

Application News

No.N120

Industrial X-ray Inspection System

Observation of Double-Sided Tape Using an X-Ray CT System

■ Introduction

Double-sided tape is not simply used to fasten sheets of paper together, but is also applied to fasten other materials, and has a variety of uses. A variety exist, including strongly adhesive tapes compared to those used to fasten paper, which are used to fasten carpets to flooring or for other construction and industrial applications, as well as those used for temporal tacking. In terms of the structure of a typical double-sided tape, a strip of paper, cellophane or other substrate is coated on both sides with an adhesive, and peel-away paper is then affixed to the adhesive surfaces. There are also tapes consisting of adhesive and peel-away paper only, with no substrate.

The double-sided tape scanned in this article is intended for industrial use, and is strongly adhesive in comparison to tapes used to fasten paper.

This article introduces CT imaging data from double-sided tape, taken using an X-ray CT system, as well as analytical results from 3-dimensional analysis software utilizing the CT data.

■ Observation of Double-Sided Tape

Figs. 3 and 4 show the results of images of a double-sided tape taken using the inspeXio SMX-100CT Micro Focus X-Ray CT System (Fig. 1). The sample double-sided tape has the usual structure, as shown in Fig. 2. It was cut to a width of 4 mm.

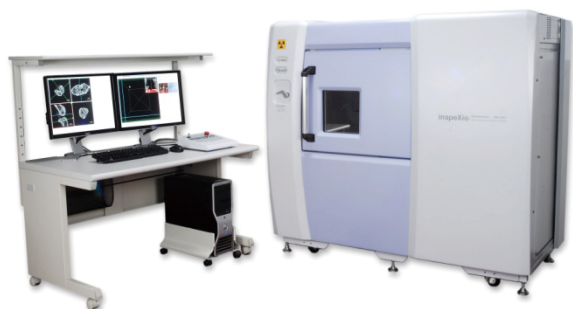


Fig. 1 Overview of the inspeXio SMX-100CT Micro Focus X-Ray CT System

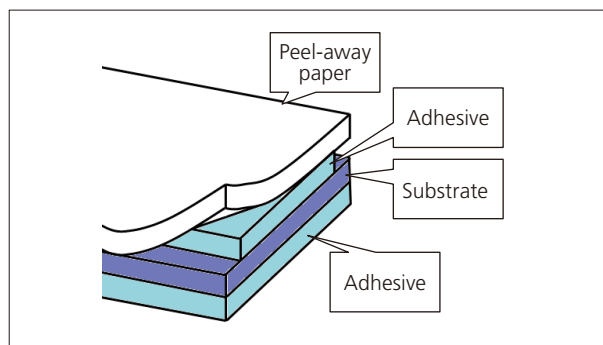


Fig. 2 Schematic Diagram of Double-Sided Tape

Figs. 3 and 4 show the MPR images. In an MPR display in which multiple CT images are stacked up in a virtual space, so as to line up four images: a CT image (1); mutually orthogonal longitudinal images (2) and (3); and an arbitrary cross sectional image orthogonal to the longitudinal cross sectional images (4). In Fig. 3, the MPR image at top left shows a cross section in the tape thickness direction. In the top left image, the substrate (textile) is at the center, and the adhesive is visible surrounding this substrate. The peel-away paper is visible below the adhesive, and it is evident that the adhesive, substrate, and peel-away paper are organized in a layered structure. It can be observed in the cross section at bottom left that a cloth-like textile has been used as the substrate, and that the weave is apparent. The image at bottom right shows a cross section cut along the green line in the image at top right, and is thus a cross section of the adhesive.

Next, Fig. 4 shows a further magnification of a portion of Fig. 3. It is possible to check on the particles contained in the adhesive and the substrate textile. In addition, Fig. 5 shows a 3-dimensional reconstruction of the enlarged image data.

