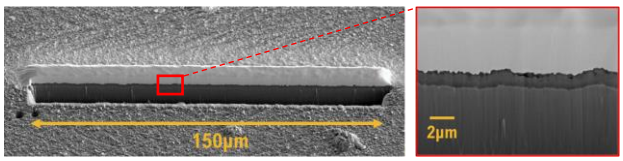
THERMOSCIENTIFIC HELIOS HYDRA PFIB

5(+) instruments in 1!

1. High-throughput & customizable ion mill

- User-selectable ion species to customize beam-specimen interaction: **Xe, Ar, O, N**
  - **Xe** offers greatest throughput (~50x improved mill rate over traditional Ga^+)
  - **O** is optimized for milling of hydrocarbons
- Multichem gas injection system allows for patterned micro-/nano-deposition of up to 6 chemistries as single species or as controlled mixtures

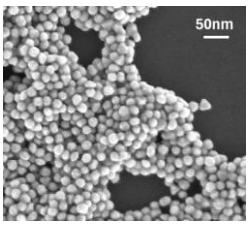


Left: Large-scale cross-section generation to confirm oxide layer thickness (courtesy H. Wen)

Right: Patterned microdeposition of W+C with ~200nm resolution (EMC staff)

2. High-fidelity analytical SEM

- Features ThermoScientific's highest resolution e^- column, capable of sub-nm imaging at low beam voltages (<2kV) for extreme surface sensitivity

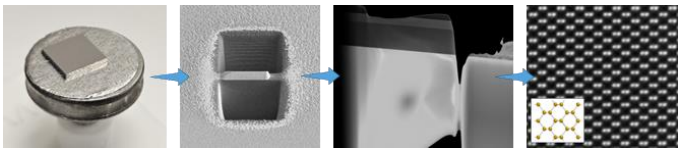


- Can detect SE, BSE, STEM, and EDS signals for morphological and chemical characterization

20nm Au nanoparticles, imaged at 2kV (S. Grant)

3. Site-specific TEM lamella preparation

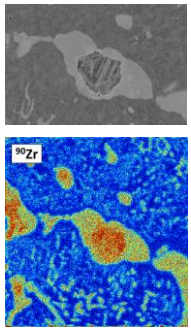
- Integral component of the workflow for atomic-resolution capabilities of the Spectra
- Allows for rapid generation of e^- beam transparent lamellas from bulk media



FIB-SEM lamella prep: from bulk crystal to atomic-resolution TEM

4. FIB-ToF chemical characterization

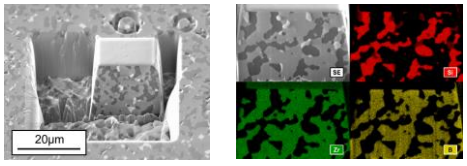
- Combines the capabilities of mass spectrometry (~ppm sensitivity) with the spatial resolution of FIB (~50nm in-plane)
- Volumetric and hyperspectral; capable of detecting all elements and isotopic analysis



FIB-TOF isotopic mapping of high-entropy alloy (courtesy H. Wen)

5. 3D structural reconstruction

- *Slice and View* facilitates automated serial sectioning and data collection for large-scale 3D reconstruction ("*Volume EM*") of hard or soft materials



3D-EDS of ZrB2-SiC composite ceramic (W. Fahrenholtz)

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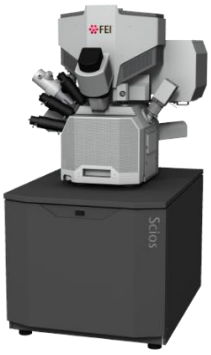
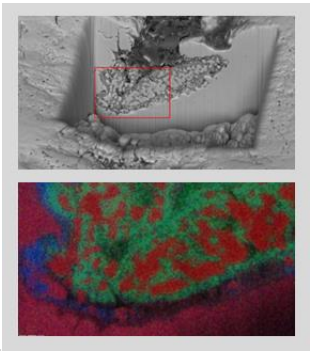
OTHER ANALYTICAL SEM/DUALBEAM SYSTEMS

FEI Scios 2 Dualbeam

MURR



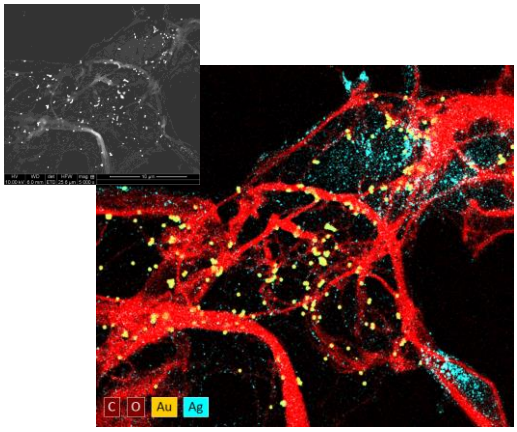
- Combines site-specific ion beam milling with high-fidelity SEM analyses to enable 3D sample investigation
- Features dual EDS/EBSD for chemical and crystallographic characterization
- Recently transitioned to MURR to enable analysis and lamella preparation of irradiated media



Imaging and chemical analysis of a sub-surface defect within a stainless steel

FEI Quanta 600F ESEM

- Versatile ESEM capable of advanced surface imaging and microanalysis
- Variable pressure vacuum modes enable analysis of nonconductive media
- Cooling and heating/biasing stages allow for in-situ characterization of specimens

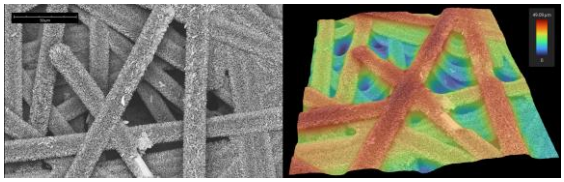


SEM imaging and elemental mapping Au and Ag nanoparticles embedded in cellulose

ThermoScientific Phenom ProX Desktop SEM

Materials Science & Engineering Institute
University of Missouri

- Brought online Fall 2022
- Enables rapid screening and basic surface analyses of specimens
- Located in the Materials Science & Engineering Institute's Materials Characterization Facility (C3241 Lafferre)



SEM image and reconstructed height map of Metal-Organic Framework (MOF) coated carbon fibers

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