GrainMapper3D *Spotlight*

Pyrite – *"Fool's gold"*

Sample Description

- Mineral specimen of intergrown pyrite crystals
- Chemical formula: FeS_2
- Crystal system: Cubic (Isometric), Pa3 space group
- Morphology: Cubic, pyritohedral, striated faces
- Common twinning: [110], the 'iron cross' twin
- Sample dimensions: 7.2 mm × 13.2 mm × 9.8 mm
- Origins: Sedimentary, igneous, metamorphic rocks; hydrothermal veins; deep ocean floor vents; soils

Mineral background

Pyrite is a common sulfide mineral recognizable by its pale brass-yellow color and metallic luster, earning the nickname "Fool's Gold". More than 90% of Earth's pyrite is produced by microbial activity, making it abundant in soils and sediments. Bacteria drives pyrite production, oxidation and breakdown. Being chemically reduced, its isotopic compositions provide insight into oxygenation of Earth's oceans and atmosphere. Society utilizes pyrite as an ore of sulfur and impurities like copper, lead, zinc, gold, silver, and arsenic. Many industries have made use of pyrite derivatives. Pyrite's conductive properties make it relevant in lithium battery, semiconductor, and photovoltaic applications.

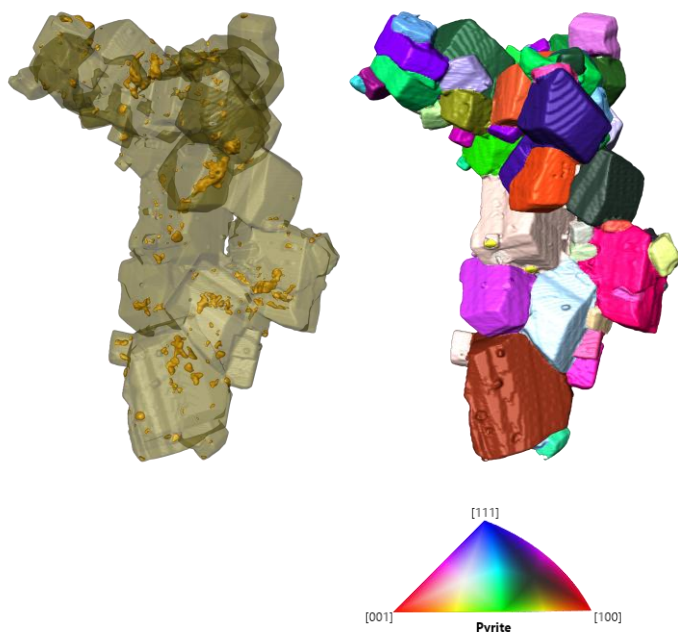*Figure light microscopy image (left) and 3D surface map of a pyrite mineral (right).*

