

VÅNTEC-1

SUPER SPEED AND HIGH RESOLUTION FOR THE D8 FAMILY AND D4 ENDEAVOR

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Introduction

Many XRD laboratories with high-sample throughput or process control applications require fast measurements or short measurement times beyond the capabilities of a standard point detector. In those cases, the point detector system with narrow receiving slit can be replaced by a 1-dimensional detector, which drastically increases the system efficiency by collecting the diffracted intensity in parallel over a wide 2θ range. The Bruker AXS VÅNTEC-1 detector is based on Mikrogap™ technology and reduces typical measurement times to minutes or seconds in scan mode. With its large active area of 50 mm x 16 mm and more than 1000 active readout channels always working, it is also capable of diffraction snapshots of up to $12^\circ 2\theta$ in fixed mode.

This application report uses NIST certified standards to demonstrate the capabilities of the VÅNTEC-1 detector.

Instrumentation

- D8 ADVANCE $\theta/2\theta$
- 2.2 kW Cu long fine-focus X-ray tube
- Rotation sample stage
- Variable divergence slit assembly
- VÅNTEC-1 detector

Measurements

Figure 2 shows a measurement of a NIST1976 corundum plate that was primarily used to demonstrate measurement speed. A range from 20° to $100^\circ 2\theta$ was measured in approximately 2 minutes with parameters set for medium resolution.



Figure 1 • The VÅNTEC-1 detector.

To test the resolution over the entire angular range, the line profile standard LaB_6 (NIST660a) sample was measured with smaller slits and longer measurement time over the range from 20° to $150^\circ 2\theta$.

Parameters for NIST1976

- Tube power: 40 kv/40 mA
- Scan mode: locked coupled
- 0.5° fixed divergence slit
- Ni Cu-K β -filter
- Step size: 0.013 $^\circ$
- Time per step 0.02 sec/step

Parameters for NIST660a:

- Tube power: 40 kv/40 mA
- Scan mode: locked coupled
- 0.3° fixed divergence slit
- Ni Cu-K β -filter
- Step size: 0.005°
- Time per step 2.4 sec

