

Characterization of High Curie Temperature Piezocrystals: doped $\text{Pb}(\text{Yb}_{1/2}\text{Nb}_{1/2})\text{O}_3$ - PbTiO_3 and BiScO_3 - PbTiO_3

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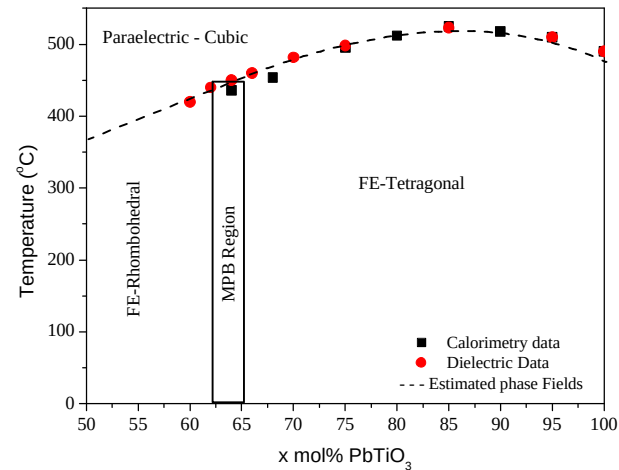
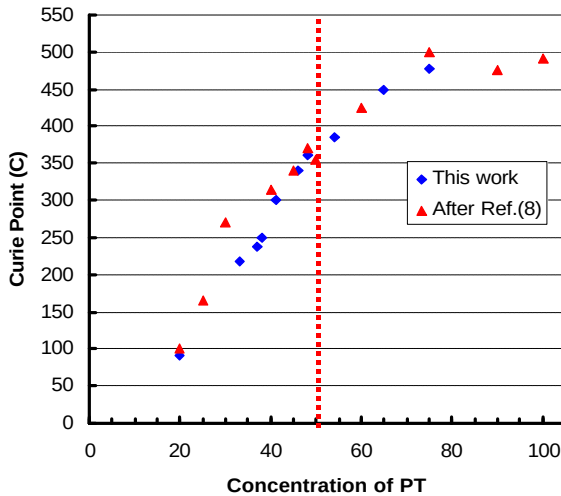
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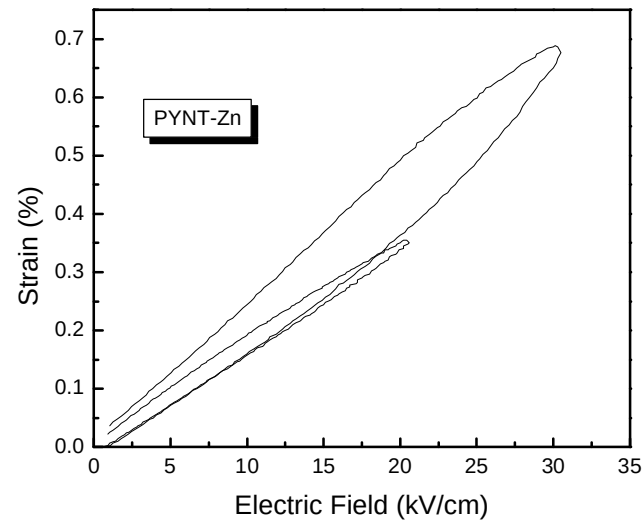
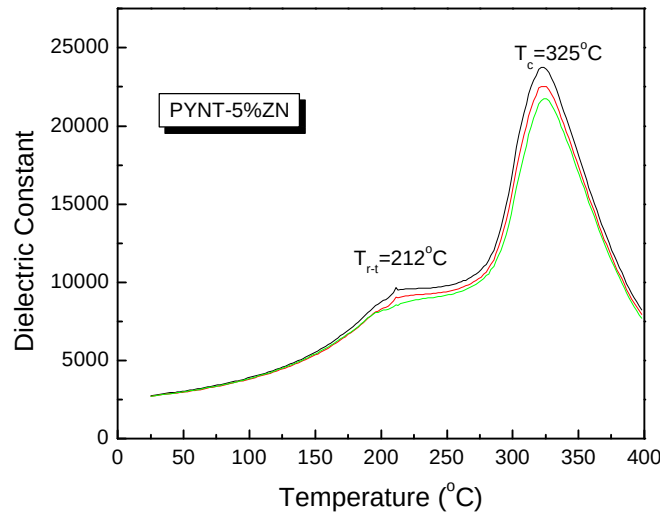
Phase diagram of (1-x)PYN-xPT and (1-x)BS-xPT systems



(After Rich Eitel reference)

