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Application News

Xslicer™ SMX™-6010 Microfocus X-Ray Inspection System

Example of Observing Printed Circuit Board in 5G Smartphone Using a Microfocus X-Ray CT System

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User Benefits

- Printed circuit boards and components in 5G smartphones can be inspected non-destructively by fluoroscopic observation.
- For multi-layer components with internal structures that are difficult to observe by fluoroscopy, CT imaging enables detailed defect observation by layer and three-dimensional observation of the entire part.

■ Introduction

As smartphones become more powerful and widespread, the volume of data transmitted is increasing year by year, increasing the demand for large-volume, low latency data communication. the 5th Generation Mobile Communications System (5G), a communications system with ultra-high speed, ultra-low latency, and multiple simultaneous connections, was developed against this backdrop. Services for 5G smartphones were launched in the United States in 2019.

Because 5G communication is only possible on compatible handsets, new smartphones are being developed and marketed as 5G becomes more widespread. To add 5G communications capabilities without sacrificing portability and functionality, it is necessary to mount many electronic components in limited board space. Against this backdrop, double-stacked structures, in which two boards capable of mounting components on both sides are stacked on top of each other, have become mainstream in recent years. The double-stacked structure increases the board area and enables more components to be mounted.

However, a certain percentage of electronic components will fail. To ensure stable product operation, it is essential to inspect the quality of components and the state of the solder joints on the boards. Therefore, X-ray inspection equipment that can observe components and solder joints without damaging the product is useful for inspection.

This article introduces an example of observing a double-stacked printed circuit board of a 5G smartphone using the Xslicer SMX-6010 microfocus X-ray inspection system.

Fig. 1 Xslicer™ SMX™-6010 Microfocus X-Ray Inspection System

■ Observation of Printed Circuit Board

Fig. 2 shows a panoramic image of a printed circuit board for a smartphone. The Panorama imaging function combines multiple fluoroscopic images to create a single image, which is useful for observing a wide area at a glance. In fluoroscopic images, areas with low density or thickness and low X-ray absorption appear white, and areas with high density or thickness and high X-ray absorption appear black. The upper part of Fig. 2 shows the rear camera and a single board. The lower part of the image shows a double-stacked board with high-density components. Fig. 3 is a fluoroscopic image of a single board, showing the SIM card slot and various sensors. Fig. 4 shows an image of a sensor scanned at a higher magnification. In the highly magnified image, the detailed shape of the parts and the voids inside the solder can be observed.

