

Journey of a Life-time Down Ferroelectrics-Road with Professor Cross

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I had been Eric Cross's student and I had the pleasure of working with this kind-spirited individual for 30 years. His imprint defines the arc of my professional life. Any small contributions that I may have made are a reflection of the time he took to help me in many ways.

Our adventure in science focused on understanding the inhomogeneous condition of relaxor ferroelectrics. I will overview in this presentation the things that we had worked on together, and those that he inspired me to do, over the numerous years of our relationship. I will first discuss our original concept of glassiness in relaxor ferroelectrics, typified by the Vogel-Fulcher relationship which explains the slow dynamics of the system. This led us to then realize that there was the presence of subdomains in soft ferroelectrics, characterized by the presence of a hierarchical domain structure, which is exactly what we found in poled PMN-PT crystals. This led us to challenge the concept that the high piezoelectricity in morphotropic phase boundary (MPB) PMN-PT crystals was due to a homogenous uniform state with a monoclinic structure. Rather, we focused on his original concept of the micro-to-macro domain transition, and realized that poled single crystals had a strong similarity to this condition. Our idea was that the special properties of poled PMN-PT crystals were in fact due to the inhomogeneous nature of PMN-PT, a cousin to the relaxor problem. Our data, models, and ideas focused on the concept that poled PMN-PT crystals consist of an array of microdomains within normal macrodomain platelets, where the high piezoelectricity is due to the local reorganization of polar nanoregions within the macrotwin plates.