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"Seeing" 3-Dimensional Atomic Arrangements in Real Materials

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报告人介绍

Prof. Yongsoo is an experimental physicist working on condensed matter & nanomaterials, he received his B.S in Physics at Mathematical Science, Seoul National University in 2009 and his Ph.D. in Physics at the University of Michigan in Ann Arbor in 2014. He then worked in the Department of Physics and Astronomy at UCLA as a postdoc from 2014-2018. Now, Prof. Yang is the assistant professor in the department of physics at Korea Advanced Institute of Science and Technology, and his research interests include synchrotron x-ray scattering, aberration-corrected electron microscopy, atomic electron tomography(AET), and surface X-Ray diffraction (SXRD). Prof. Yang has over 20 major publications and received the State Physics Excellence in Teaching Award and the NVIDIA GPU Grant. He is a committee member for Academic Affairs, Korean Society of Microscopy, and member for American Physical Society (APS), Microscopy Society of America (MSA), Korean Physical Society (KPS), Korean Ceramic Society (KCERS), and the Cheongam POSCO Science Fellow. He is also a Referee/Reviewer for Nature Communications, Science Advances, Physical Review Letter, Physical Review B, Physica Status Solidi B: Basic Solid State Physics.

内容摘要

Modern science and technology rely on functional materials, and the physical and chemical properties of these materials often strongly depend on defects, local disorder, nanoscale heterogeneities, and grain structures at the atomic scale. Traditional crystallography, which is reliant on periodicity, has been the main method for determining crystal structures, but cannot determine defects or other non-crystalline features. My work goes beyond crystallography. Without any prior assumption of underlying structure, atomic electron tomography (AET) is now able to locate the 3D coordinates of individual atoms and their dynamics with picometer precision and with elemental specificity. A variety of complex atomic structures have been measured with 3D atomic-level details; including grain boundaries, chemical order/disorder, phase boundaries, and point defects. I will further demonstrate that AET can also be applied to capture the 4D atomic structural dynamics, unveiling the nucleation process at the atomic scale. Recently, combined with a deep-learning-based neural network, it now became possible to precisely measure the 3D surface structure of nanomaterials with high precision, revealing surface-substrate boundary effect, coalescence dynamics, and surface catalytic activity at the atomic scale. Understanding the atomic resolution structural dynamics together with the relationship between atomic structure and material properties will open up new avenues in materials science and allow the rational design of novel materials at the atomic scale.

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