Structural Study of PMN-xPT by Neutron Diffraction

D. PHelan, P.M. GEHRING, Q. HUANG, NIST, Z.-G. YE, Simon Frasier, C. STOCK, ISIS, G. XU, J. WEN, Brookhaven — Stark differences between x-ray and neutron measurements of the structures of ferroelectric-relaxors PMN-xPT ((1-x)Pb(Mg\textsubscript{1/3}Nb\textsubscript{2/3})O\textsubscript{3}+xPbTiO\textsubscript{3}) and PZN-xPT (Z=Zn) have been reported [1]. One explanation for these differences is that these crystals have strained surface layers on the order of several tens of $\mu$m thick, the crystal structure of which differs from that of the crystal bulk. This phenomenon has been coined the “anomalous skin effect” but has been recently challenged [2] and thus remains controversial. We reinvestigated the skin effect in PMN-xPT by considering the possibility that the oxygen stoichiometry might play a role. Two sets of powders (x=0.1, 0.2, 0.3, and 0.4) were grown, one with and one without oxygen annealing, and high resolution neutron powder diffraction measurements were carried out for both sets. For a given x, both sets of powders have the same structural phase, suggesting that the effects of oxygen annealing are minimal. For x=0.1 and x=0.2 both sets of powders are rhombohedral, which contrasts with the single crystal neutron diffraction measurements. This supports a skin effect in that the grain size of the powders is small enough that the Bragg peaks are dominated by the strained surface layer. References [1] G. Xu et al., Phase Transitions 79, 135 (2006) [2] E. H. Kisi and J.S. Forrester, J. Phys.:Condens. Matter 17, L381 (2005)