

Microscopy of Ceramic Materials

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01 Microscopy for Ceramics Research

02 Light Microscopy

03 Electron Microscopy

04 Ion Beam Microscopy

05 X-ray Microscopy

06 Analysis

07 Summary

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03 Electron Microscopy

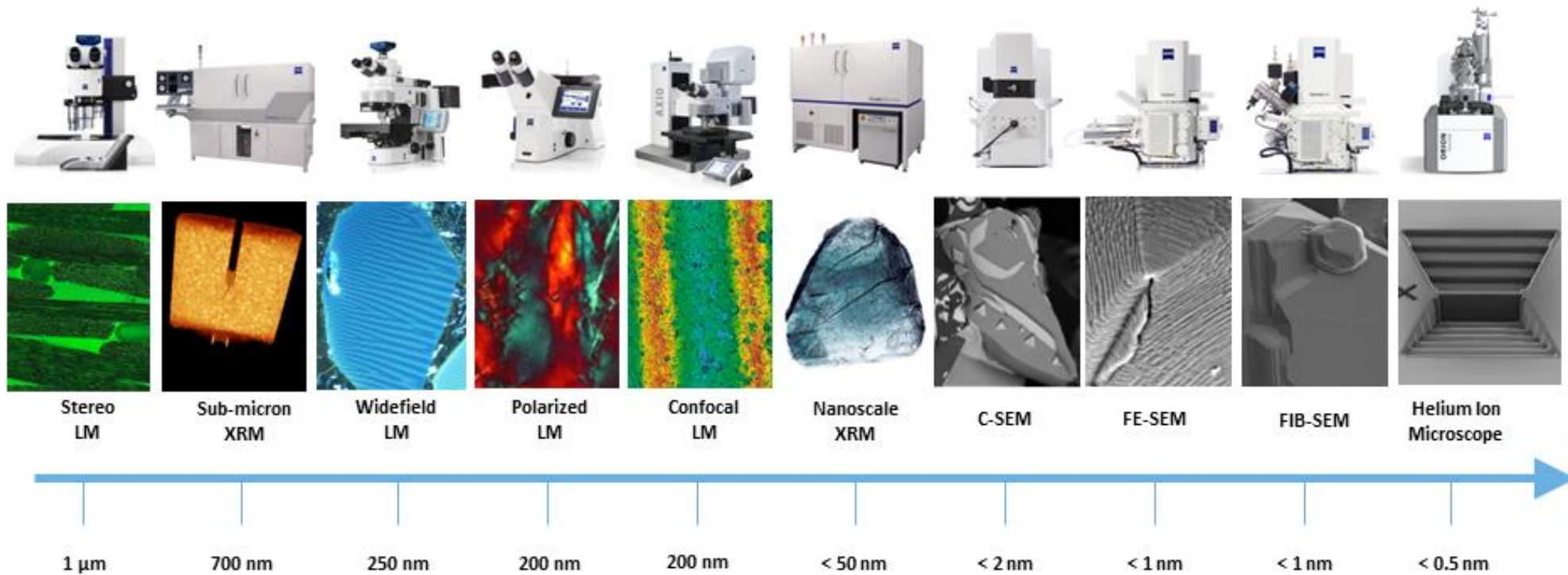
04 Ion Beam Microscopy

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Characterisation Across Length-scales



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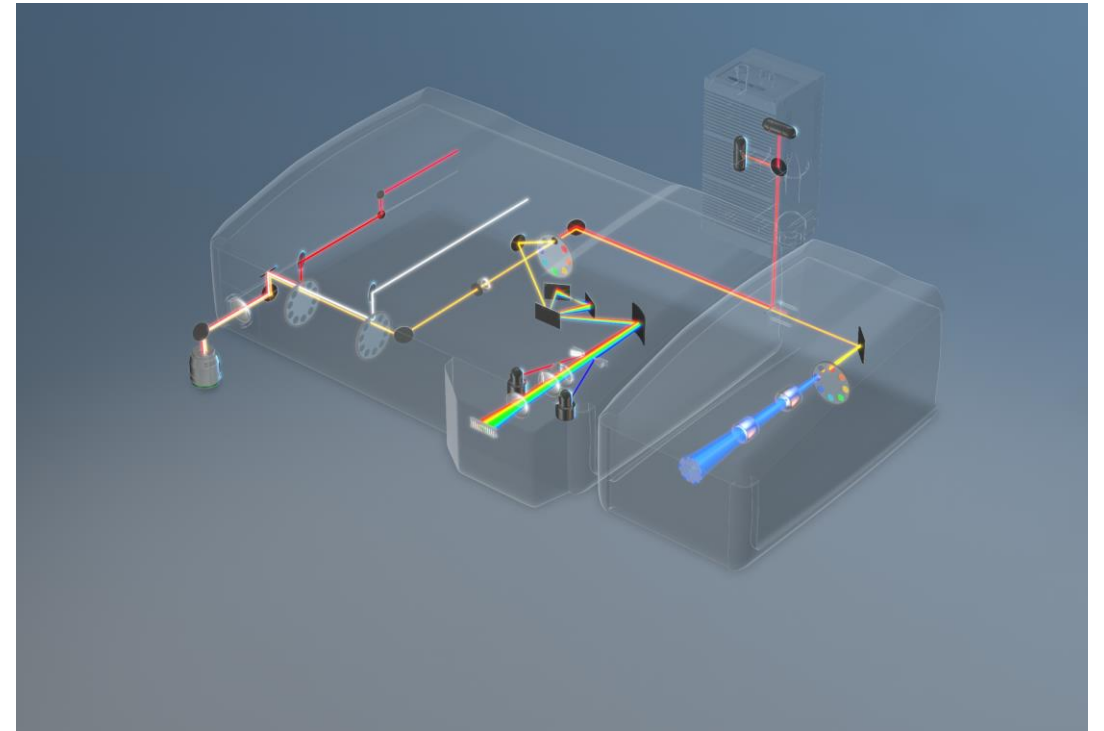
07 Summary

