

# Thermo Scientific ARL EQUINOX 100

X-ray Diffractometers



# Compact XRD solution

## High performance in a compact size

The Thermo Scientific™ ARL™ EQUINOX 100 X-ray diffractometer (XRD) is designed to meet structural and phase analysis requirements in both industrial and research laboratories. The bench-top design is ideal and a cost-effective solution for routine analysis, dynamic studies, formulation determinations, and teaching in university and colleges.

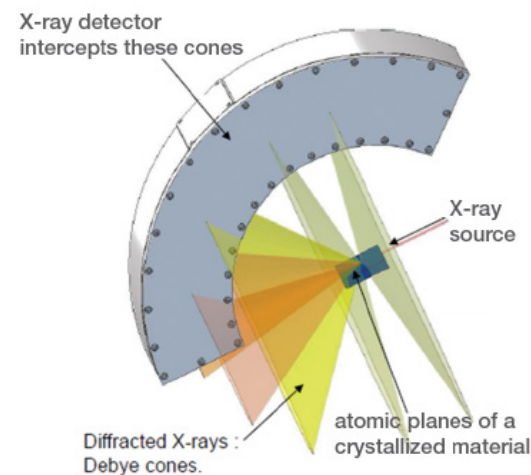
The ARL EQUINOX 100 XRD features a unique curved position sensitive detector (CPS) for real-time simultaneous acquisition of full pattern, enabling faster analysis, *in situ* experimentations, and crystalline phase development/phase transitions.

- Standard power supply; no external water cooling needed
- Reliable and robust with no moving parts
- High intensity from low-power microfocus source
- Real-time simultaneous data acquisition
- Versatile sample entry and analysis
- Transmission and reflection measurement for superior sample representativity

## Reliable and robust

The Thermo Scientific ARL EQUINOX series is designed for laboratories ranging from mobile labs to production control and central laboratories. This X-ray diffraction (XRD) technology allows for greater flexibility and is quicker in process response times.

- No moving parts: stationary X-ray source and detector
  - Fixed focal length: does not need realignment
- Acquisition in asymmetric mode over  $110^{\circ}2\theta$ 
  - Adjustable sample incidence angle
  - Ideal for small angle measurements



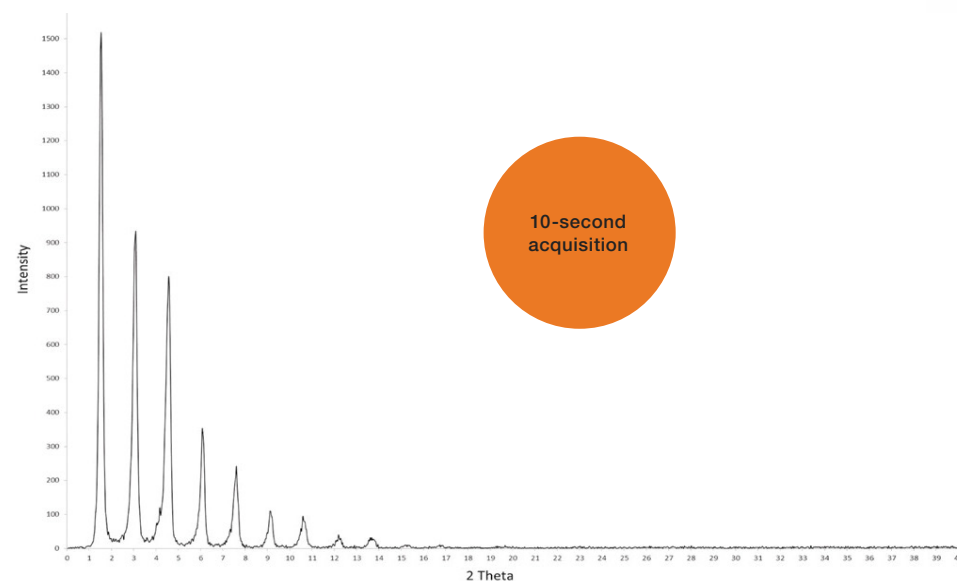
ARL EQUINOX 100 geometry: Asymmetric mode with a Position Sensitive Detector for real time XRD acquisition

# Flexible instrument

## High intensity from low-power microfocus source

Microfocus X-ray sources are low-power X-ray tubes that generate a very brilliant beam. This design gathers incidence scattered X-rays using a mirror system to collect and focus the beam. Thus, even at low power the X-ray flux diffracting the sample is much higher than traditional systems.

