

VÅNTEC-1

LOW ANGLE MEASUREMENTS

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Introduction

Many crystalline materials like nano-materials, pharmaceuticals, and clays have large d-spacings and require diffraction experiments in a low-angle 2θ range. Measurements with a one-dimensional detector in this angular range typically elevate backgrounds, and can potentially damage a detector if it is exposed to the direct beam without a properly adjusted beam stop.

In contrast, the Bruker AXS VÅNTEC-1 detector is based on Mikrogap™ technology without any wire or potential radiation-induced semiconductor defects. It has extreme radiation hardness and is not damaged in any way by exposure to the direct X-ray beam. Nevertheless, it is advisable to use a beam stop and reduce the active area of the detector to reduce the background at lower angles.

This application uses Silver Behenate, a commonly used material for calibrating the low-angle range of a diffractometer, to demonstrate the capabilities of the VÅNTEC-1 detector in the low-angle range.

System Configuration

- D8 ADVANCE $\theta/2\theta$
- 2.2 kW Cu long fine-focus X-ray tube
- Tube power: 40 kV/40 mA
- Scan mode: Locked coupled
- Rotation sample stage
- VÅNTEC-1 detector with beam stop
- Automatic divergence slit, set to 0.1°
- Ni Cu-K β -filter
- 2.5° Soller slits



Figure 1 – The VÅNTEC-1 detector

- 1 mm anti-scatter slits
- Step size: 0.007°
- Step time 0.1 sec/step

Measurements

Figure 2 illustrates a Silver Behenate measurement in the angular range between 0.5° and $10^\circ 2\theta$. The measurement was taken in approximately two minutes and is shown without any correction. Note the excellent signal to background ratio even when operating with a very low angle .

Results

Very fast measurements with a VANTEC-1 detector are possible down to $1^\circ 2\theta$ in Bragg-Brentano geometry, even with the required very small divergence and anti-scatter slits. For measurements starting at $2^\circ 2\theta$, the measurement speed would be drastically increased by using a larger divergence slit and the full active area of the detector.

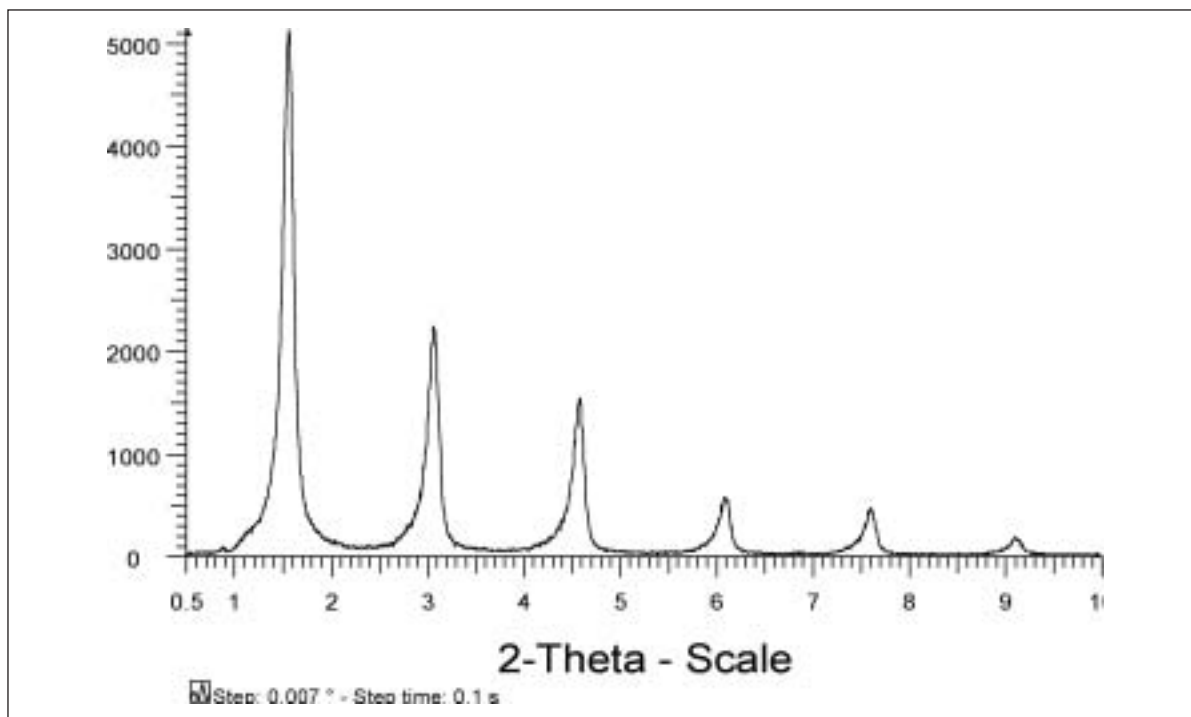


Figure 2 – Silver Behenate measured in approximately 2 minutes ($0.007^\circ/\text{step}$ and $0.1 \text{ sec}/\text{step}$), with the primary beam stop aligned to block the divergent primary beam below 1° .

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