

# InSight Series

## Soft-Pack Battery Transmission X-ray Diffractometer

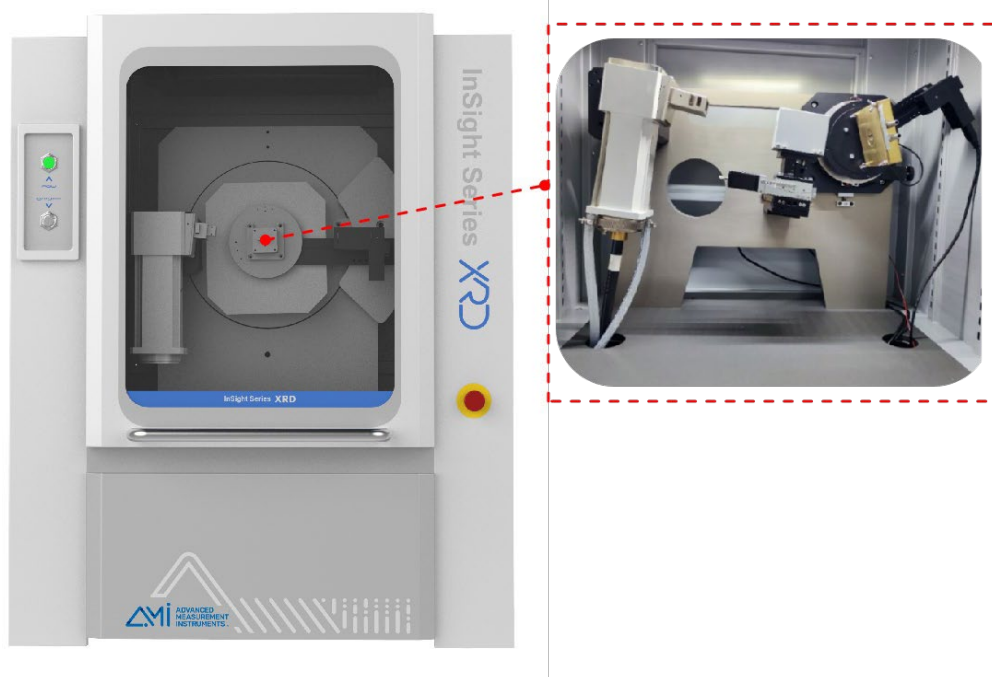
### INTRODUCTION

*“See the change, unlock the InSight “*

Soft-pack (pouch) batteries play a critical role in both cutting-edge research and next-generation commercial energy storage. Yet studying their internal behavior during charge and discharge—especially over long cycles—has been limited by the constraints of traditional in-situ XRD methods. The **InSight Series** changes that.

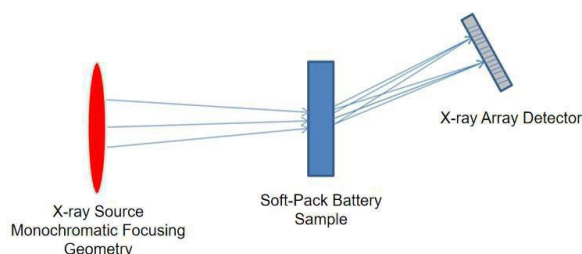
This dedicated in-situ Transmission X-ray Diffractometer is purpose-built for soft-pack battery analysis. Unlike conventional reflective-style molds, the InSight Series uses a vertical transmission geometry to collect diffraction data from both the anode and cathode simultaneously—across the full cell thickness.

Paired with a high-intensity 1600 W Mo X-ray source, a photon-counting 2D array detector, and precision temperature control from -30°C to 300°C, the InSight Series offers unmatched resolution, speed, and stability for real-time battery material studies.



## Why In-situ Transmission XRD for Soft-Pack Batteries?

- **True Long-Term Cycling:**  
Unlike coin cell molds, soft-pack batteries offer superior sealing and stability for thousands of cycles.
- **Full-Depth Material Insight:**  
Vertical transmission geometry collects diffraction data through the entire pouch—enabling dual-electrode analysis.
- **Superior Resolution at Any Thickness:**  
Focused beam transmission ensures peak clarity, even in thicker pouch cells.
- **Thermal Behavior Included:**  
Variable-temperature stage enables in-situ measurements at both sub-zero and high-temperature conditions.
- **Electrochemistry + Structure, Together:**  
Seamless integration with an electrochemical workstation allows simultaneous control and data acquisition during charging/discharging.



