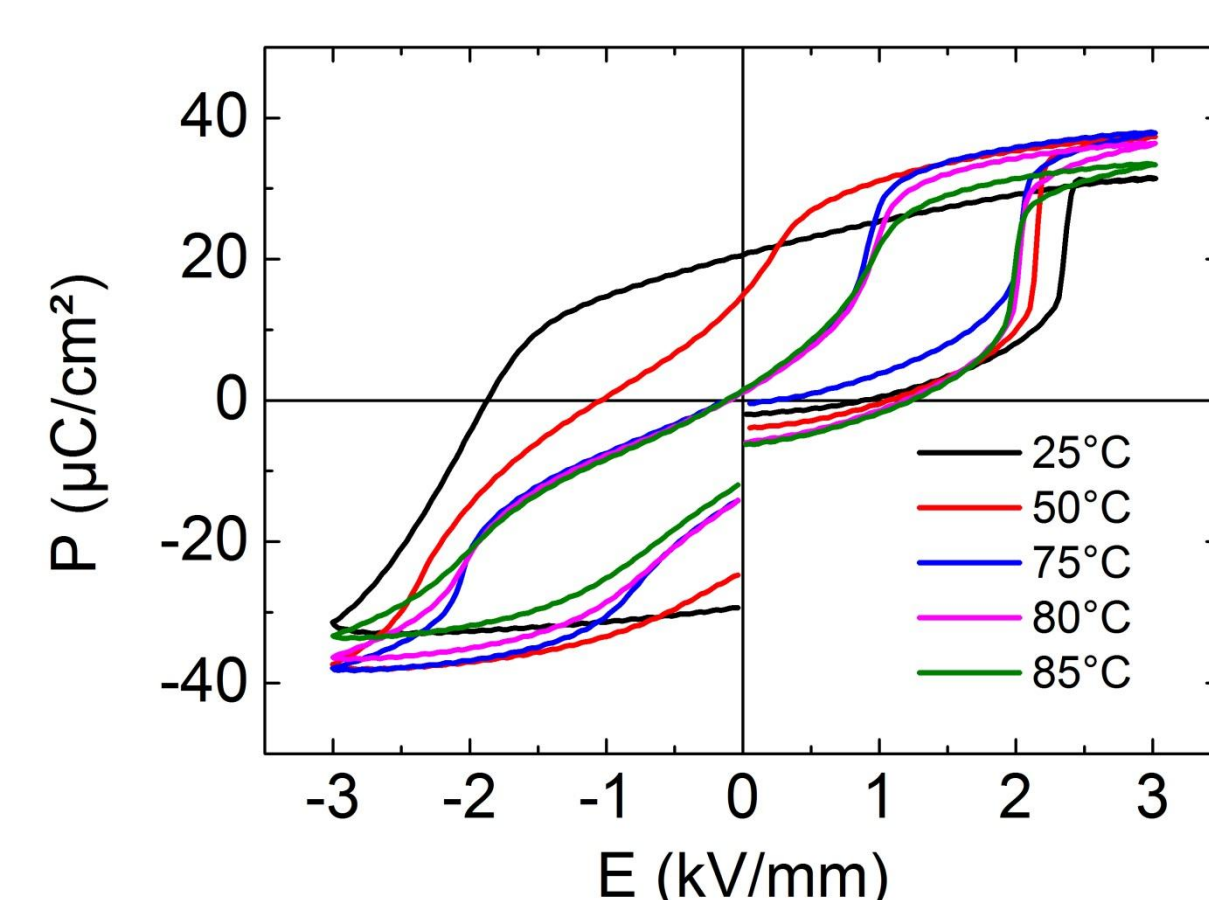
Permittivity ϵ' : $T_{F-R} = 80^\circ\text{C}$



