What Dominates the Electrocaloric Performance in Ferroelectrics: Texturing, Doping, or Phase Co-existence?

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Most of the time, the electrocaloric effect (ECE) is very small in ferroelectrics. However, giant electrocaloric response was reported in several organic and inorganic relaxor ferroelectric systems, thus, initiating an intense research effort on this phenomenon. There are some strategies for improving electrocaloric response in ferroelectrics such as; *Compositional Modification*, i.e. doping, selecting compositions with phase coexistence, or *Utilization of Anisotropy*, i.e. using single crystals with specific orientations, texturing polycrystalline ceramics, etc. This talk will discuss the main drivers and their relative effects on the enhancement of electrocaloric performance in PMN-PT and PLZT based systems.

Lead magnesium niobate (PMN) - lead titanate (PT) solid solution ceramics with 0.90PMN-0.10PT & 0.72PMN-0.28PT was produced by tape-casting in $<001>_{pc}$ textured and random forms. Dielectric, ferroelectric and electrocaloric properties textured and random ceramic with respect to temperature have been investigated and reported. The Curie-Weiss analysis indicated relaxor dominant behavior for both the random and textured ceramics. Quenching the ceramics from above the Curie temperature led to an increase in the unipolar strain response because of easier domain wall motion. The electrocaloric (EC) response of the random and textured samples were measured using indirect methods to investigate the effect of texture on the EC effect. The desirability of texturing in these systems for possible EC applications have been discussed. Additionally, effect of La doing on the development of ferroelectric, antiferroelectric and relaxor ferroelectric phases and their coexistence in the lead zirconate titanate system was investigated for the enhancement of electrocaloric response of the PLZT system.