What is a Light Microscope?

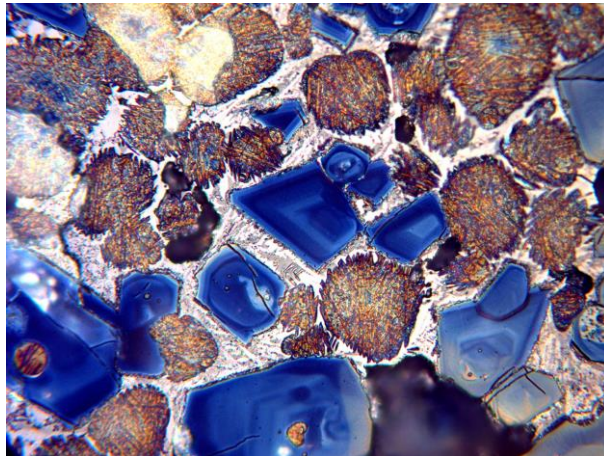
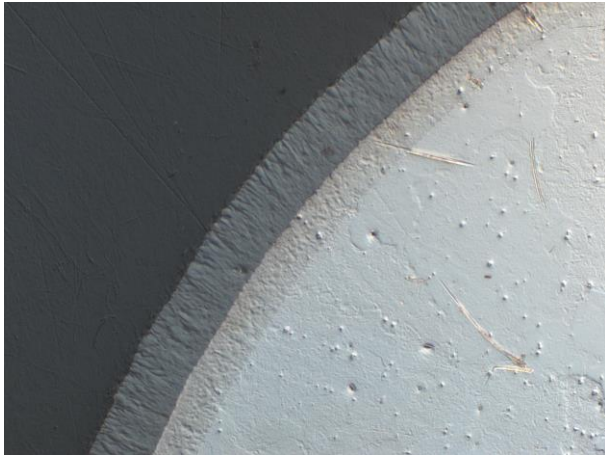
Widefield



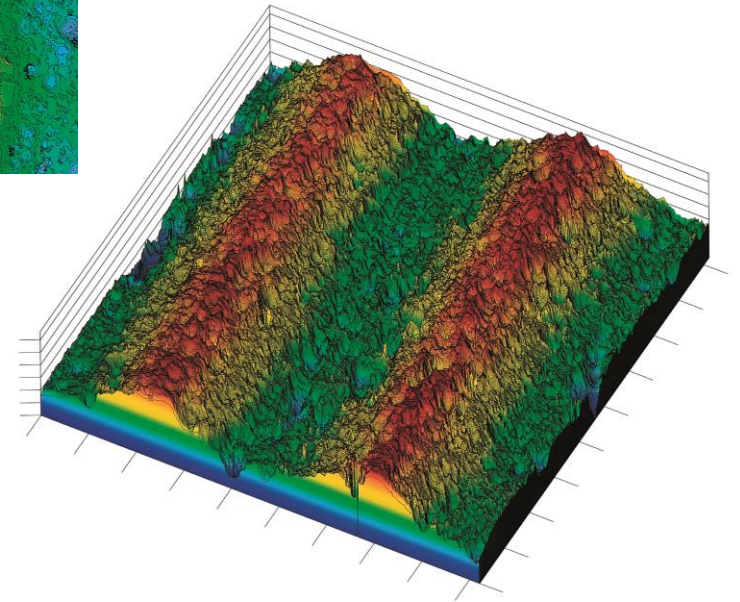
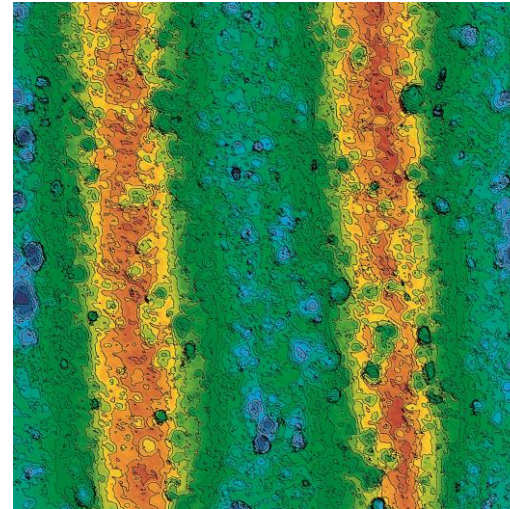
Laser Scanning Microscope



