Nanometer resolution mapping of structure and bonding in ferroelectrics

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Structural phase transitions in ferroelectric perovskites have been intensely investigated over many decades owing to their large impact on physical properties as well as industrial applications. Barium titanate ($BaTiO_3$) is a ferroelectric material often considered as a classic example of displacive phase transition. However, various experimental and theoretical studies have suggested competing order-disorder character [1, 2], in which the atomic positions change by performing thermally activated jumps between two or more equilibrium positions. Thus, there is a need to probe the crystal symmetry in nanoscale or even at unit-cell level in order to understand the physics of phase transition. To map out structure and bonding across region of interest in nanoscale, we used energy-filtered scanning convergent beam electron diffraction (EF-SCBED). EF-SCBED is based on automated recording of energy-filtered CBED patterns on the CCD camera while scanning over the user-defined region with a nanometer-sized electron beam. This talk will report on progress we have made in the study of $BaTiO_3$ and other ferroelectric crystals*.

*This work is supported by U.S. Department of Energy under contract DEFG02-01ER45923.lines.