New capabilities for Applied electric field and texture analysis for *in-situ* studies

C.M. HOFFMANN[1], C.M. FANCHER[1], A. PARIZZI[1], V. SEDOV[1], X. WANG[1], A.J. SCHULTZ[2]

[1]Neutron Scattering Division, Oak Ridge National Laboratory, Oak Ridge, TN 37919, USA
[2]Argonne National Laboratory, Argonne, IL 60439, USA.

In-situe experiments to investigate structural changes with applied stimuli under controlled conditions are well suited to gain insight into the driving forces for non-equilibrium conditions like phase transitions. Understanding the structure changes and underlying dynamics to respond to such non-equilibrium conditions is an important aspect of material stability and potential technical applications. $BaTiO_3$ is a good example for continued studies with a steady stream of new discovery for structure behavior near and through phase transitions. In this contribution we will showcase an *in-situ* study applied, alernating current (AC) electric field study with concomitant temperature control demonstrated on single crystalline $BaTiO_3$. Using time-of-flight single crystal neutron diffraction with event-mode data collection now enables event filtering and re-binning of the neutrons according to the applied voltage with AC freuquency. This allows extracting structure snap-shots along the hysteresis curve. Measureing data in this stroboscopic manner, the AC cycles add up, until the neutron statistics are sufficient to allow fine slicing or binning of the data resulting in real time resolution of the snap-shots along the polarization curve.

Furthermore, applying time-of-flight Laue techniques to orientation distribution analysis of textured samples is a yet unmatched, unique option directly examine texture. Collecting a volume of diffraction space without overalp or averaging, exposes the whole orientation distribution sphere in one to four sample settings, dependent on symmetry. Orientational dependencies of applied conditions can be studied with extraordinary detail due to unprecedented resolution of the data.

The data shown were collected on the TOPAZ wavelength-resolved time-of-flight Laue single crystal neutron diffractometer at the spallation neutron source at the Oak Ridge National Laboratory.

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