- X-ray flux close to a standard X-ray source
- Focusing mirror for higher intensity
- Mirrors capture and focus X-rays onto sample for better efficiency.
- Beam size: approximately 5 mm x 300  $\mu\text{m}$
- Focusing beam geometry



Acquisition at low angle on Silver behenate powder recorded in reflection mode.

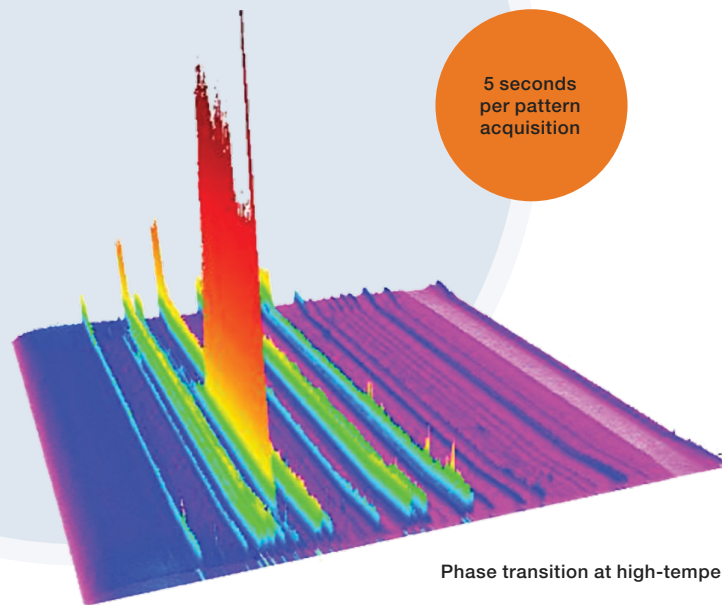
## Versatile sample entry and analysis

The ARL EQUINOX 100 XRD is the most versatile benchtop XRD instrument on the market, adapted for several sample types in various analytical conditions for measurements in reflection or transmission. Sample holders are easily switched in the matter of seconds with no realignment needed. Accessory stages are as follows:

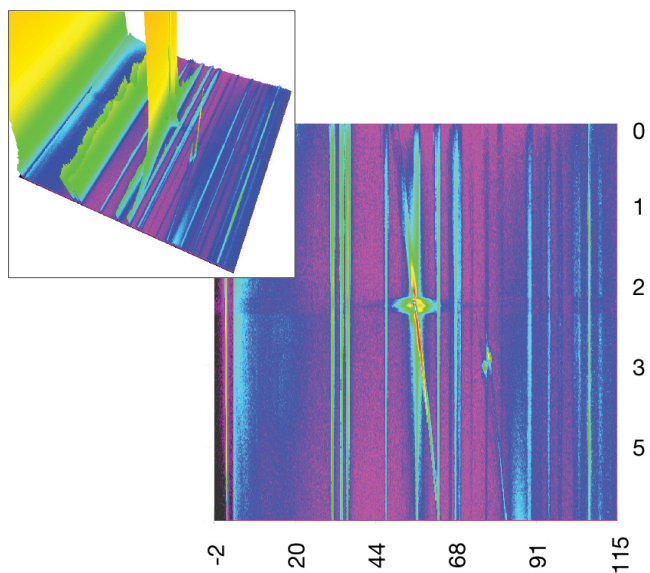
- Fixed non-spinning sample stage
- Single position spinning stage for reflection and transmission
- Reflection mode spinning stage with height adjustment
- Controlled atmosphere reflection sample stage
- Capillary transmission sample stage
- Six-position automatic sample changer with spinning stages
- GIXRD thin layer analysis stage
- Temperature-controlled stage

## Real-time simultaneous data acquisition

The CPS real-time detectors are unique acquisition tools that collect all diffraction data simultaneously. These detectors can perform diffraction experiments on powders, bulk material, and thin films all in real time, enabling not only fast analysis but also dynamic studies.



Phase transition at high-temperature.



Grazing incidence measurement: Observation of an interference with the substrate peak.