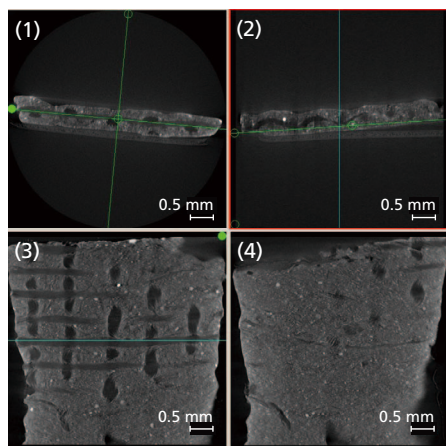


Fig. 3 MPR Images of Double-Sided Tape

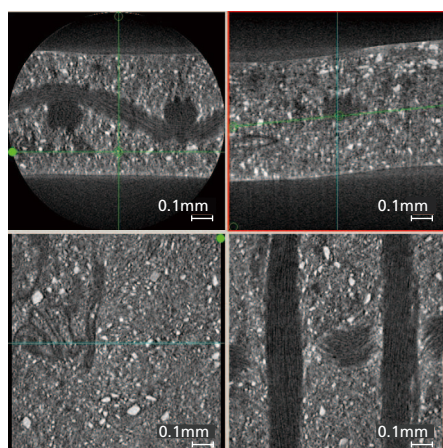


Fig. 4 MPR Images of Double-Sided Tape (Magnified Images)

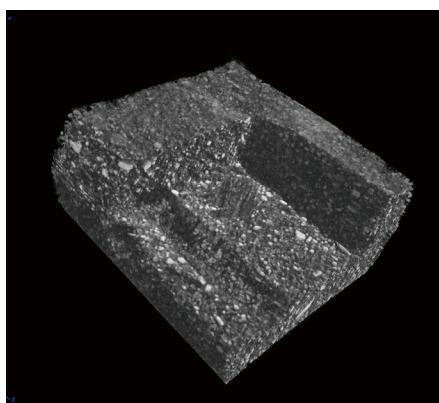


Fig. 5 3D Image of Double-Sided Tape

Sample Analysis of Double-Sided Tape

Obtaining images with the X-ray CT system enables measurement of the thickness of the adhesive layer, as well as volumetric measurements and assessment of the distribution of the particles contained in the adhesive. In actuality, Fig. 6 shows an example of the analysis of the particles contained in the adhesive using the VGStudio MAX software and defect detection module from Volume Graphics. This program assesses the volume of each particle, and the results by volume are indicated by color. The adhesive base is shown semitransparent. Fig. 7 shows the statistical results (horizontal axis: particle size; vertical axis: count) by size for the particles detected.

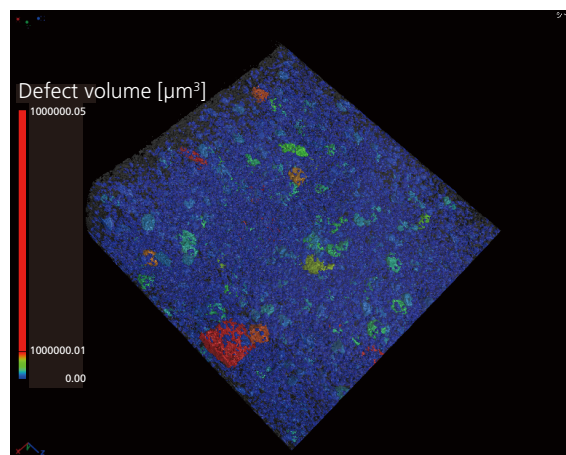


Fig. 6 An Example of the Analysis of Particles in Double-Sided Tape

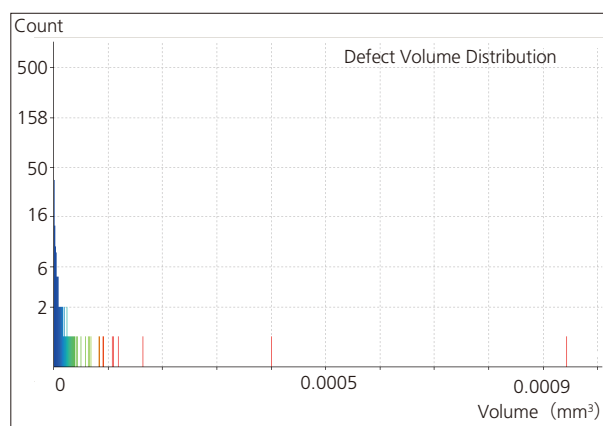


Fig. 7 An Example of the Analysis of Particles in Double-Sided Tape

Conclusion

In this way, with the inspeXio SMX-100CT, it is possible not only to volumetrically observe the layered structure of double-sided tape, but by using analysis software, to digitize and extract the particles contained in the adhesive by volume for statistical evaluation.