

Advanced Material Characterization Techniques & Development of Materials Characterization Laboratory at K-State

Dr. Yaqiao Wu

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Abstract:

Advanced materials characterization encompasses both microstructural analysis and property evaluation (e.g., mechanical testing). Integrating multiple advanced techniques enables direct correlations between microstructure, chemistry, and material performance, thereby guiding future materials design.

Transmission electron microscopy (TEM), particularly modern scanning TEM (STEM) equipped with EDS, EELS, 4D-STEM, tomography, and various in-situ capabilities (heating, cooling, mechanical testing, liquid/gas cell, etc.), allows structural, chemical, and physical analysis from the micron scale down to the atomic level. Complementary to these methods, atom probe tomography (APT) provides true three-dimensional (3D) atomic-scale mapping of elemental identity and spatial position. The first part of this talk will highlight the power of modern TEM and APT techniques through case studies on various materials.

The second part of the talk will introduce the newly established Materials Characterization Laboratory (MCL) at Kansas State University, a core facility under the Office of the Vice President for Research and located in Rathbone Hall, including the current instrumentation, laboratory setup, and future development plans, as well as outline how MCL will collaborate with and provide services to faculty, students and postdocs across the university.

Biosketch:

Dr. Yaqiao Wu is the Director of the newly established Materials Characterization Laboratory at Kansas State University. Dr. Wu received his Ph.D. in 2000 from the Institute of Metal Research, Chinese Academy of Sciences. Prior to joining K-State, he was a Research Professor at Boise State University (BSU), served as the Director of Microscopy and Characterization Suite (MaCS) at the Center for Advanced Energy Studies (CAES). He also held research positions at the Ames Laboratory of USDOE and at the National Institute of Materials (NIMS) in Japan. Dr. Wu's expertise is in nanoscale structural and chemistry characterization through the combination of transmission electron microscopy (TEM) and atom probe tomography (APT) techniques. His research interests include materials design, synthesis, property analysis, nanoscale characterization, with a focus on establishing critical connections between structure, chemistry, and behavior at nanometric to atomic level. He has studied a wide range of material systems, including nanostructured magnetic materials, semiconductors, ceramics, quasicrystals, carbon nanotubes, and nuclear materials. Dr. Wu has authored or coauthored more than 120 papers in peer-reviewed journals.

