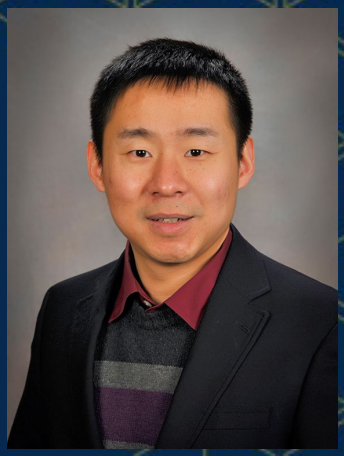
Materials Science and Engineering Department

Winter Seminar Series

Explore the 4-Dimensional Information in Transmission Electron Microscopy



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February 1, 2023
3-4PM | Hill Seminar Room (LeBow 240)

All images, from smartphone photos to transmission electron microscopy micrographs, are made of pixels. Each pixel in the image could be defined by 3 parameters - x-position, y-position, and a number that denotes the brightness or color. Thus, each image is a 3-dimensional dataset. In this presentation, I will introduce a technique that adds one more dimension to the micrograph dataset. Precession electron diffraction (PED) is a scanning transmission electron microscopy-based technique that the diffraction information in each pixel is recorded, which constitutes the 4th dimension. Taking advantage of this additional dimension in the dataset, a number of applications are enabled. The examples include orientation mapping and straining mapping. The crystal orientation is obtained by matching the experimental diffraction results with the ones in the database. Strain information is extracted by comparing the experimentally measured strain to the strain-free counterpart in the reciprocal space. Deformed Ti bulk samples and VO_2 thin films grown on sapphire are used as a model material to elucidate the how new knowledge can be generated by analyzing the PED data. Additional information, such as index mapping and cross-correlation mapping, will also be discussed.

Dr. Kelvin Xie's research focuses on understanding and designing materials at nano- and atomic-scales using advanced microstructural characterizations (e.g., TEM and atom probe tomography). Kelvin is an Assistant Professor in the Department of Materials Science and Engineering at Texas A&M University from 2018. Before this appointment, he was working as a Postdoctoral Research Fellow and then an Assistant Research Scientist with Prof. Kevin Hemker at Johns Hopkins University. He obtained his Ph.D. in 2013 at the Department of Mechanical Engineering and Australian Centre for Microscopy and Microanalysis under the supervision of Professors Julie Cairney and Simon Ringer.

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