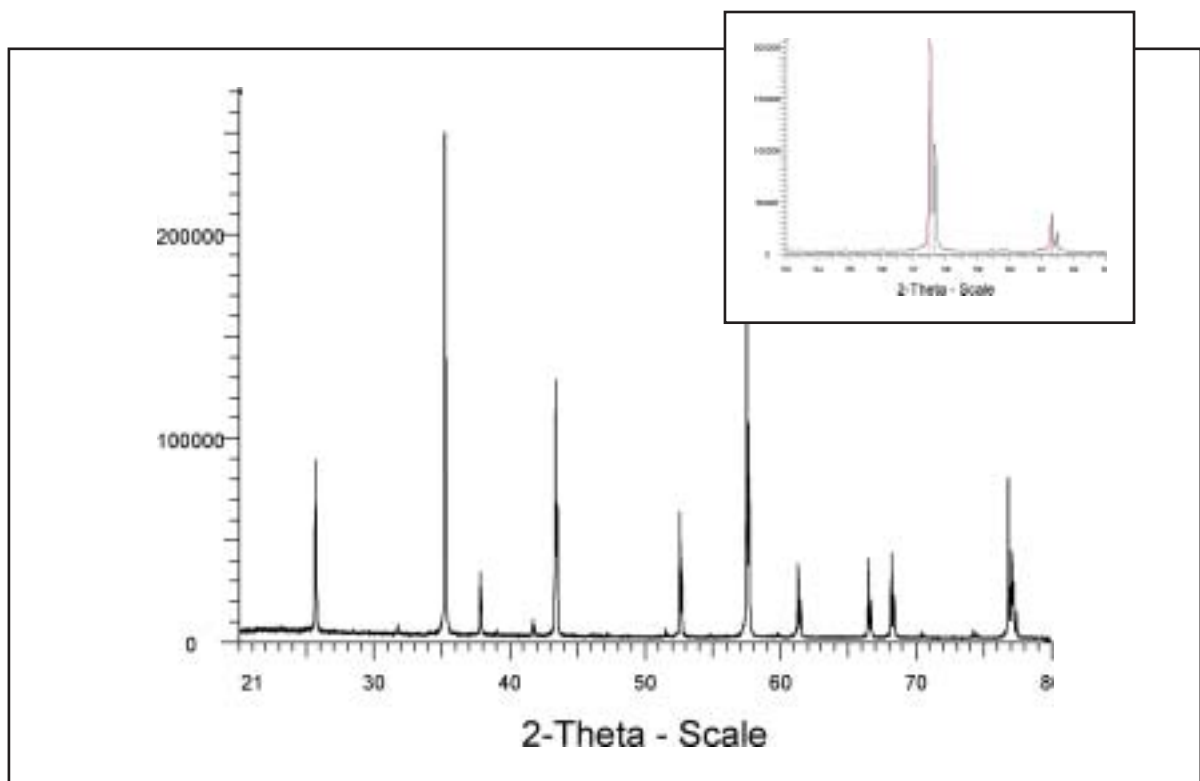


Figure 2 • Fast measurement on a NIST 1976 corundum plate with VANTAGE-1 detector. Measurement time approximately 2 minutes. Note excellent resolution in the inserted zoomed area.

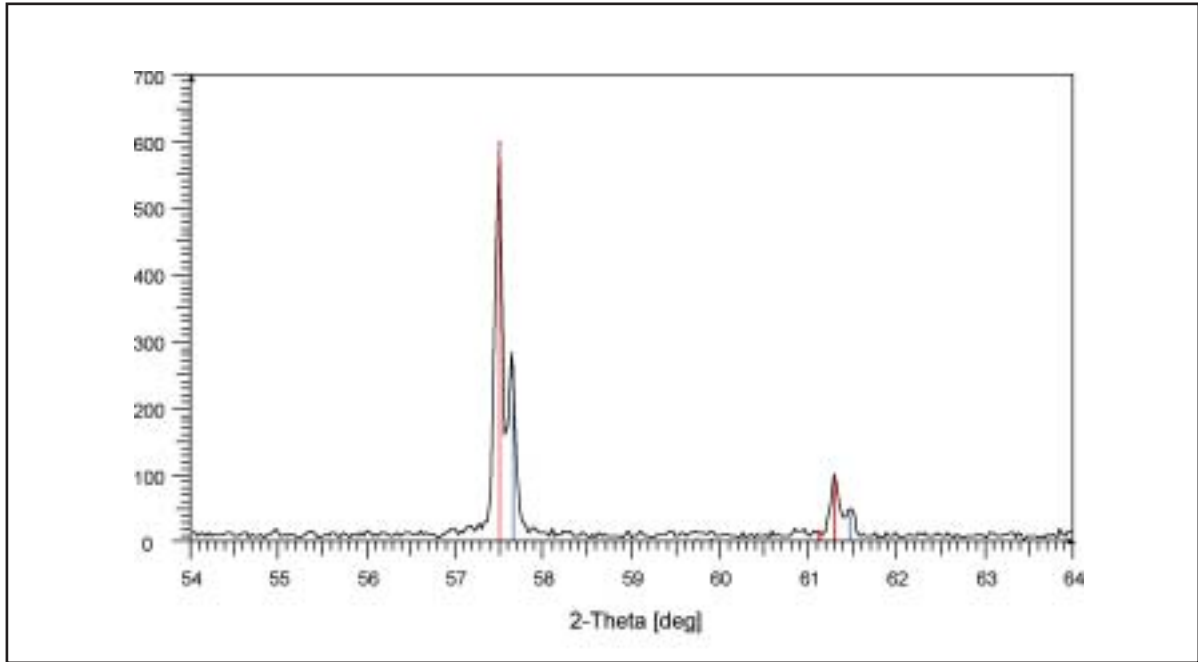


Figure 3 • X-ray Diffraction snapshot in fixed mode on NIST1976. 10° 2θ were measured with a total measurement time of 100 msec.