Microstructure Analysis



Texture Analysis



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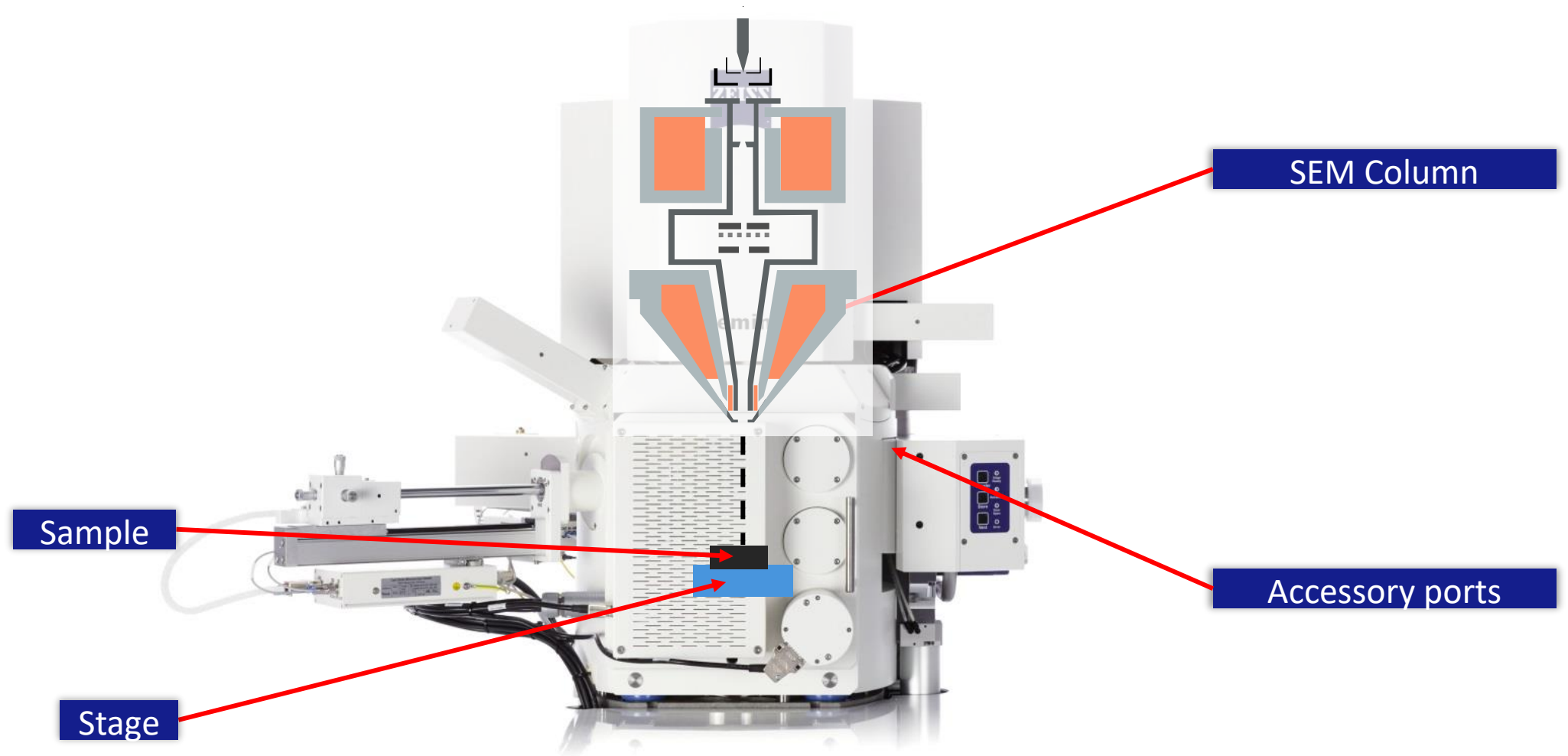
04 Ion Beam Microscopy

