東京大学グローバルCOEプログラム　機械システム・イノベーション国際拠点

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New Directions with Aberration-corrected STEM.

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会場：東京大学工学部9号館　1F 大会議室

要旨

The recent introduction of 5th-order aberration correctors has brought another leap in capability for the STEM, allowing quantitative imaging of light atoms with the annular dark field (ADF) detector and two-dimensional EELS mapping of composition and electronic fine structure. Recent results from the ORNL FEI Titan 80-300 (Schottky XTEM field emission gun, CEOS 5th-order corrector) and Nion UltraSTEM100 (VG 100 kV cold field emission gun, Nion 5th-order corrector) will be presented. The UltraSTEM operates as low as 60 kV, while its low energy spread still allows spatial resolution approaching 1 Å, which represents a new regime for imaging materials below their damage threshold. Results will be presented from graphene and BN using a medium angle detector in which the six-membered rings are clearly resolved and the B and N atoms can be directly distinguished. Adatoms, defects, step edge sites and substitutional impurity sites will be shown.

Results will also be presented from complex oxides and multiferroic materials including the extraction of ferroelectric displacements from bright field images, ADF images, and directly from spectroscopic images of distorted O positions. In conjunction with theory, unusual interfacial properties are explained.

Yttria-stabilized zirconia (YSZ)/strontium titanate (STO) epitaxial heterostructures with nanometer layer thicknesses have recently been shown to exhibit eight orders of magnitude increase in ionic conductivity near room temperatures [1]. STEM images show the YSZ layers to be coherent and highly strained, while EELS shows disorder in the O sublattice at the interface indicative of a high vacancy concentration. Simulated annealing of the observed structure indicates an activation energy for O migration much lower than in bulk YSZ, consistent with experiment.

Finally, the detection of O impurities in specific N columns in α-Si_3N_4, both by imaging and spectroscopy, will also be presented.

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主催：　東京大学グローバルCOEプログラム「機械システム・イノベーション国際拠点」事務室

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