

Application News

inspeXio™ SMX™-225CT FPD HR Plus Microfocus X-Ray CT System

Example of Observing Paper Diaper and Sanitary Napkin Using a Microfocus X-Ray CT System

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User Benefits

- ◆ The three-dimensional shape of paper diapers and sanitary napkins can be visualized non-destructively, which is useful for product development and quality control.
- ◆ The water absorption and retention performance can be evaluated by observing the specimen before and after absorption.

■ Introduction

Paper diapers (hereinafter called diapers) were developed in Sweden in the mid-1940s because of a shortage of cotton, the raw material for cloth diapers. When they were developed, they were mainly used as a substitute for cloth diapers. However, because of their ease of use and their high-water absorbency and water retention, they are now widely used worldwide for urine care by people of all ages, from infants to the elderly. Sanitary napkins (hereinafter called napkins) have been improved in absorption and comfort since they were first sold in the United States in 1920 and are now widely used as a general napkin for menstrual blood care.

Diapers and napkins differ in shape and material because they absorb different types and amounts of substances, but they all have the same importance of not staining clothing or skin. Therefore, when developing diapers and napkins, it is necessary to design a structure that can firmly absorb and retain the expected amount of urine and menstrual blood and to control the quality of the products.

The micro-focus X-ray CT system is a useful tool for visualizing the three-dimensional structure of a diaper or napkin before and after use and for confirming its ability to absorb and retain the liquid. Since the X-ray CT system can visualize the three-dimensional structure of the object non-destructively, changes before and after absorption of the liquid can be observed on the same specimen.

Here, an example of observing diapers and napkins before and after water absorption using the inspeXio SMX-225 CT FPD HR Plus microfocus X-ray CT system (Fig. 1) is presented.

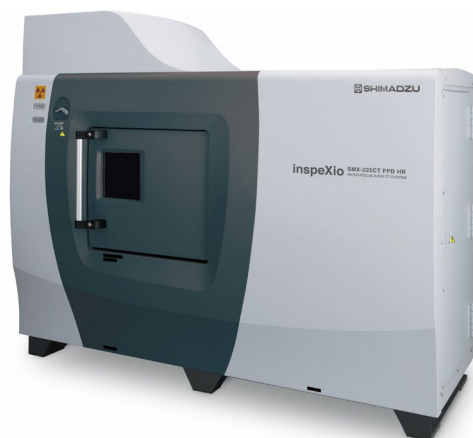


Fig. 1 inspeXio™ SMX™-225CT FPD HR Plus microfocus X-ray CT system

■ Observation of Diaper and Napkin

Fig. 2 shows three-dimensional representations and cross-sectional images obtained by CT scanning of each diaper before and after applying 50 ml of water. The images are white where density is high and black where density is low. In Images 1 to 3, before water absorption, white particles are observed in the cotton-like pulp, which shows the distribution and size of the superabsorbent polymer (hereinafter called SAP). After water absorption, Images 4 to 6 show how the SAP has expanded due to water retention.

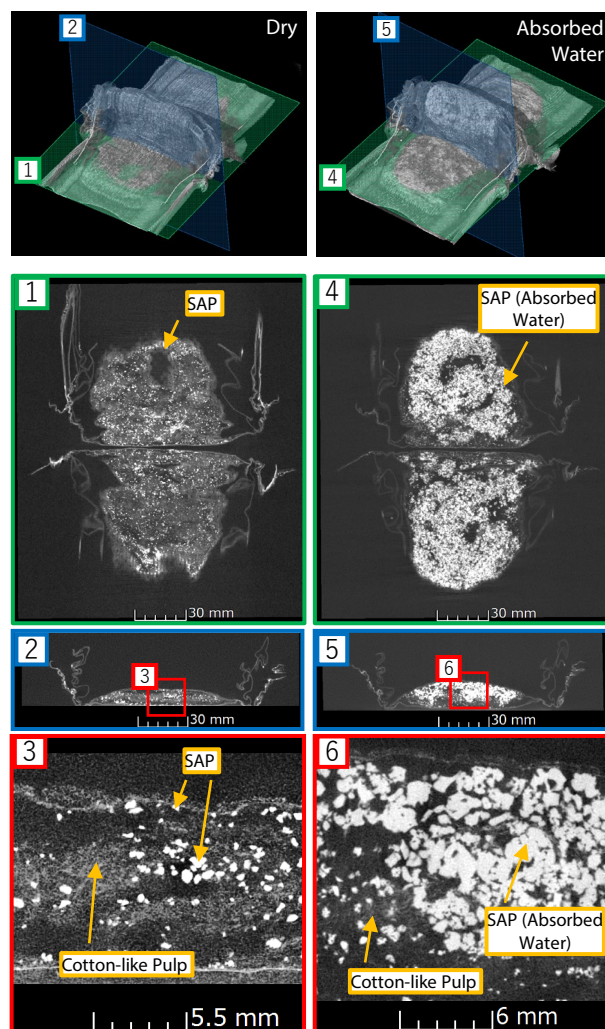


Fig. 2 Three-dimensional representation and sectional image of the diaper

Fig. 3 shows three-dimensional representations and cross-sectional images obtained by CT scanning of each napkin before and after 50 ml of water was applied. The diaper absorbed all 50 ml of water, but the napkin did not absorb all the water because its absorption capacity was less than 50 ml. In Images 1 to 3, before water absorption, the SAP, observed in the diaper in Fig. 2, do not exist inside, but only the cotton-like absorbers exist. Image 4 to 6 shows that water is retained in the cotton-like absorbers over a wide area, leaving little room for further water absorption.