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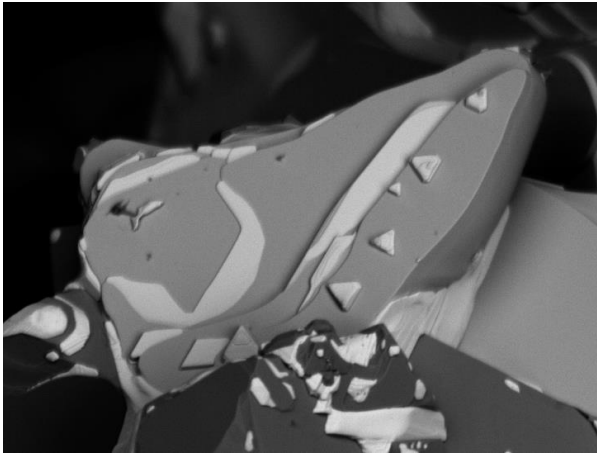
06 Analysis

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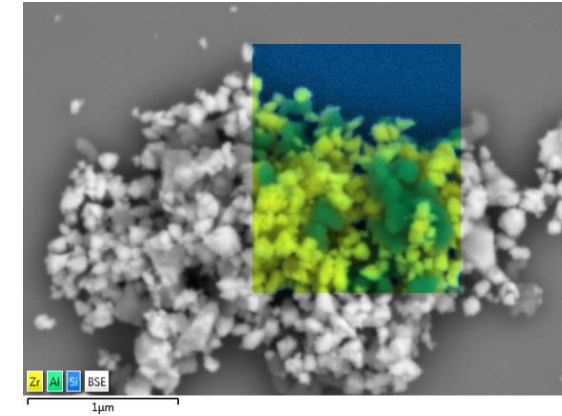
What is a Scanning Electron Microscope (SEM)?



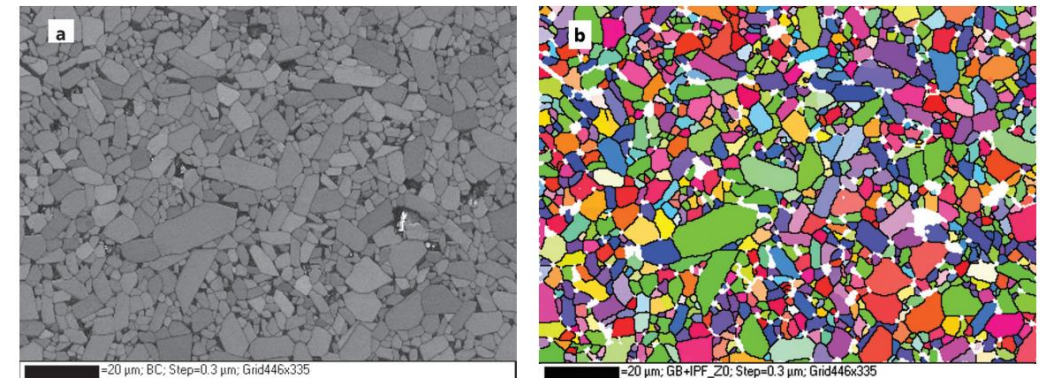
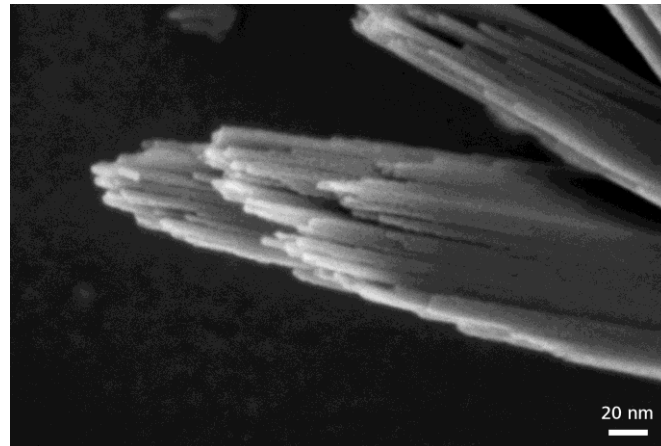
Microstructure Analysis