*In-situ Transmission XRD Optical Path Diagram*

## KEY FEATURES

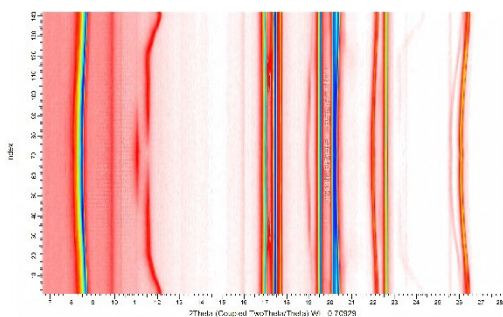
- **1600 W Molybdenum X-ray Tube**  
Delivers strong, high-penetration X-rays optimized for soft-pack battery materials.
- **Photon-Counting 2D Array Detector**  
High-efficiency, low-noise capture of fine diffraction details, with fast scan times.
- **Transmission Geometry**  
X-rays enter through one side of the pouch and exit through the opposite—ideal for full-cell analysis.

## KEY FEATURES (cont.)

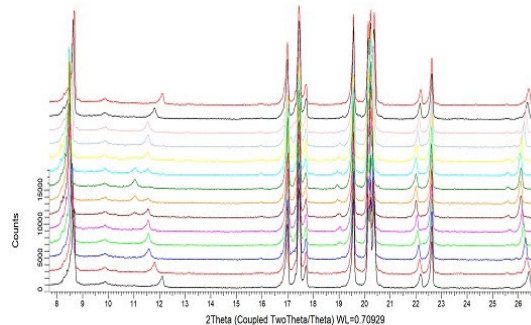
- **Temperature-Controlled Sample Stage**  
Wide range ( $-30^{\circ}\text{C}$  to  $300^{\circ}\text{C}$ ) supports studies of degradation, performance, and thermal failure.
- **Precision Goniometer**  
Theta–2Theta geometry with a 144 mm radius for stable, accurate angular scanning.
- **Compact Footprint**  
Lab-friendly design with powerful capability:  $900 \times 680 \times 550$  mm, 100 kg.

## PERFORMANCE EXAMPLES

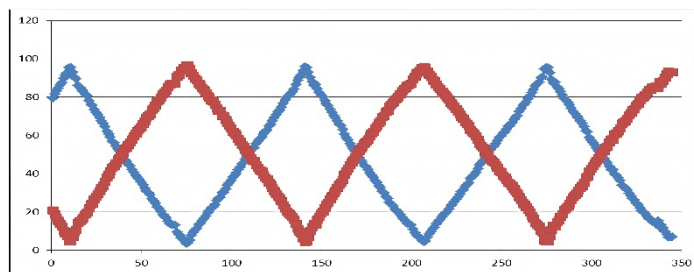
From anode intercalation to cathode degradation and thermal behavior, these performance examples demonstrate the system's ability to deliver high-resolution, high-confidence data—in real time, inside working soft-pack batteries.



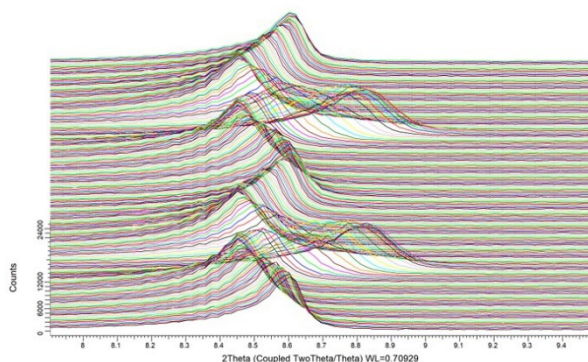
*In-situ Transmission XRD Data Display for Lithium  
Cobalt Oxide Soft-Pack Battery*



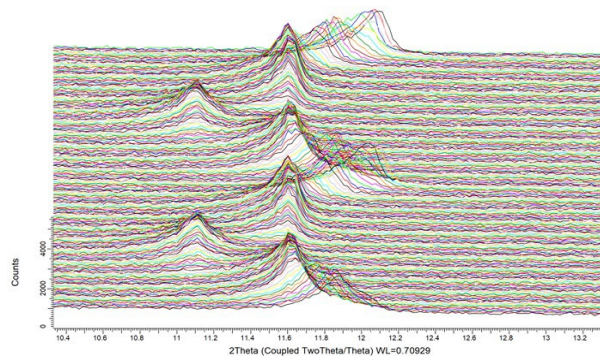
*Single Data Measurement Time: 300 seconds*



