Decoupling of Ferroelectric Polarization and Lattice Distortion in Relaxors

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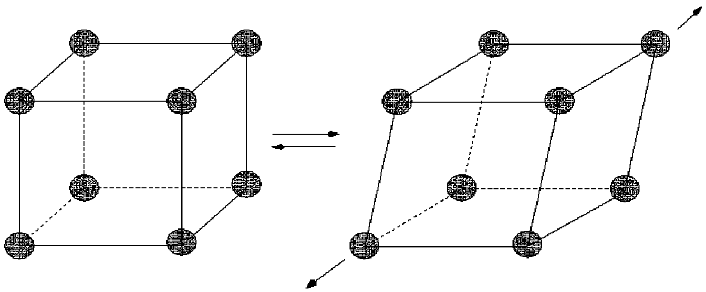
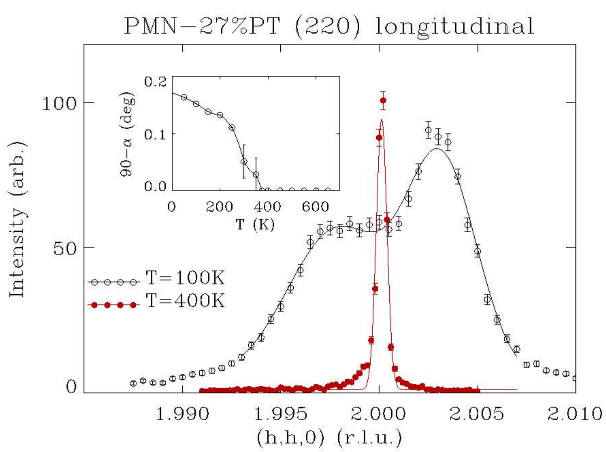
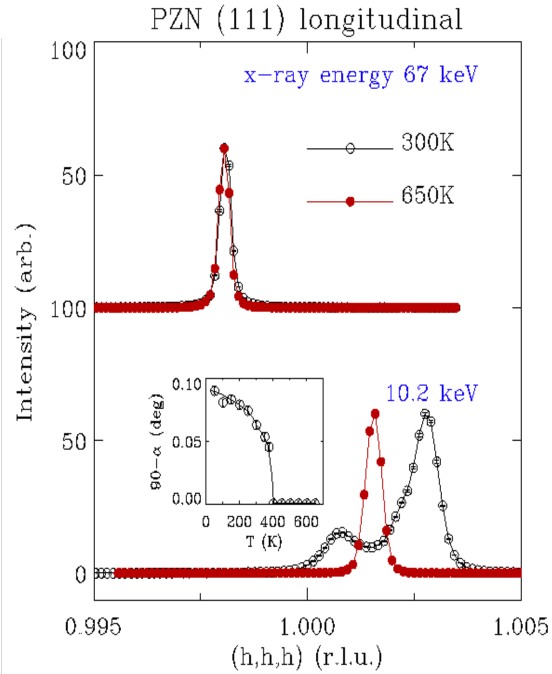


PZN-xPT and PMN-xPT are relaxor ferroelectrics with extremely high piezoelectric responses and great application potential. Typically, ferroelectrics undergo a structural transition to a ground state with a macroscopic polarization. For example, PMN-27PT undergoes a transition from cubic to rhombohedral lattice at Tc~375 K, showing a splitting in the (220) Bragg peak.





High energy 67 keV x-rays show no change of the unit cell shape inside the free standing unpoled PZN crystal. This new phase (X) has been discovered in a series of PZN-xPT and PMN-xPT compounds with low PT concentrations. On the other hand, lower energy x-rays (10.2 keV) show a different structure (rhombohedral) in the outer-layer of ~50 microns.

Despite the fact the unit cell does not show any distortion, the soft optic mode recovers below Tc. Such a recovery indicates that a ferroelectric polarization persists within an undistorted lattice in the relaxors below the Curie temperature Tc.