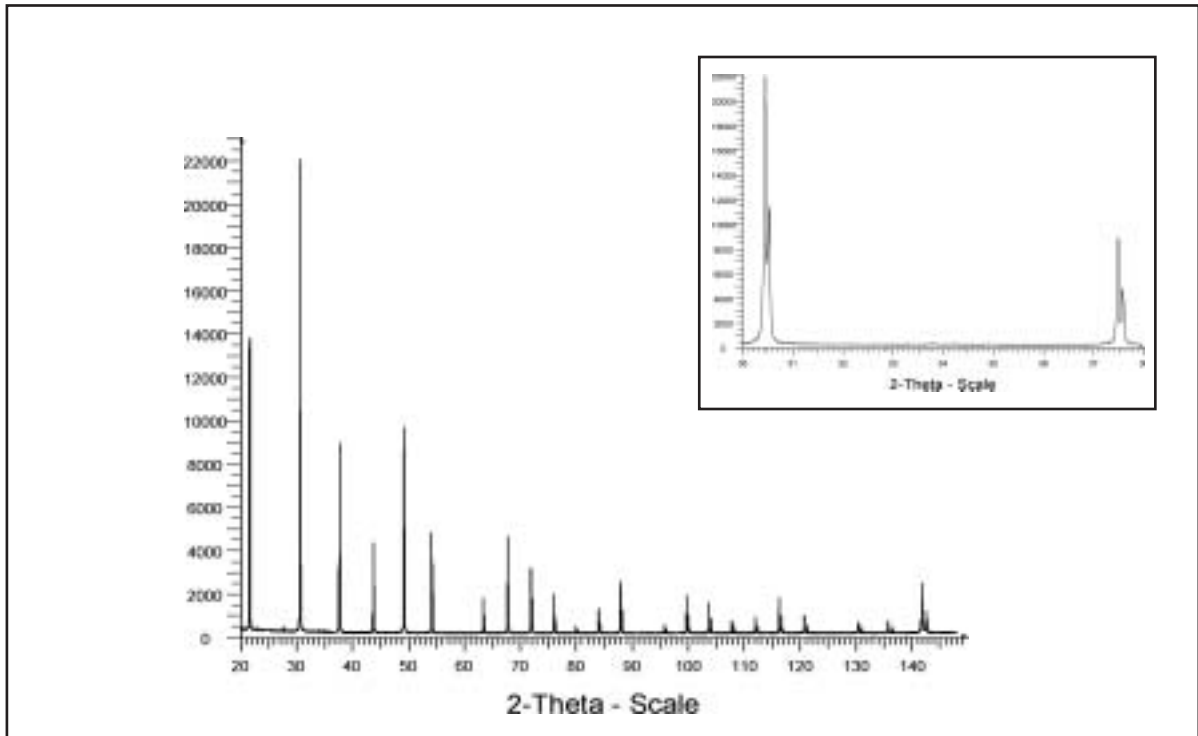


Figure 4 • NIST660a measured over the entire angular range. Note the excellent resolution and high peak-to-background resolution.

Results

The VÅNTEC-1 detector is capable of performing extremely fast measurements in scanning mode as well as taking snapshot measurement in fixed mode. Routine scan measurements can be performed in 20 sec. to a few minutes, depending on the required resolution and angular range. X-ray Diffraction snapshots with an angular range of up to $12^\circ 2\theta$ can be collected as fast as 100 msec.

The peak shape and detector resolution was investigated with a LaB_6 line profile standard. The collected data was fitted easily with commonly used analytical functions and a FWHM below 0.04° was observed for the low angle peak positions using a standard Bragg-Brentano geometry.

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