Figure absorption scan reconstruction highlighting pyrite (light gold) with inclusions (mustard yellow) as a second phase across the 3D sample volume (left) and 3D crystallographic orientation map (right).
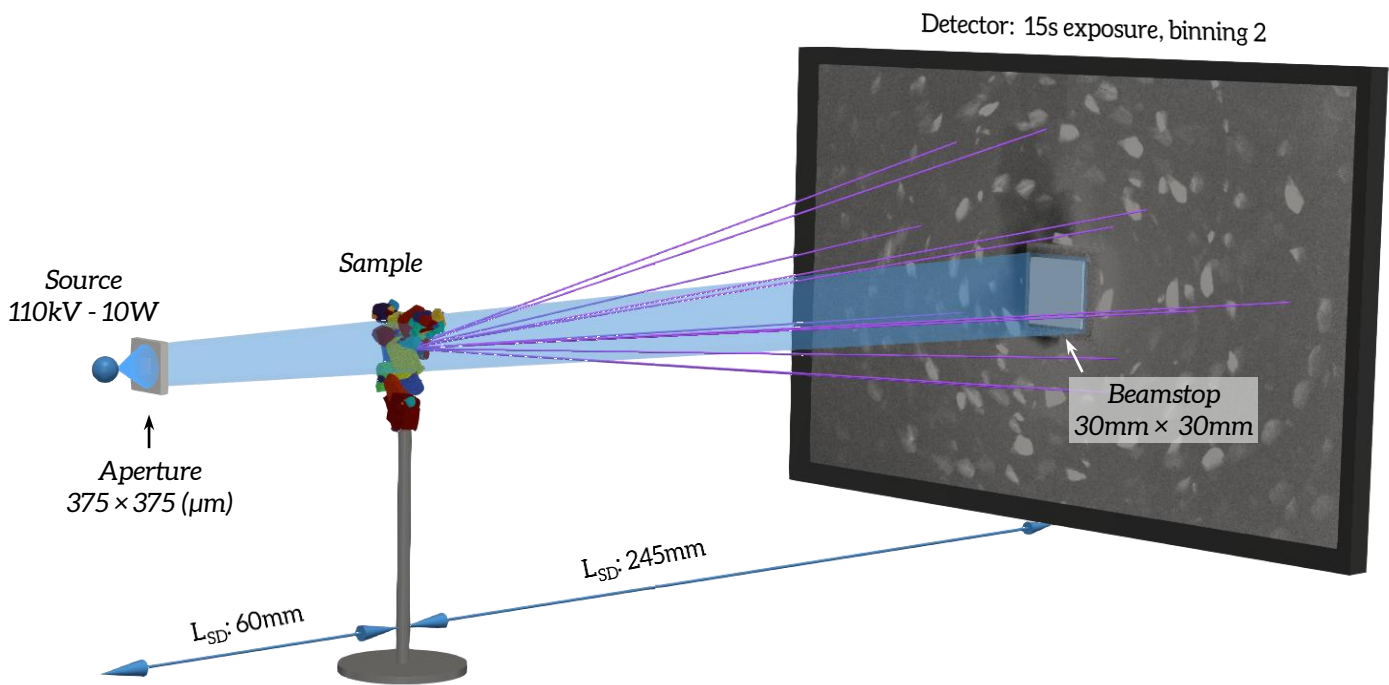
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Figure: Schematic illustration of the setup for diffraction contrast tomography data acquisition of the pyrite sample. Key acquisition parameters are marked.
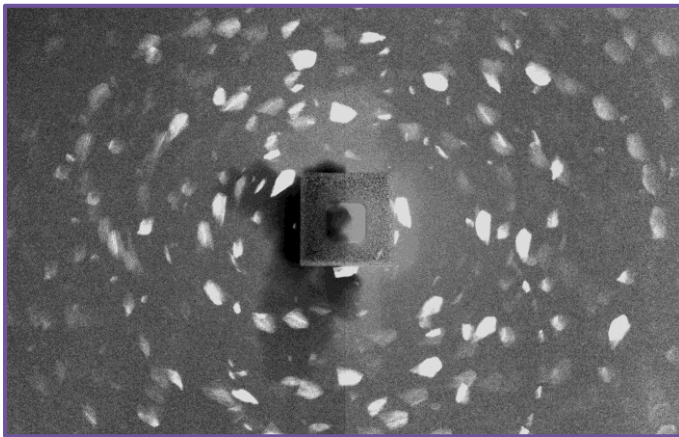

Figure (left): Example diffraction contrast projection at a certain rotation angle. The sample was scanned with projection geometry, with the shape of the diffraction spots representing the shape of the grains.

Data Acquisition Parameters

System: ZEISS Xradia 520 Versa with LabDCT Pro

Absorption Contrast Tomography

- *Voltage*: 110 kV
- *Power*: 10 W
- *Objective*: 0.4X
- *Source – Sample distance*: 30 mm
- *Sample – Detector distance*: 100 mm
- *Exposure*: 1s / binning 2
- *Number of projections*: 2401
- *Voxel size*: 16 μm

Diffraction Contrast Tomography

- *Data acquisition mode*: Helical Phyllotaxis Raster
- *Aperture*: DCT 375 × 375 (μm × μm)
- *Voltage*: 110 kV
- *Power*: 10 W
- *Objective*: Flat Panel Detector
- *Source – Sample distance*: 60 mm
- *Sample – Detector distance*: 245 mm
- *Exposure*: 15s / binning 2
- *Number of projections*: 5980
- *3D Grain Map voxel size*: 30 μm

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