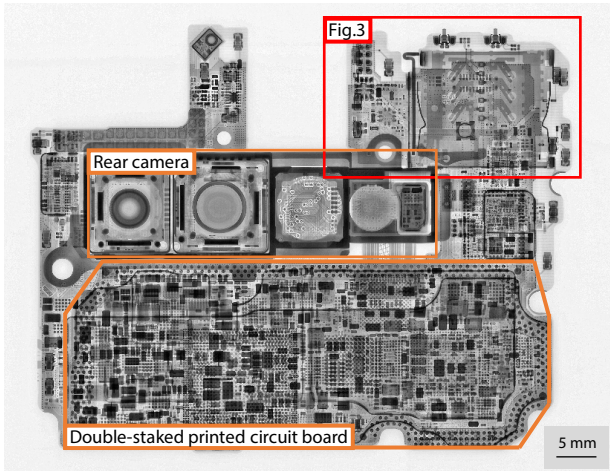

Fig. 2 Panoramic Fluoroscopic Image of the Printed Circuit Board

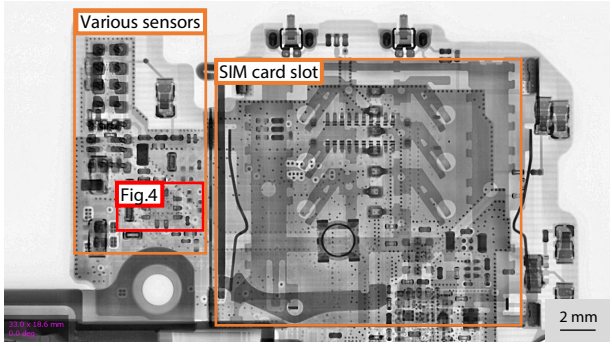

Fig. 3 Fluoroscopic Image of the SIM Card Slot and Various Sensors

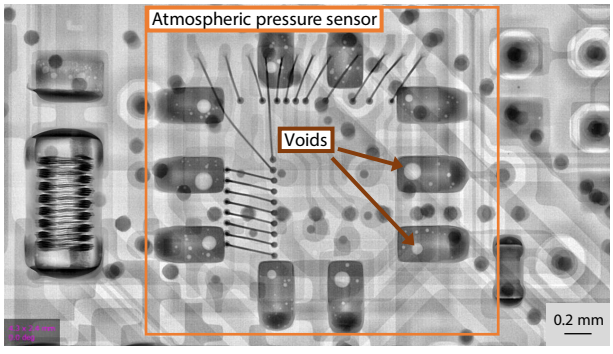

Fig. 4 Fluoroscopic Image of the Atmospheric Pressure Sensor

Fig. 5 shows a fluoroscopic image of the doubled-stacked board. In the double-stacked section, parts can be mounted on both sides of two boards, so the number of parts within the field of view is larger than in Fig. 3, where a single board is scanned. Figs. 6 and 7 are high magnified images of part of the double-stacked board. Although it is possible to observe minute structures and defects in the high-magnified image, it is difficult to grasp the relative positions of the parts and the presence of defects compared to the case where a single board is scanned. That's because parts are projected on top of each other.

Therefore, CT scanning is effective for inspecting the overlapping parts individually. Fig. 8 shows the three-dimensional image obtained by CT scanning of the area shown in Fig. 6. In the board shown here, components are mounted on both sides of the first board and on the front of the second board, but none are mounted on the back of the second board. Figs. 9 and 10 show three-dimensional and cross-sectional images obtained by CT scanning of the BGA at high magnification. It is also possible to measure the diameter of a small solder ball and the length of any defects in the high-magnified image. In this way, it is easier to grasp the shape of components and the physical relationship between components in CT images than in fluoroscopic images. As a result, CT images are very effective for observing multi-layer boards.