Chemical Analysis



Crystallographic Analysis



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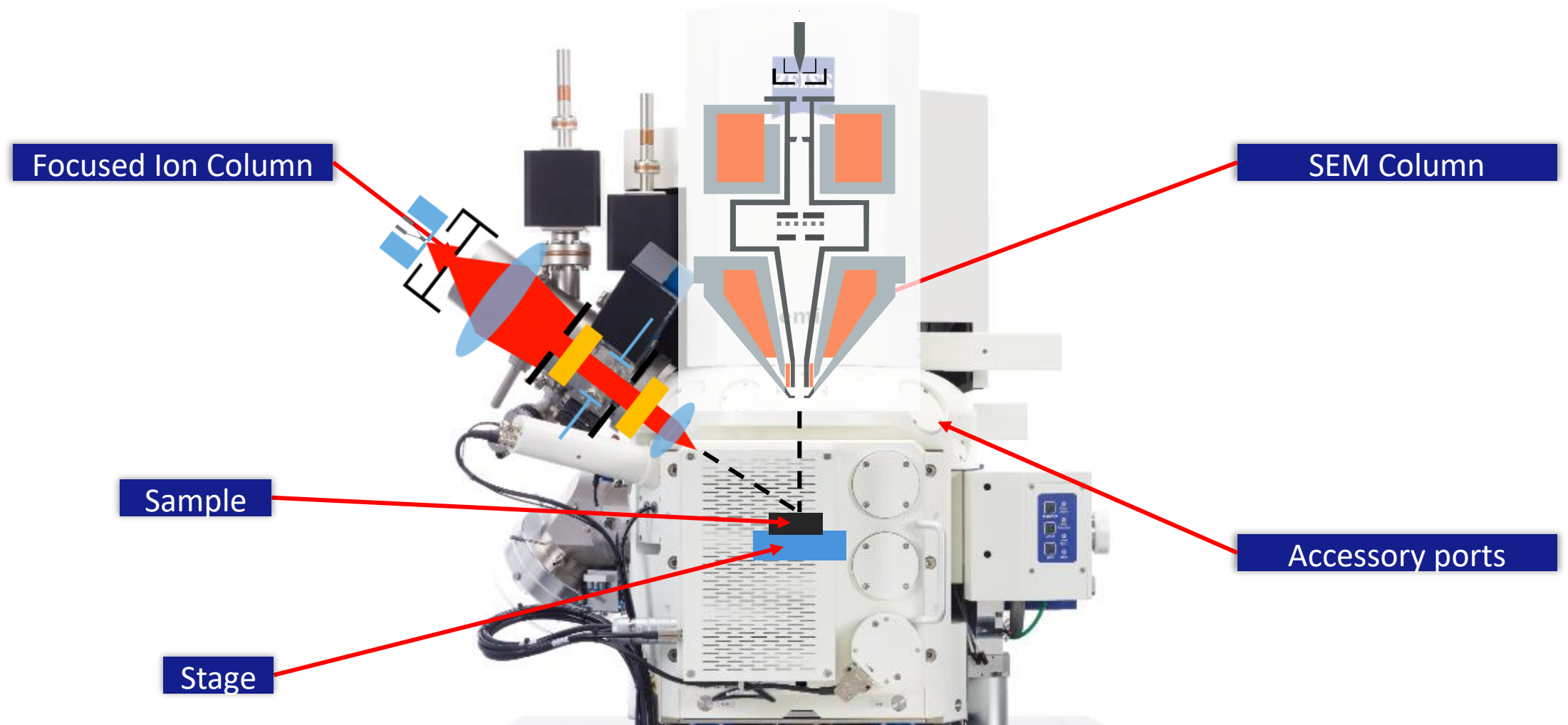
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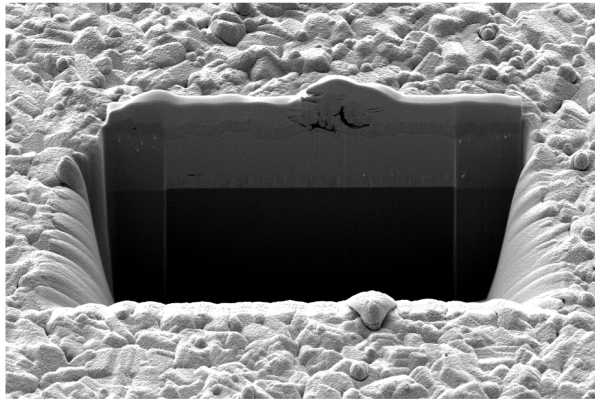
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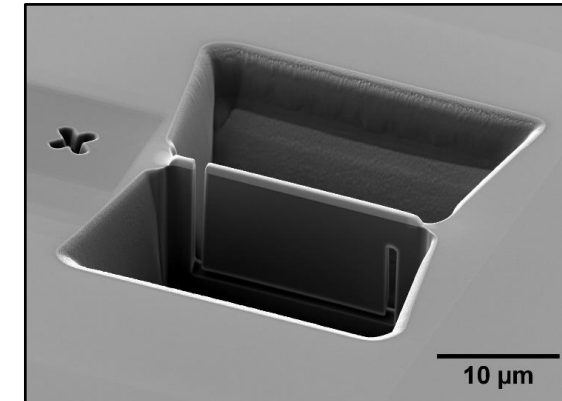
What is a Focused Ion Beam SEM (FIB-SEM)?



