Automatic Sample Changer and Automatic Filter Changer for 3D micro CT "CT Lab HX"

1. Introduction

Rigaku has been supplying the compact desktop 3D micro CT "CT Lab HX", a wide field of view and high-resolution CT imaging system, since 2018.

CT Lab HX is suitable for computed tomography (CT) imaging of electronic devices, castings, pharmaceutical devices, industrial parts, resins, minerals, etc., and is widely used for fundamental research and quality control.

However, to perform CT scans, it used to be necessary to replace samples manually. In the field of product inspection and performance testing, where imaging of many samples is needed, a function that enables automatic sequential CT scans was desired.

Also, the filters to control X-ray energy had to be manually exchanged. There were requirements for a mechanism that facilitates CT scanning through seamless management of automatic filter exchange and calibration. The Automatic Sample Changer and the Automatic Filter Changer were developed to meet these demands.

2. Features of the Automatic Sample Changer

2.1. Large turret for up to sixteen samples

The Automatic Sample Changer is mounted on top of the CT Lab HX main body (Fig. 1).

Up to sixteen samples can be set on the turret of the sample changer. Turrets loaded with samples can be exchanged. A sample with a maximum diameter of 45 mm can be placed on a sample holder for CT scanning.

The minimum FOV (field of view) with the Automatic Sample Changer is 15 mm in diameter. High-resolution CT imaging with a minimum pixel size of 5 μm is available.

2.2. Automatic sample exchange procedure

The sample is placed on the sample holder (Fig. 2)

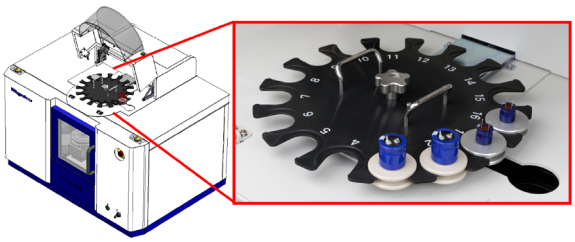

Fig. 1. CT Lab HX with Automatic Sample Changer and enlarged view of the turret.

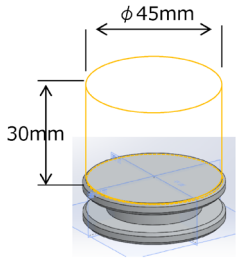

Fig. 2. A sample holder image and the maximum sample size.

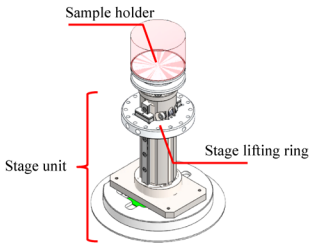

Fig. 3. The stage unit.

and moved together with the sample holder from the turret to the imaging position inside the CT. The stage unit (Fig. 3) is used to move the sample holder. When the stage lifting ring is pushed down, the stage unit pushes the sample holder up to the height of twice the

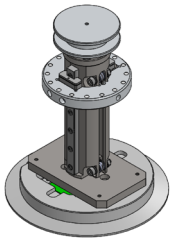

Fig. 4(a). The sample stage at the imaging position.

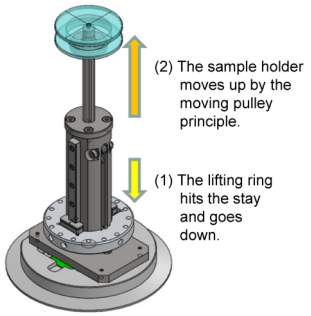

Fig. 4(b). The sample stage at the sample exchange position.

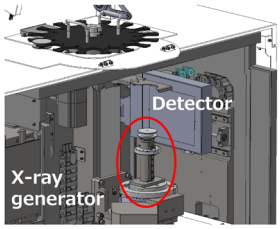

Fig. 5(a). CT imaging position.

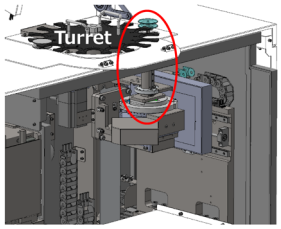

Fig. 5(b). Sample exchange position.

pushed-down distance by the moving pulley principle.

Using this sample stage, the sample can be moved to the sample exchange position at the turret with a simple structure without installing a new lifting drive shaft in the CT.

2.3. Compatible with both single and automatic sequential CT scan

When an Automatic Sample Changer is mounted on the CT Lab HX, there is no interference with conventional CT performance. You can still insert a sample via the front door as usual and take individual CT images instead of using the sample changer. In individual imaging, CT Lab HX’s minimum FOV of φ5 mm (minimum pixel size 2.2 μm) and high-resolution imaging to a maximum FOV ϕ200 mm wide-field CT imaging (offset scan) are available.

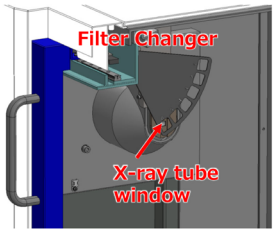

Fig. 6(a). Automatic Filter Changer.

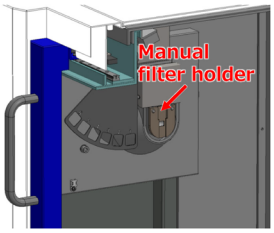

Fig. 6(b). Automatic Filter Changer in the retracted position.

3. Features of the Automatic Filter Changer

3.1. Fan-shaped structure

CT Lab HX’s Automatic Filter Changer has a fan-shaped structure as shown in Fig. 6(a). This is a convenient structure for placing a sample near the X-ray tube for ultra-high resolution imaging without interference with the filter changer for the CT scanner.

3.2. Compatible with manual filter holders

As shown in Fig. 6(b), the manual filter holder can be used when the Automatic Filter Changer is in the retracted position, which is convenient for imaging with a special filter.

4. Conclusion

The CT Lab HX Automatic Sample Changer enables automatic sequential CT imaging of many samples. We will expand the scope of applications of industrial micro-CT by enhancing temperature and pressure attachments and analysis software.