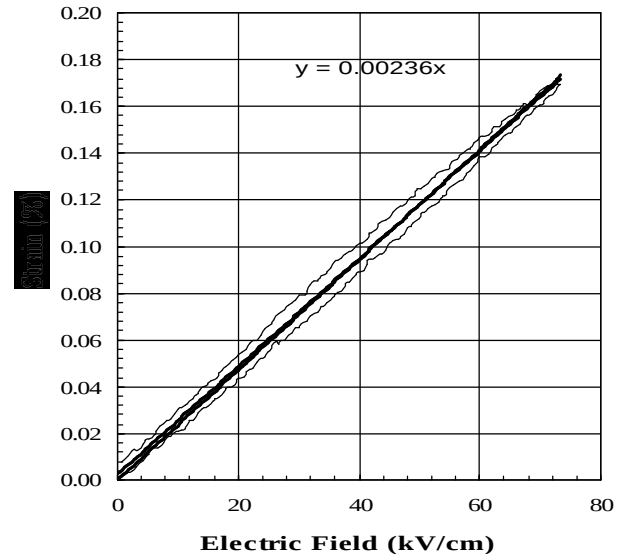
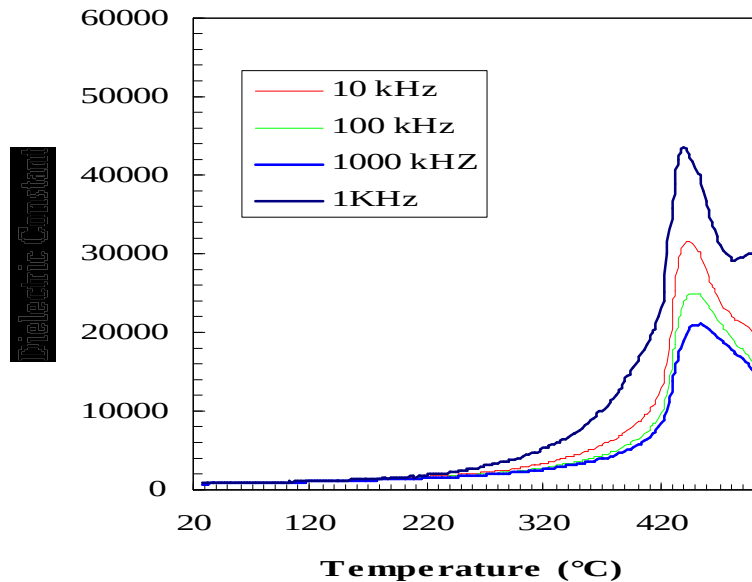
The phase diagram show that the MPBs for PYN-xPT systems are located at $x=0.5$ and $x=0.64$ for BS-xPT system. The Curie temperatures are around 350 °C and 460 °C, respectively.

Characterization of zinc doped PYN-PT single crystals



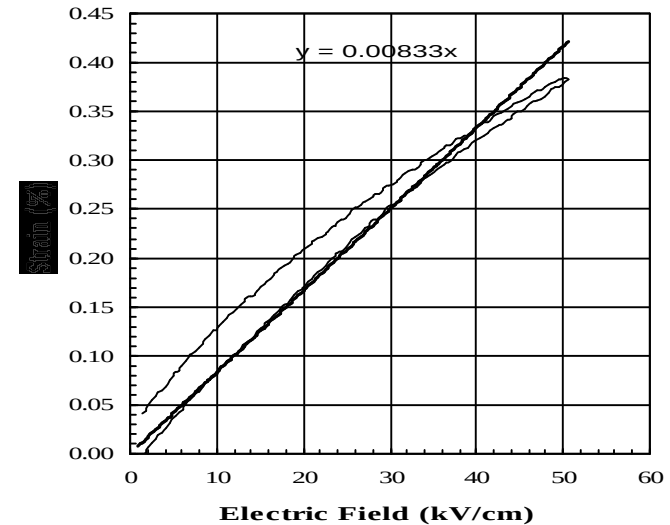
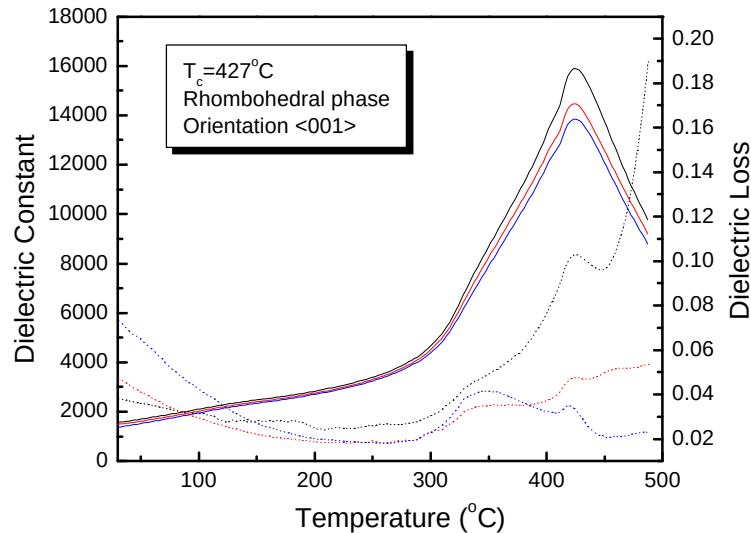
Along $\langle 001 \rangle$ orientation, the Curie temperature is around 325 $^{\circ}\text{C}$ and phase transition temperature around 212 $^{\circ}\text{C}$, the strain is low-hysteresis when the field at 20kV/cm, the piezoelectric coefficient is around 1700pC/N