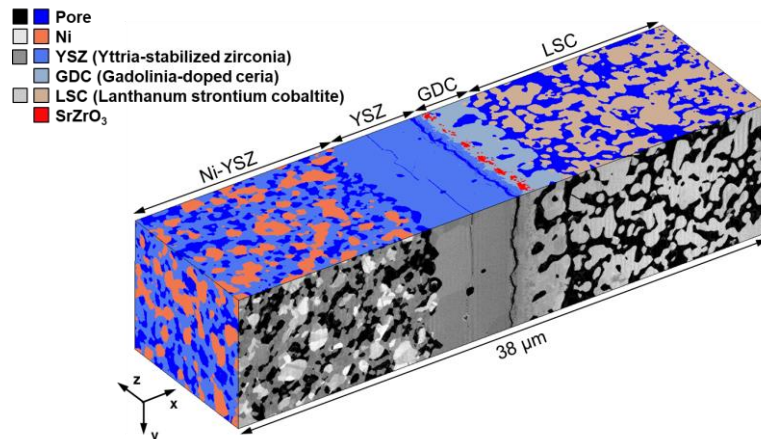
Cross-section Analysis



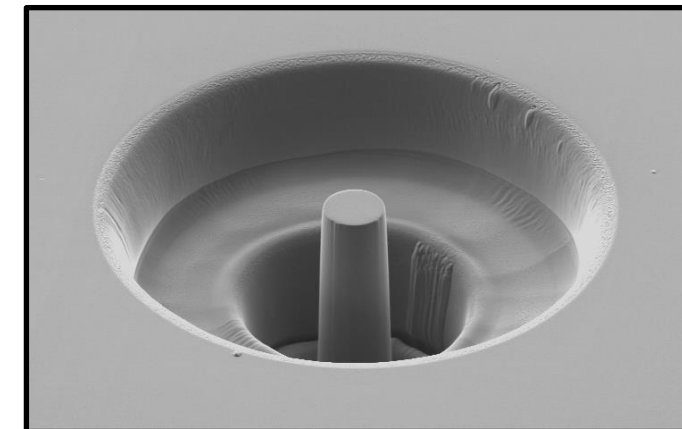
TEM Lamella Preparation



3D Tomography



Micromechanical Specimen Preparation



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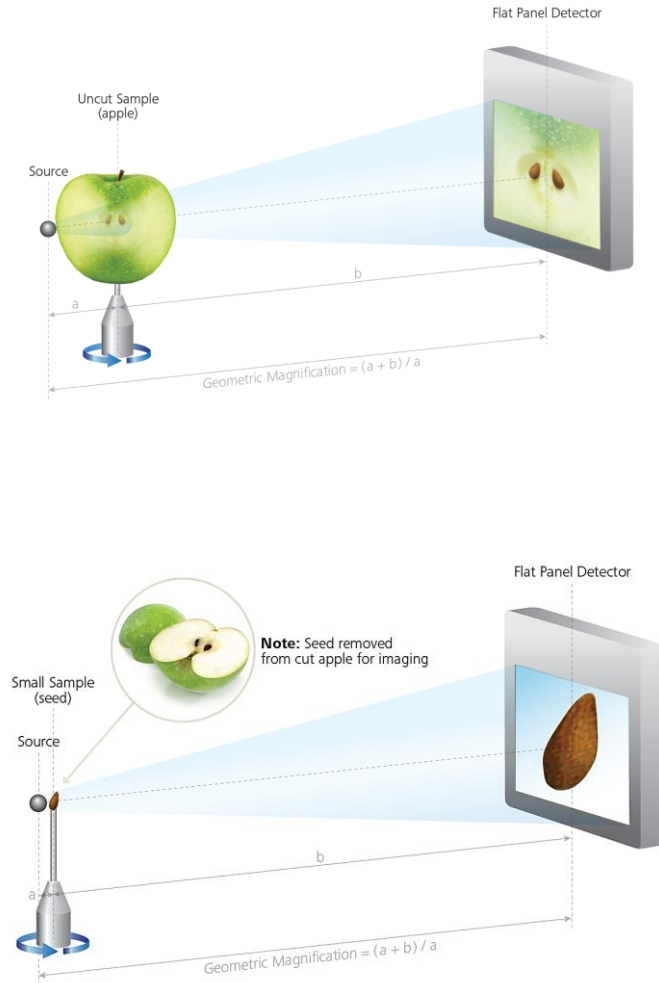
05 X-ray Microscopy

