

## Benchtop X-ray diffractometer

**MiniFlex300****MiniFlex600**

## 1. Introduction

In January 2012, Rigaku released the MiniFlex300 and the MiniFlex600, the latest models in the MiniFlex benchtop XRD series. The numerical designations indicate the generator performance of these systems, 300 W and 600 W respectively.

MiniFlex diffractometers are widely used in a variety of fields, such as ceramics, minerals, inorganic materials and pharmaceutical ingredients. They are small compared with conventional X-ray diffractometers—about one-twentieth the volume and one-tenth the weight.

## 2. New features

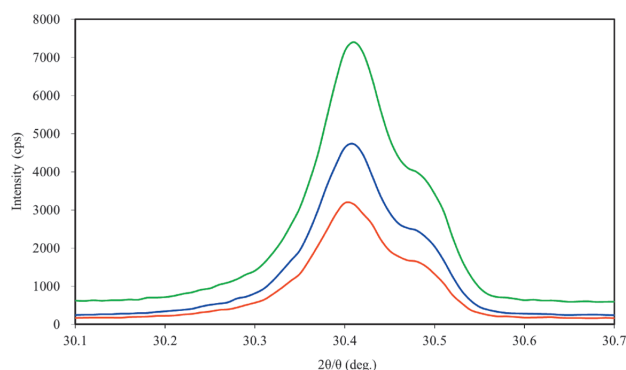
### 2.1. High power

Approximately 1.5 times higher intensity is obtained with the MiniFlex600 compared to the MiniFlexII (450 W).

### 2.2. High intensity and high resolution mode

Two modes can be selected according to the application: intensity priority or resolution priority. In intensity priority mode, a continuously variable divergence slit is used in addition to the slit correction

mode (variable divergence slit+fixed divergence slit) featured on the MiniFlex II to obtain high intensity measurement data. In resolution priority mode, high resolution soller slits of 0.5° and 2.5° are provided in addition to the standard soller slit of 5.0°. A fine focus X-ray tube with 0.4×0.8 mm focus is used for higher resolution measurement than is possible with a normal focus X-ray tube.



**Fig. 1.** Comparison of X-ray diffraction intensity between MiniFlex 300 (red line)/600 (green line), and MiniFlexII (blue line).

### 2.3. Real-time angle correction system

In real-time angle correction, angular precision is increased by applying a correction based on the difference between the theoretical and observed angle values. Once the correction value has been determined, it can be applied to every measurement under computer-control. The best angle precision is achieved by the combination of the high precision mechanical goniometer ring and real-time angle correction.

### 2.4. High intensity measurement using high-speed one dimensional detector D/teX Ultra

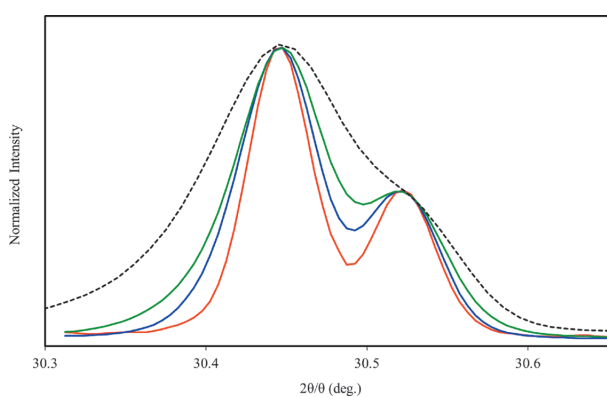
Using the D/teX Ultra detector, intensity data from 10 to 100 times higher can be obtained compared with

a scintillation counter. The D/teX Ultra has high energy resolution, and the user can change the energy detection range via software. XRF reduction mode enables users to perform low background measurements without a graphite monochromator.

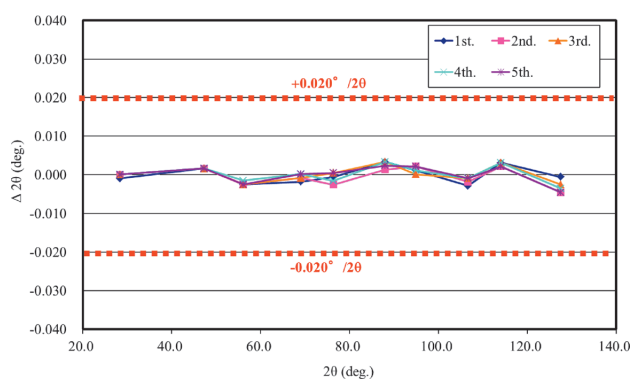
### 3. Other features

Because the MiniFlex300 has an internal chiller, it does not require an external chiller unit and therefore requires a smaller installation space.

