Characterization of angle – dependent Focal spot in a miniature X-ray tube

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1. Introduction

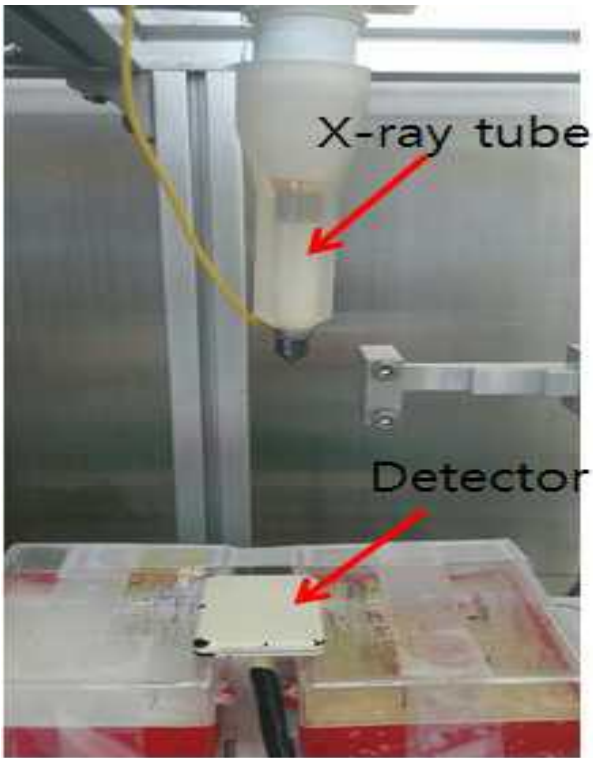
Miniature x-ray tube can be used to obtain important images easily due to its small size and movability. Because the miniature x-ray tube discussed in this paper is a transmission type, it can emit x-rays in all directions, making it possible to take angle-dependent images. Focal spot is essential in an x-ray tube because it affects the quality of images taken by the x-ray tube. The size of the focal spot is equivalent to that of the x-ray generation region located at the x-ray tube target. If the size of focal spot is too large, images produced will be blurry. In other words, smaller focal spots produce clearer images.

Currently common x-ray tubes have a relatively thick target, causing them to emit x-rays in one direction with uniform focal spot size. This type of x-ray produced is called reflection x-ray.

However, unlike the conventional, miniature x-ray tubes, that this paper focuses on, have thin beryllium targets, allowing for both reflection x-ray and transmission x-ray to be generated at the targets. And since both types can affect the size of focal spots, these miniature x-ray tubes can emit x-rays, which is a crucial property when taking angle-dependent images. By measuring the physical characteristics of the focal spots, methods of improving the qualities of angle-dependent images can be determined. Thus, this experiment, which deals with measuring these physical characteristics will substantially help in the improvement of the qualities of angle-dependent images.

2. Methods and Results

In this experiment, miniature x-ray tube that can operate at 50kV and generate current that is lower than 1mA was used. The miniature x-ray tubes and targets were arranged as shown in the figure below to obtain images of the target (distance between miniature x- ray tube to target was 135mm). Targets can be moved and placed at various location to obtain images at various angles.



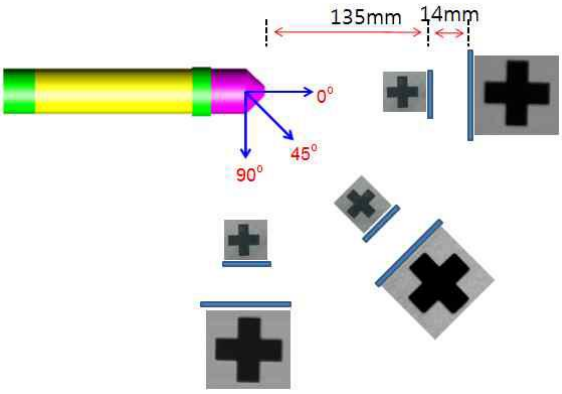


Fig. 2. Distance of miniature x-ray tube to target and different angle used.

And calculate the size of the focal spot of obtained images by using the EN-12543-5 method.

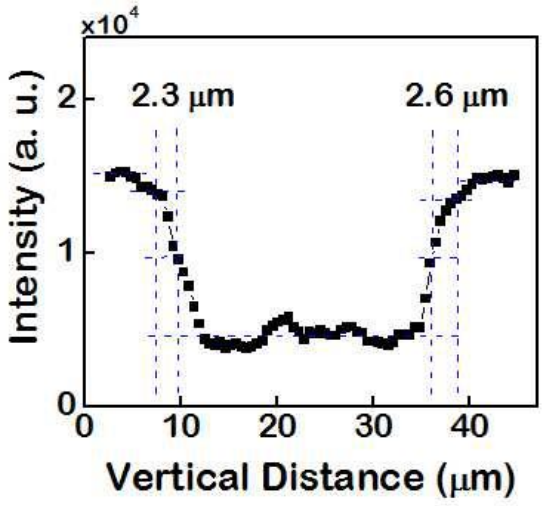


Fig. 1. Example of EN-12543-5

According to the EN-12543-5 method, the size of the focal spot of the obtained image is the distance between the 80% peak and the 50% peak.

3. Conclusions

The result was obtained by analyzing the image with procedure provided by EN-12543-5 Focal spots increase with increase in angle from 0 degree to 90 degrees.

Table I: Angle-dependent Focal spots

	Horizontal	Vertical
0degree	1.23mm	1.08mm
45degrees	1.3mm	1.22mm
90degrees	1.31mm	1.25mm

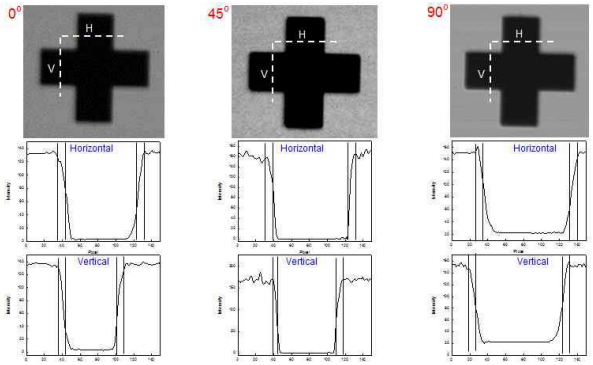


Fig. 3. Angle-dependent Focal spots at angle from 0 degree to 90 degrees.

REFERENCES

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