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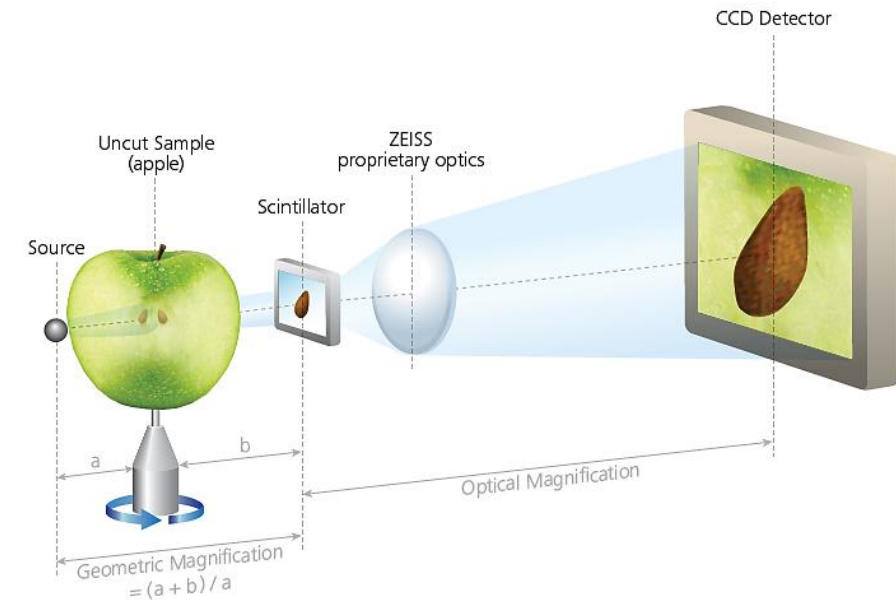
07 Summary

