

Compact X-ray Diffractometer

MiniFlex XpC



1. Introduction

X-ray diffraction (XRD) has traditionally been utilized mainly in the R&D field. Recently, however, opportunities to use XRD in the QA/QC field are increasing since the XRD technique has become easier to use with the popularization of desktop X-ray diffractometers and high-speed 1D semiconductor strip detectors (1D SSD). Rigaku has marked another step in this trend by announcing the MiniFlex XpC, a compact X-ray diffractometer optimized for QA/QC, utilizing the X-ray technologies cultivated in the company's 70-year history.

There are three requirements for the manufacturing environment: 1. shorter measurement time, 2. better operability, and 3. higher durability. The MiniFlex XpC meets these requirements thanks to its downsized X-ray generator (XG), high-speed 1D SSD D/teX Ultra 250 detector, a new sample loading function, software optimized for QA/QC, connectivity with a third-party automation system, a high-precision theta-theta goniometer, and so forth.

2. Features of the MiniFlex XpC

2.1. For shorter measurement time

It is crucial to increase the diffraction intensity to reduce the measurement time and improve throughput. The MiniFlex XpC realizes an X-ray power of 800 W by incorporating Rigaku's original small mold-type ceramic tube and an improved power supply, which provides 800 W power with almost the same size as the 600 W XG used in the MiniFlex desktop X-ray diffractometer. The

high-speed 1D SSD D/teX Ultra 250 detector, which is used for Rigaku's high-end SmartLab series, is installed in the MiniFlex XpC as standard equipment. The detector has a 1.5-times larger detection area than the D/teX Ultra 2, which is used in the conventional desktop MiniFlex system, for higher intensities in measured data.

Figure 1 shows the difference in diffraction intensity obtained using the MiniFlex XpC and the conventional MiniFlex, measuring the silicon standard reference sample NIST SRM 640f with the same scan speed. It is seen that the diffraction intensity obtained using MiniFlex XpC is almost twice that obtained using MiniFlex. This means the XpC model requires shorter

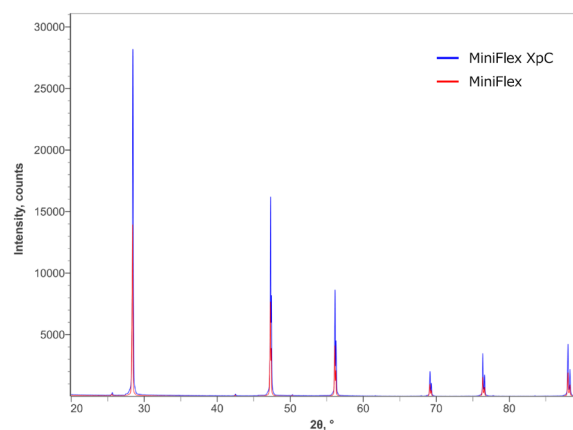


Fig. 1. Difference in intensities collected using the MiniFlex XpC and the MiniFlex.



Fig. 2. Operation window of EasyX.



Fig. 3. Schematic view of MiniFlex XpC connected to an automation system.

measurement times than its predecessor to obtain data of the same quality.

2.2. For better operability

The MiniFlex XpC is 1,490 mm in height, 1,000 mm in width (including the touch-screen device), and 890 mm in depth, which means that its volume and footprint are significantly smaller than most floor-standing XRD instruments.

Thanks to the new sample loading function, the operator does not have to open the door of the radiation enclosure to mount samples.

EasyX, a software program for screening and QA/QC, is installed as standard. Using EasyX, which was originally developed as a SmartLab Studio II plugin, a minimum of three taps (clicks) allow users to perform automated analysis, such as quantitative analysis, evaluation of crystallite sizes, and %crystallinity, lattice parameters refinement, etc. (Fig. 2). Furthermore, this software has various features to improve operability in analytical work—data browsing in a list format and in a trend chart that visualizes variation over time, and automatic pass-fail decision—in manufacturing situations.

The MiniFlex XpC can be used as a part of a full automation system for analytical work by combining it with a sample loader and belt conveyor (Fig. 3).

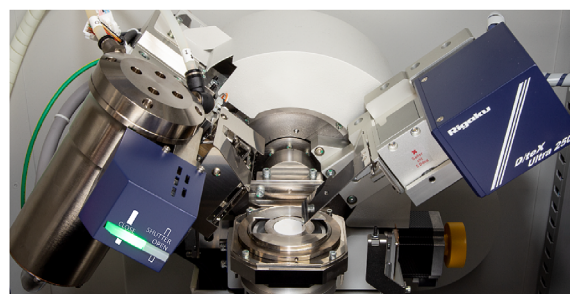


Fig. 4. The goniometer and optics of MiniFlex XpC.

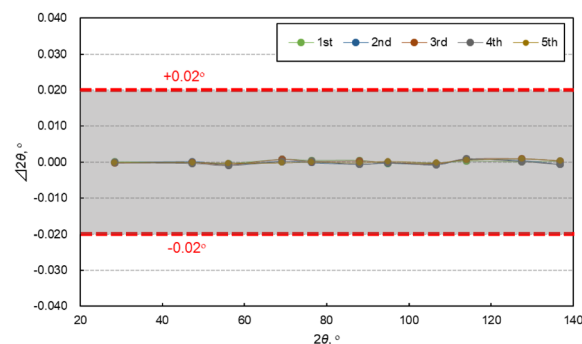


Fig. 5. Repeatability in measured angle using the MiniFlex XpC.

The instrument is also designed to accommodate the industry-standard sample holder (steel ring), in addition to Rigaku-standard sample holders.

2.3. For high durability

MiniFlex XpC is equipped with a compact theta-theta goniometer best suited to QA/QC purposes (Fig. 4). The goniometer has excellent durability; it withstands durability tests repeated more than one million times. The instrument carries a 10-year guarantee, which is the same as what comes with the full-size Rigaku goniometers.

The goniometer has high angular precision as well. Figure 5 shows the repeatability in the measured angle of a diffraction peak from the silicon NIST SRM 640f standard reference sample. The high-precision goniometer and the real-time angular correction function enable the best angular precision at any time.

3. Summary

The MiniFlex XpC incorporates a variety of functions that improve operability in manufacturing environments, increase the intensity of measurement data, and simplify the sample preparation and measurement/analysis procedures compared with its preceding model. Thus, routine analytical work, which used to take time and effort, can now be performed more quickly and easily. The MiniFlex XpC is designed so that anyone can use it without difficulty. The long-term durability of the instrument has also been ensured so that the MiniFlex XpC can be used with confidence for an extended period.