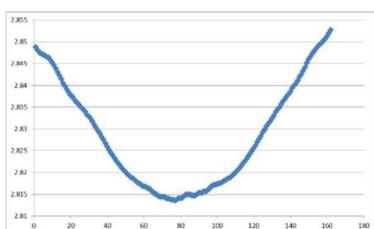
*Variation in  $\text{LiFePO}_4$  and  $\text{FePO}_4$  Phase Content*



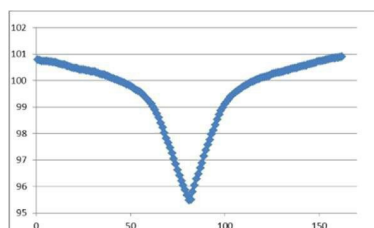
*In-situ Changes of NCM 003 Peak*



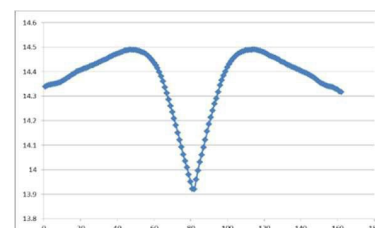
*In-situ Changes of Graphite Negative Electrode in Soft-Pack Battery*



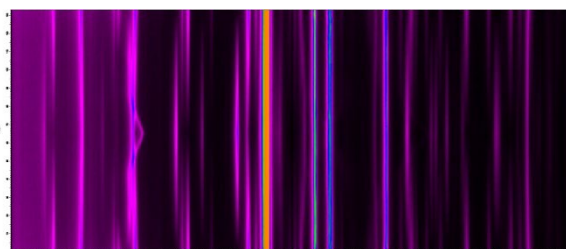
*Variation in NCM Unit Cell Parameter a*



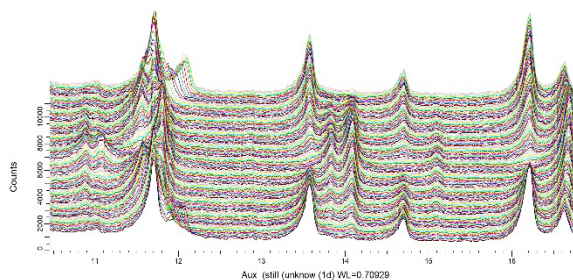
*Variation in NCM Unit Cell Volume*



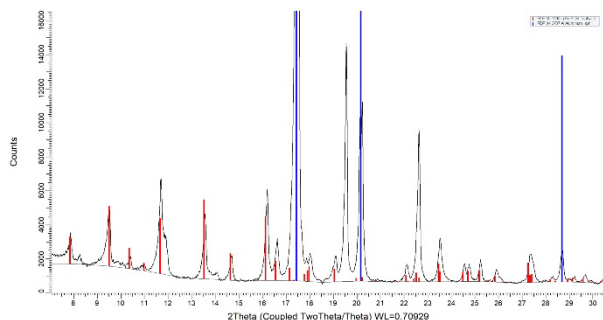
*Variation in NCM Unit Cell Parameter c*



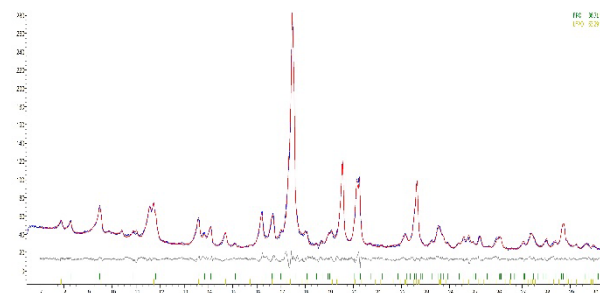
*In-situ Transmission XRD Data for Lithium Iron Phosphate Soft-Pack Battery*



*In-situ Transmission XRD Data for Lithium Iron Phosphate Soft-Pack Battery*



*LiFePO<sub>4</sub> Phase Confirmation*



*Phase Content and Structural Information Obtained from XRD Fitting*

## SPECIFICATIONS

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<b>X-ray tube</b>	1600 W
<b>X-ray tube target material</b>	Mo
<b>Goniometer</b>	Theta / 2theta geometry, the radius of the goniometer is 144 mm
<b>Detector</b>	Photon-Counting two-dimensional array detector
<b>Maximum scanning range</b>	0° - 150°
<b>2Theta minimum step size</b>	±0.01°
<b>Volume and Weight</b>	L 35.4 in (900 mm) × W 26.8 in (680 mm) × H 21.7 in (550 mm), 220.5 lbs (100 kg)
<b>Sample stage</b>	Temperature-controlled sample stage for pouch cells (-30°C ~ 300°C)