## Studies and applications

### Dynamic studies

Studies of physical and chemical properties of materials, as a function of temperature, environment, pressure and other conditions, require dynamic crystallographic measurements in real time. Structural phase transitions or modifications of materials can be captured as they occur thanks to Position Sensitive Detectors (PSD). The PSD acquires the complete XRD diffractogram simultaneously, ensuring that no transition is missed during a measurement, which can be especially challenging with unstable compounds.

### Thin film applications

Analysis of thin film materials can be easily and accurately performed with the ARL EQUINOX 100 XRD thanks to a dedicated sample platform.

Grazing incidence XRD (GIXRD) identifies the phases, texture or structure of a thin crystallized deposit on a given substrate, while reflectometry (XRR) determines the nature and thickness of film deposits as well as roughness of interfaces.

# Samples and attachments

The largest selection of sample holders on the market for benchtop XRD



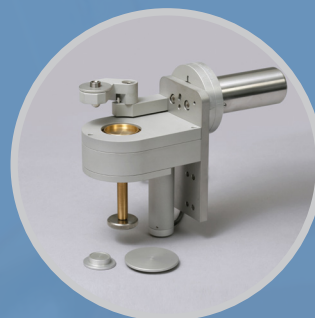
## Fixed sample stage

- Stationary sample mount for powders, small solids or samples on glass plate
- Reflection or transmission mode
- Sample position aligned by positioning screw



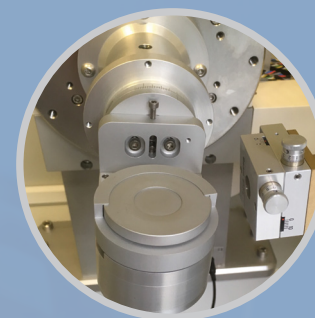
## Spinning stage for powder sample

- Reflection and transmission mode on powder
- Continuous sample rotation
- Zero background holder for micro-quantity samples
- Special cups to protect air-sensitive samples



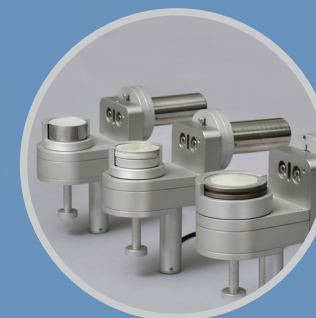
## Spinning stage with height adjustment

- Reflection mode on powder and bulk
- Sample maximum size: 40 x 20 mm with a centered sample
- Height adjustment to 30 mm
- Continuous sample rotation



## Spinning stage for filter studies

- Specific measurement in reflection mode on filter
- Continuous sample rotation
- Available with silver membrane filter (25 mm diameter)



## Spinning stage for pressed pellets

- Reflection mode for pressed samples like cement
- Continuous sample rotation
- Choice according to customer's specifications
  - 51 mm steel rings
  - 40 mm steel rings or free pressed



### Sample stage with controlled atmosphere

- Reflection mode for powder
- Continuous sample rotation
- Modes of operation:
  - Completely isolated cell with closed connections
  - Gas control in the cell
  - Gas circulation to recycle atmosphere



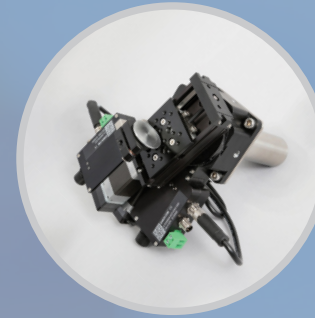
### Capillary stage for transmission measurement

- Transmission mode on sample in capillary
- Goniometric head support
- Continuous sample rotation
- Borosilicate or quartz capillaries available with a diameter from 0.1 to 3.5 mm



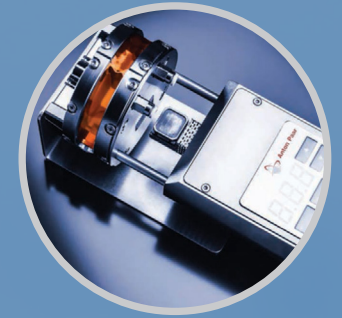
### Automatic 6-position sample changer

- Six sample positions in reflection mode
- Continuous sample rotation
- Zero background holder available



### Thin layer attachment

- Specific attachment for thin film application
- Sample size up to 25 x 25 x 10 mm
- High accuracy motors in  $\theta$  and Z adjustments
- Excellent for GIXRD
- X-ray reflectometry (XRR)