TSDC: $T_d = 78^\circ\text{C}$

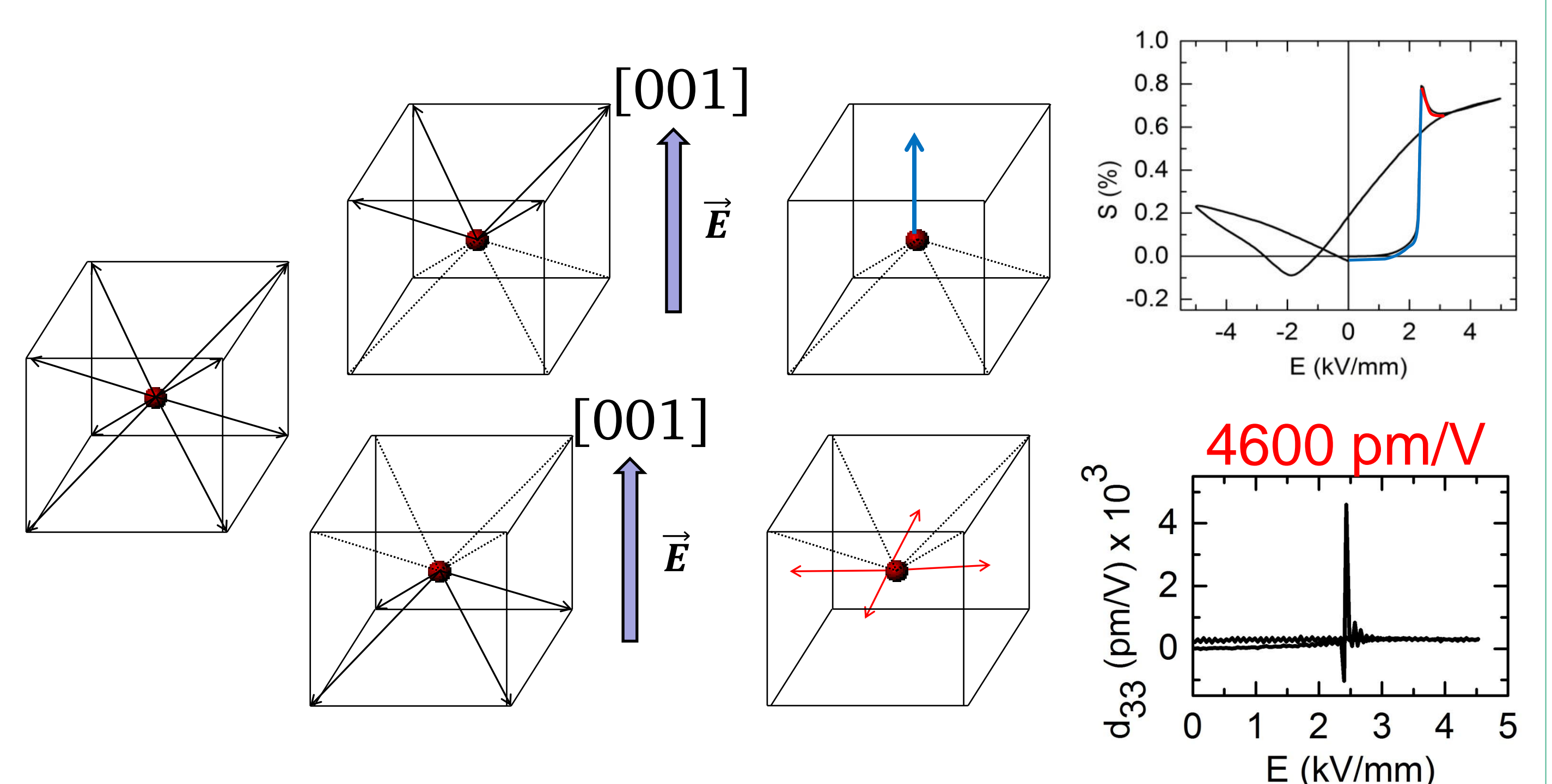


Polarisation at $E = 3$ kV/mm



- At 50°C loop pinching sets in.
- Between 75°C and 85°C nearly no change in polarisation behavior.

Speculation on strain behavior



No rhombohedral domain switching, but direct jump to tetragonal symmetry:

1. Dipole moments with angle smaller than 90° switch towards $[001]$ → **high strain**
2. $\langle 111 \rangle$ dipoles with angles larger 90° switch to $[100]$, $[-100]$, $[010]$ or $[0-10]$ and are trapped → **sudden decrease of strain**
3. Increasing strain due to elongation of unit cell

Publications last funding period

- *J. Appl. Phys.* **116**, 044111 (2014)