Fig. 4 shows three-dimensional representations made semi-transparent to make it easier to observe internal changes caused by water absorption. The diaper images show how the SAP, which is widely distributed, expands due to water absorption. The napkin images show how water penetrates the cotton-like absorbers and is retained throughout the napkin.

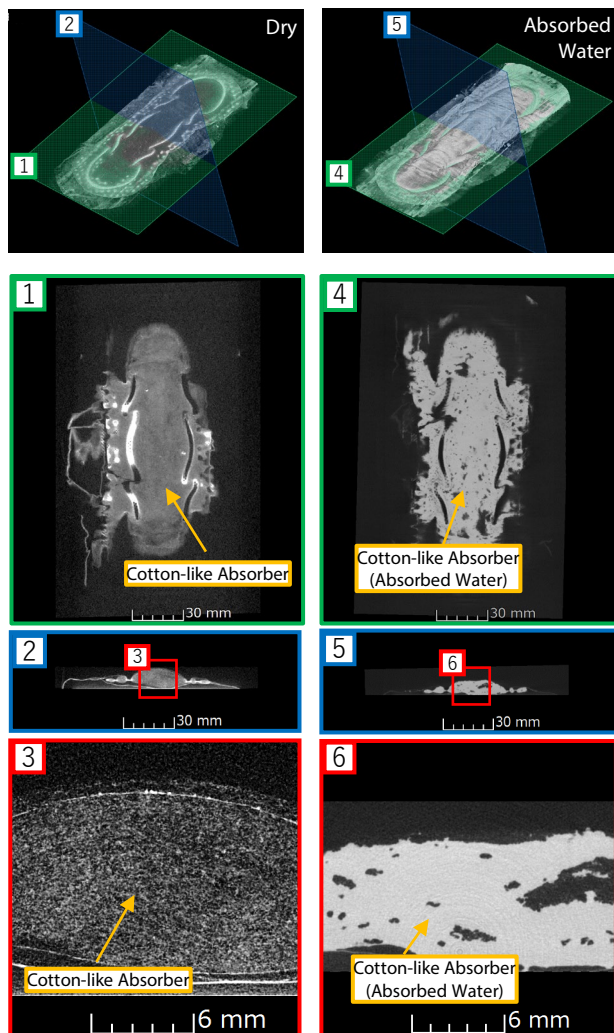


Fig. 3 Three-dimensional representation and sectional image of the napkin

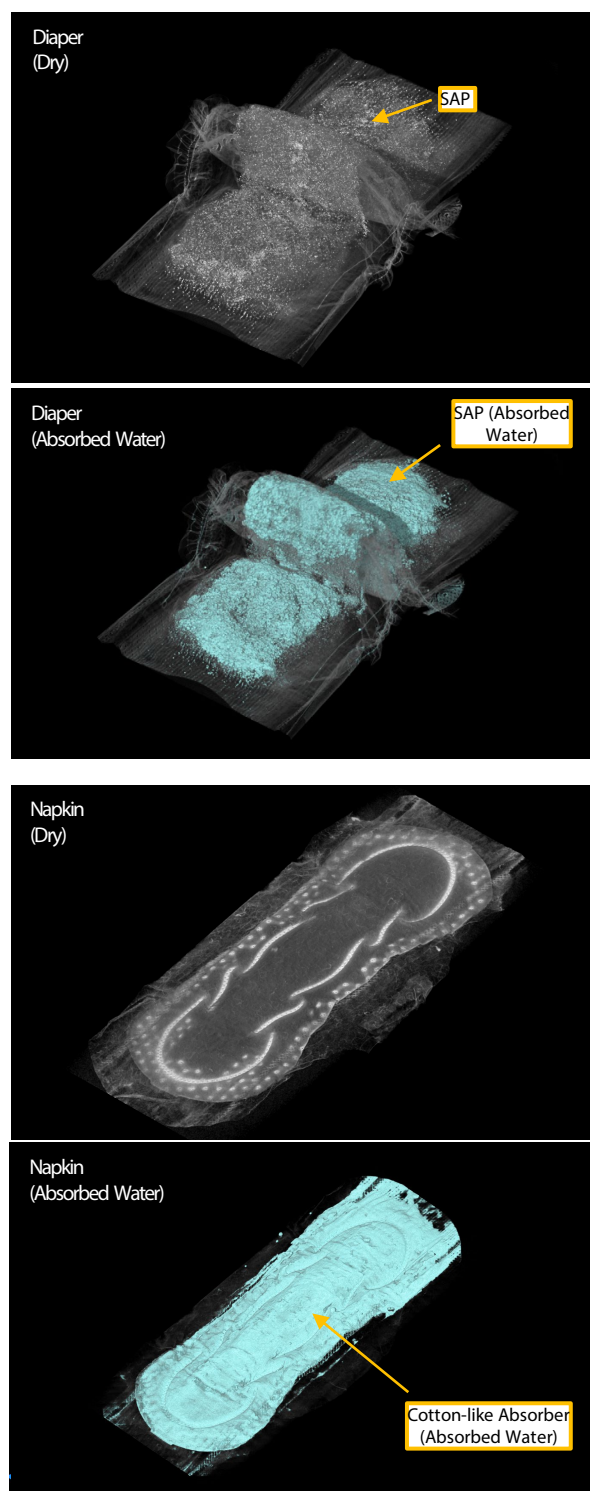


Fig. 4 Three-dimensional representation of the diaper and the napkin before and after water absorption

■ Conclusion

As demonstrated in this example, the micro-focus X-ray CT system can visualize the structural changes of SAP and cotton-like absorbers caused by liquid absorption on the same specimen, which is of great use in product research and development and quality control.

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