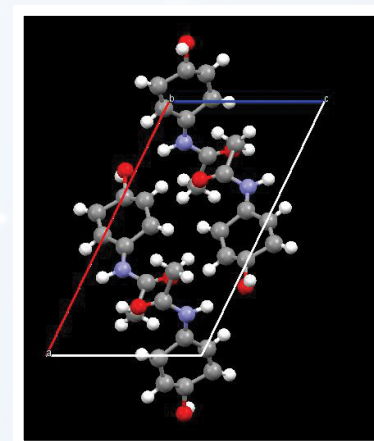
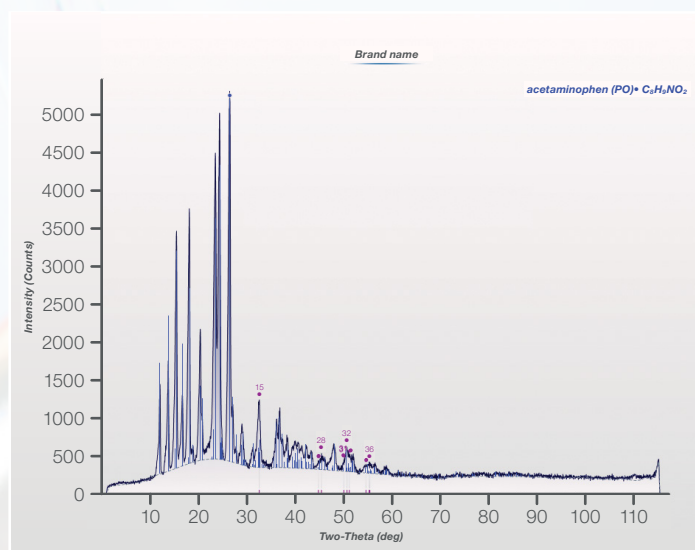
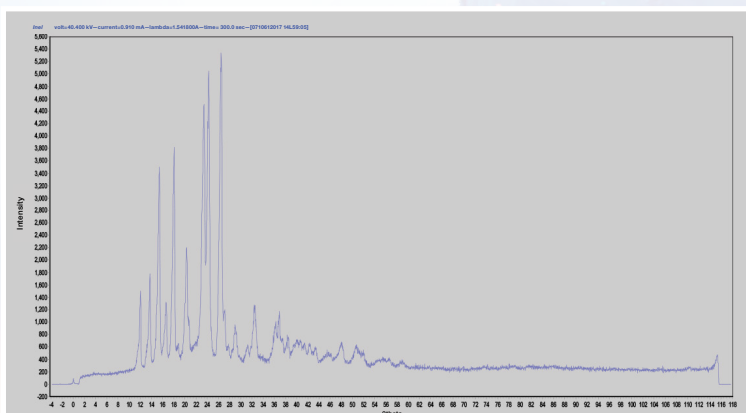


### Temperature controlled stage

- BTS500: temperature range from ambient to 500°C
- BTS150: temperature range from -10°C to 150°C
- Reflection mode
- Sample conditioning in vacuum, air, or inert gas possible
- Fast heating and cooling
- Accurate temperature measurements by a thermo sensor close to the sample
- $10^{-1}$  mbar to 1 bar relative

# Analytical Performance

Analysis of materials ranging from minerals to pharmaceuticals can easily and accurately be performed using the ARL EQUINOX 100 XRD. The resolution and speed of the instrument is exceptional for a benchtop instrument thanks to simultaneous acquisition of the whole pattern. Everything from phase identification, quantitative, percent crystallinity calculations to even crystal structure solutions can be performed using the ARL EQUINOX 100 XRD.



# Thermo Scientific™ SolstiX™ XRD Software 21 CFR Part 11 ready

Thermo Scientific SolstiX XRD Software with Security Suite is available with ARL EQUINOX 100 X-ray benchtop diffractometer, enabling pharmaceutical companies to confidently achieve in a compliant environment while getting the performance results they need. Our software solutions satisfy 21 CFR Part 11 requirements for electronic signatures and complete audit trails.

- Protect stored electronic data related to quality assurance within manufacturer's computer systems
- Put controls in place to keep records authentic, incorruptible, and confidential
- Electronic signatures for the user to take responsibility for the electronic data in the system
- Requirements in the data record: date and time of the scan, name of the unique signer, and technological controls to ensure security (e.g., passwords)



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