Characterization of tetragonal BSPT single crystals



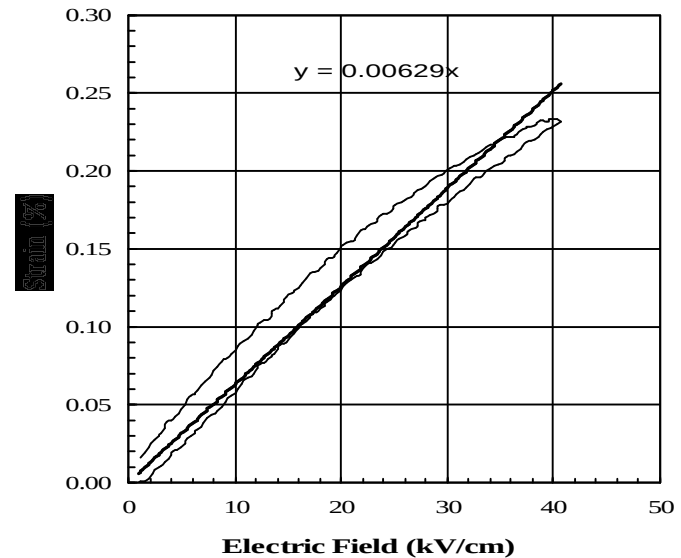
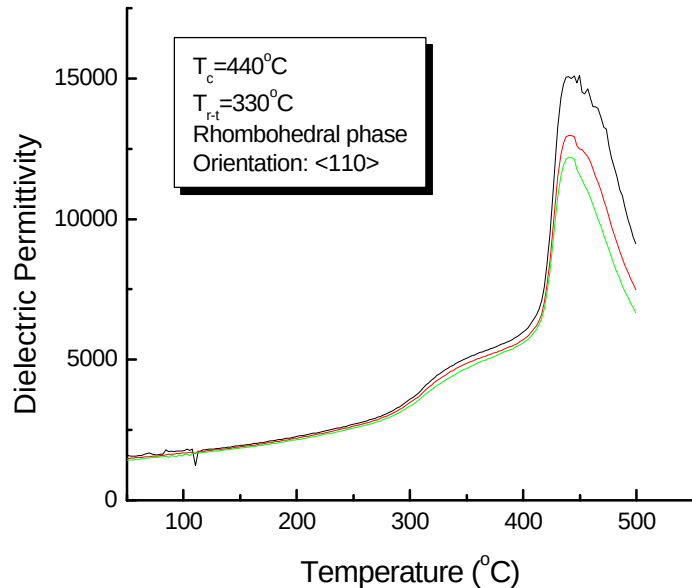
The Curie temperature was found to be $\sim 460^{\circ}\text{C}$, after high temperature poling, the piezoelectric coefficient is around 250 pC/N, coupling factor is 74% at room temperature.

Characterization of rhombohedral BSPT crystals



The BSPT crystal along $\langle 001 \rangle$ direction, the Curie temperature around 427 $^{\circ}\text{C}$, the piezoelectric coefficient 850pC/N and coercive field 20kV/cm.

Rhombohedral BSPT crystal along $\langle 110 \rangle$ direction



Along $\langle 110 \rangle$ direction, the Curie temperature is around 440°C while the phase transition temperature at 330°C . The coercive field is 24kV/cm and piezoelectric coefficient about 400pC/N .

Conclusion and Future Works

- High Curie temperature single crystal PYNT and BSPT have been grown using flux method
 - Large Coercive field – domain stability ($E_c \sim 10\text{-}30\text{ kV/cm}$)
 - Promising piezoelectric and electromechanical properties in rhombohedral phase which expand the application temperature range to about 300°C ($d_{33} \sim 800\text{-}2000\text{ pC/N}$)
 - Tetragonal BSPT crystal has very low dielectric constant at room temperature which is candidate for the single-element transducer ($K \sim 300$)
- * Try to find new method to grow large rhombohedral phase BSPT and PYNT crystals, explore excellent properties of the new materials.