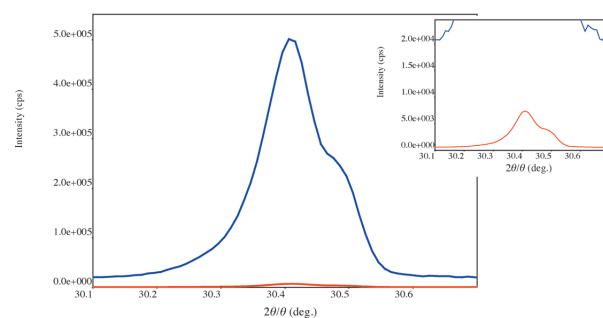
An automatic sample changer for six samples, the ASC6, which has a sample in-plane rotation mechanism, can be used for sample measurement.



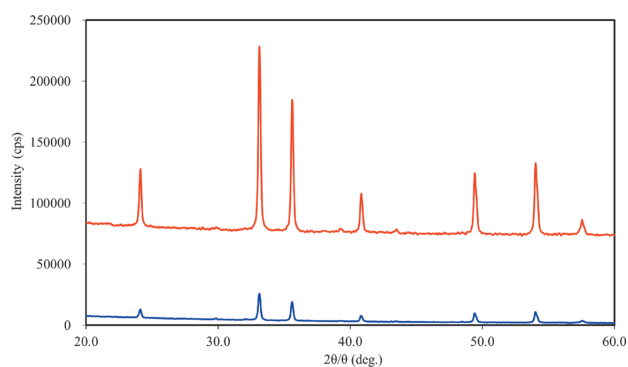
**Fig. 2.** Comparison of X-ray diffraction profile in high resolution measurement mode. Dotted-line: Standard, Green line: High resolution 1, Blue line: High resolution 2 Red line: High resolution 3



**Fig. 3.** Angular precision of Si standard reference material using real-time angle correction system. (Y-axis ( $\Delta 2\theta$ ) is the difference between the theoretical and the observed angle value. X-axis ( $2\theta$ ) is the diffraction angle value of Si.)



**Fig. 4.** Comparison of X-ray diffraction intensity between scintillation counter (red line) and D/teX Ultra (blue line).



**Fig. 5.** Effect of high energy resolution with D/teX Ultra. Red line: Window width 17, Blue line: Window width 3.

**Table 1.** Specification and utility requirements.

			MiniFlex300	MiniFlex600			MiniFlex300	MiniFlex600	
Hardware	Generator	Maximum power	300 W (30 kV – 10 mA)	600W (40 kV – 15 mA)	Software	Instrument control	MiniFlex Guidance		
		X-ray tube	Cu, Co, Fe or Cr						
		Shutter	Rotary shutter linked to interlock						
	Goniometer	Scanning mode	2 $\theta$ / $\theta$			Data analysis	PDXL Basic Analysis package PDXL Qualitative Analysis package PDXL Quantitative Analysis package PDXL Comprehensive Analysis package PDXL Rietveld Analysis package PDXL Structure Analysis package ICDD, ICSD, and COD database available		
		Radius	150 mm						
		Scanning range	-3 ° to 145 °						
		Scanning speed	0.01 to 100 °/min (2 $\theta$ )						
		Minimum step width	0.005 °						
		Divergence slit	Fixed or Variable						
		Scattering slit	Fixed						
		Receiving slit	Fixed						
	Detector		Scintillation counter (NaI), D/teX Ultra (optional)			Dimensions	560 (W) × 530 (D) × 700 (H) (mm)	560 (W) × 460 (D) × 700 (H) (mm)	
	Computer		Windows Desktop PC, Notebook PC (optional)						
	Attachments	Specimen rotation attachment Automatic sample changer for 6 samples Variable knife edge Diffracted beam monochromator D/teX Ultra 1D high-speed detector		Internal heat exchanger		External heat exchanger	Power supply (Main body)	AC 100 to 240 V ± 1 $\Phi$ ± 10%	
								50/60 Hz ± 1% 0.7 kVA	50/60 Hz ± 1% 1.0 kVA
							Power supply (PC)	AC 100 V ± 1 $\Phi$ ± 10%	
								50/60 Hz ± 1% 0.7 kVA	