[MS34-P05] Structural description of the macroscopic properties of lead zirconate titanate Manuel Hinterstein, Helmut Ehrenberg, Hans Kungl, Jerome Rouquette

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PZT materials with compositions at the morphotropic phase boundary (MPB) between the tetragonal (P4mm) and rhombohedral (R3m) phase fields exhibit very high dielectric and piezoelectric properties which are intensively used for technological applications (sensors and actuators, microelectromechanical systems, and high frequency devices) [1]. We recently reported an *in situ* description of the origin of the ferroelectric properties as a function of the applied electric field E based on a synchrotron X-ray diffraction study [2]. The monoclinic (pseudo-rhombohedral)/ tetragonal phase ratio was found to increase with electric field which strongly supported the hypothesis of Noheda *et al*., who explained the strong piezoelectric properties of PZT by the presence of a monoclinic phase [3] based on a polarization rotation mechanism [4]. Additionally, polarization flipping of polar lead atoms could unambiguously be characterized by a maximum in the disorder of lead ($B_{iso}(Pb)_m$) for the positive-negative value of the coercive field (Ec) in the P_S - E hysteresis cycle. Here, we present a structural description of the macroscopic piezo- and ferroelectric properties in the important technological material Lead Zirconate Titanate (PZT) by *in situ* synchrotron X-ray and Neutron diffraction. In addition to a technically applied material, we investigated the poling behavior of different composition series in the vicinity of the MPB. The structural changes were either induced by variations of the lead oxide content during sintering or different titanium / zirconium ratios. Stroboscopic pump-probe measurements down to 250 μs time resolution reveal differences in poling kinetics depending on composition. For the technically applied material they spectacularly comfort our interpretations and clearly show the time structure characterizing the ferroelectric poling response.

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