

# X-ray Powder Diffraction

X-ray powder diffraction (XRD) is a fundamental, non-destructive technique for analyzing the structure of materials, enabling the precise identification and quantification of crystalline phases, determination of crystallite size and microstrain, analysis of thin films, nanostructures, and textural properties. The method supports a wide range of applications—from routine quality control to advanced research on functional materials, battery components, and thin-film systems.

Our laboratory is equipped with the Empyrean Series 3 diffractometer (Malvern Panalytical), a highly flexible, modular multi-geometry XRD platform. The system supports reflection and transmission geometries, grazing-incidence measurements, SAXS/VSAXS, and X-ray reflectivity. Thanks to its modular optical architecture, rapid component exchange, and fully motorized sample positioning, the instrument offers exceptional adaptability for both standard and highly specialized experiments.



## Key Features

- **Multi-geometry XRD platform**  
Support for reflection, transmission, grazing-incidence, SAXS, and reflectivity modes for comprehensive structural characterization.
- **High-precision sample positioning**  
Motorized XYZ translation (10–10–10 mm) with rotation/tilt capabilities and micro-beam analysis down to  $<300 \times 300 \mu\text{m}$  for localized studies.
- **Atmosphere-controlled measurements**  
Capability to operate in air, vacuum, nitrogen, and a broad range of reactive gases, including  $\text{H}_2$ ,  $\text{CH}_4$ ,  $\text{CO}_2$ , and other reducing or oxidizing atmospheres.
- **Operando capability for energy materials**  
Dedicated holders for coin-cell batteries and an electrochemical cell for structural monitoring during charge–discharge cycling.



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