What is an X-ray Microscope (XRM) Non-destructive 3D Tomography

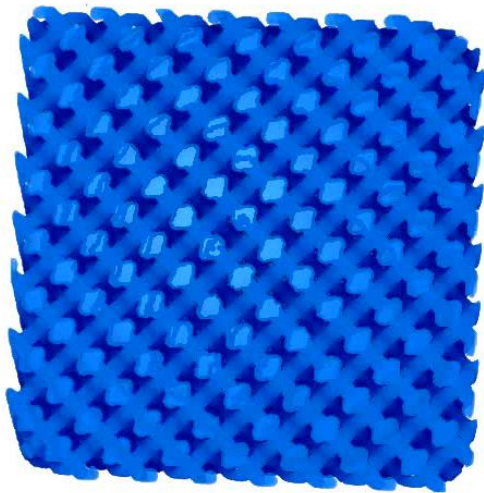
X-ray CT



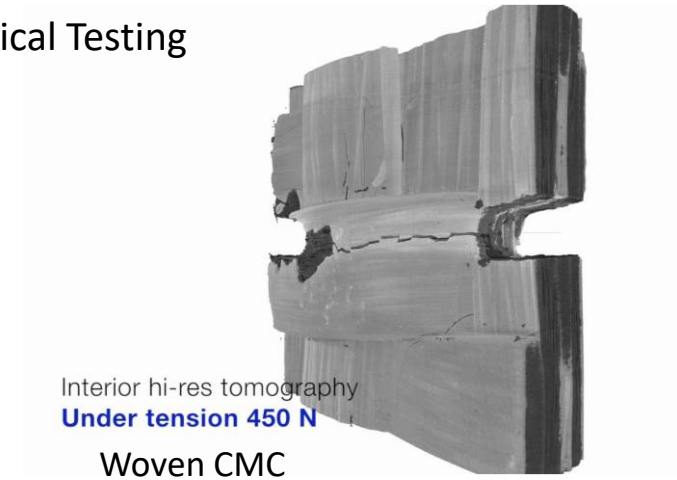
X-ray Microscope



3D Tomography



In-situ Mechanical Testing



3D Grain Mapping

SrTiO_3 , 0.8x0.8x3.0 mm



Courtesy of Prof. A. Krause,
University of Florida, US

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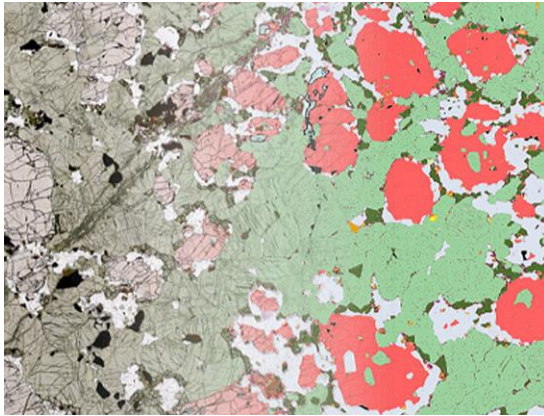
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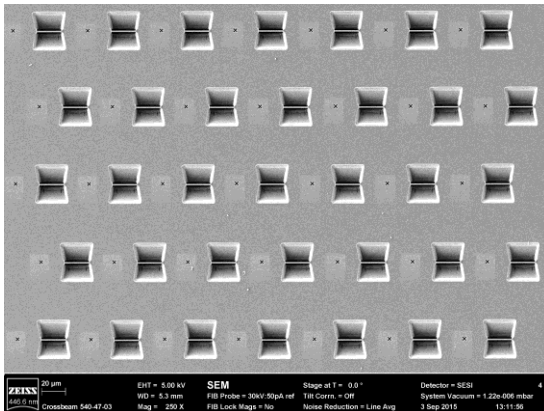
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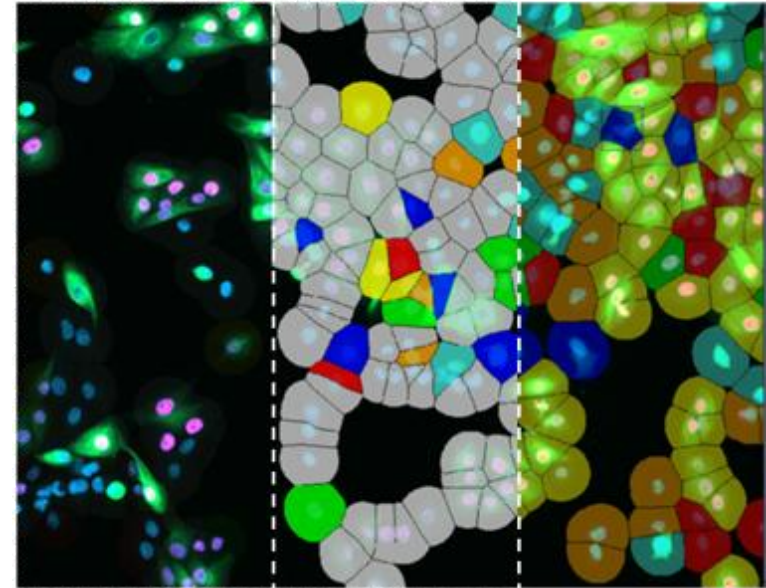
Correlative Microscopy



Automation



AI Processing & Segmentation



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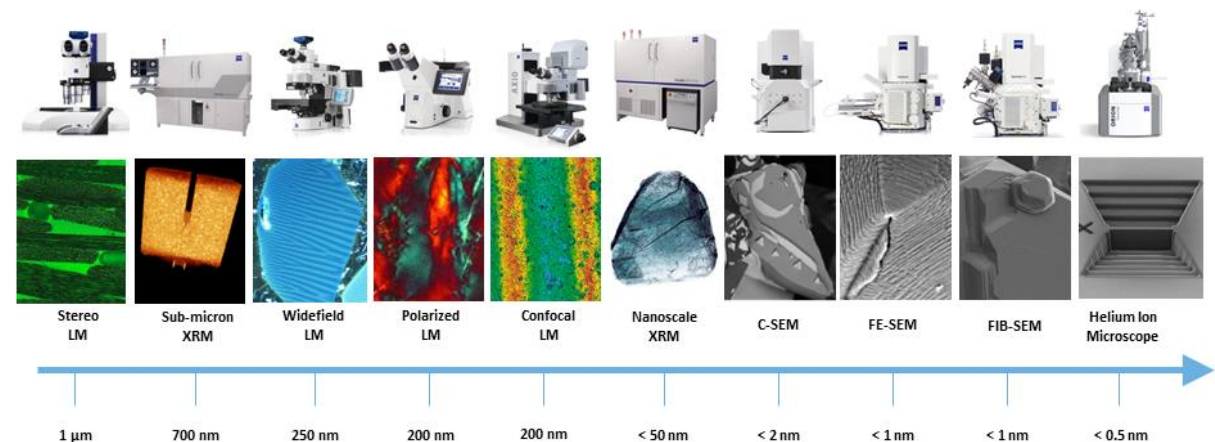
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- Ceramics are present in many material systems including technical ceramics, composites and batteries
- Microscopy is a key technology for the characterisation of ceramics
- There is a broad range of microscopy techniques, with the following being most suited to ceramic analysis:
 - 2D analysis is possible with light and electron microscopy
 - 3D and 4D analysis is possible with FIB-SEM and X-ray Microscopy
- Push for enhanced post acquisition processing and analysis software





Seeing beyond