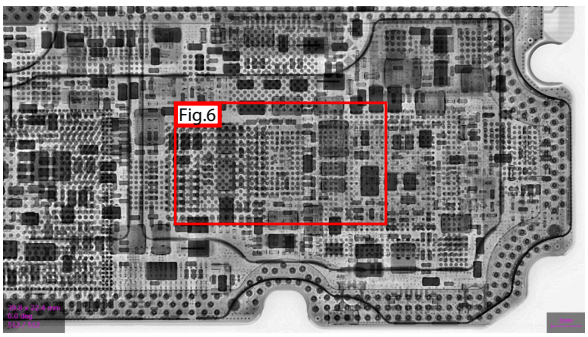

Fig. 5 Fluoroscopic Image of the Double-stacked Printed Circuit Board

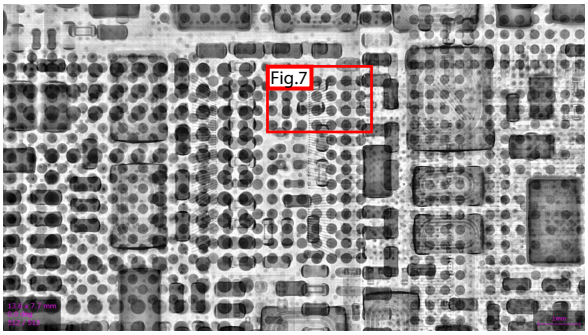

Fig. 6 Fluoroscopic Image of the IC Chip

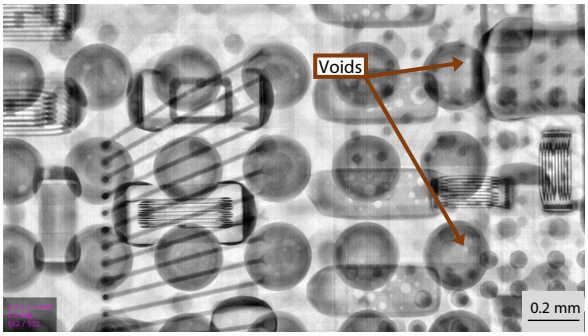

Fig. 7 Fluoroscopic Image of the BGA

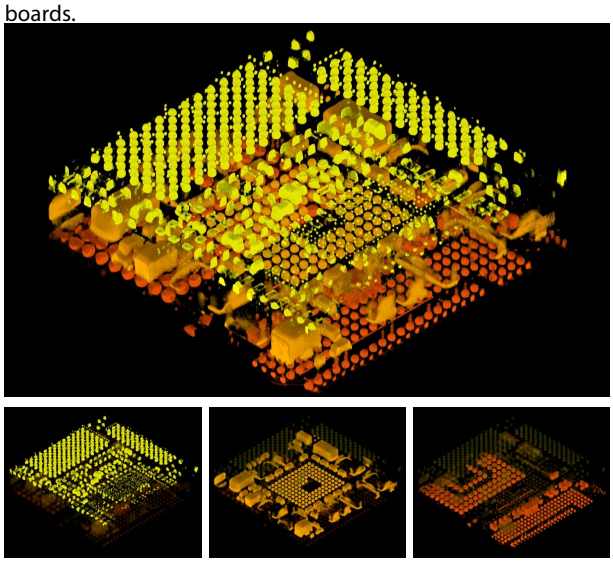

Fig. 8 Three-Dimensional Representations of the IC Chip

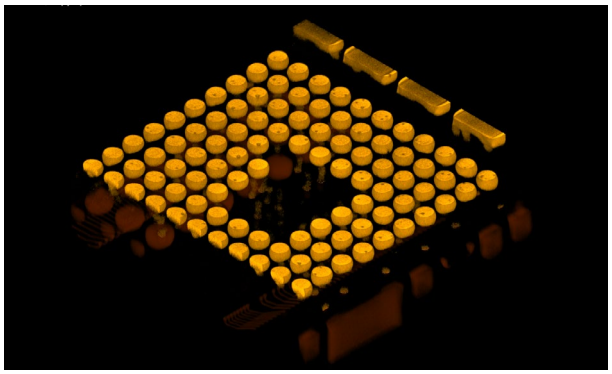

Fig. 9 Three-Dimensional Representation of the BGA

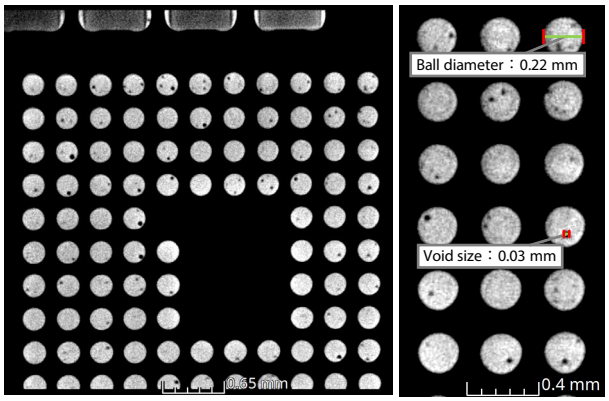

Fig. 10 Cross-Sectional Images of the BGA

■ Conclusion

As described above, the micro-focus X-ray inspection system can visualize the three-dimensional structure of a printed circuit board mounted on a 5G smartphone non-destructively. In addition to conventional fluoroscopy, panoramic and CT scans can be used to easily and quickly inspect the entire electronic board in detail, thus assisting in controlling product quality.

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01-00288-EN First Edition: Mar. 2022

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