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Application News

Micro Vickers Hardness Tester HMV™-G31-FA Series

Measuring the Vickers Hardness on the Shanks of Hardened Screws in Accordance with ISO 18203 (JIS G 0559)

Mana Oshiro

User Benefits

- Depth of hardened layers can be measured in accordance with the industrial standards ISO 18203 (JIS G 0559 and JIS G 0557) and for nitride layers with JIS G 0562.
- Setting the measurement position is easy using the Pattern Setting function, enabling efficient working.
- Measurements can be performed at any position even on test specimens with complex shapes using the Edge Detection and Stage Viewer functions.

■ Introduction

The surfaces of steel materials are hardened in order to improve their hardness and toughness. Quenching is a heat treatment process in which steel is heated to its transformation temperature or higher and then cooled rapidly to change the internal crystalline structure. The depth of the layer that has been hardened by this process is referred to as the hardened layer. The Vickers hardness test and other similar tests are used to measure this.

Screw shanks, which are required to be strong, are sometimes subjected to the quenching process, and it is necessary to confirm that the treatment has worked properly.

In this article, are presented of efficiently confirming the depth of the harexamplesdened layer on a screw shank in accordance with the industrial standards ISO 18203 (JIS G 0559) using the HMV-G31-FA Micro Vickers Hardness Tester.

■ Test Specimens

Fig. 1 shows a test specimen and Fig. 2 the instrument. M10 screw shanks were sectioned in the directions parallel to and transverse to the axis. The test conditions are shown in Table 1.

The Vickers hardness test method is prescribed in the ISO 6507-1 (JIS Z 2244-1) standard. The measurements were performed in accordance with this, and the force was set so that the length of the diagonal of the indentation was 20 µm or longer.

Fig. 1 View of Test Specimen
(Left: Sectioned in Parallel Direction, Right: Sectioned in Transverse Direction)

Fig. 2 HMV-G31-FA

Table 1 Measurement Conditions

Tester:	HMV-G31-FA Series Micro Vickers Hardness Tester
Indenter Type:	Micro Vickers indenter
Force:	2.94 N (HV 0.3)
Holding Time:	15 sec
Number of Measurements:	15 points / 25 points

■ Stage Viewer Function

Parts with complex shapes, such as screw shanks, require time to find the target measurement position. However, the Stage Viewer function saves time by enabling the measurement positions to be set after obtaining images of the surface of the test specimen over a wide range and getting an overall view. Fig. 3 shows images of the test specimen surface taken using the Stage Viewer function. In addition to confirming the target measurement position, it enables measurement positions to be selected with good surface conditions.

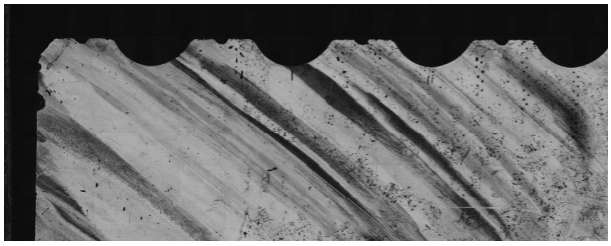

Fig. 3 Test Specimen Surface Images Taken Using the Stage Viewer Function
(Above: Surface Sectioned in the Parallel Direction,
Below: Surface Sectioned in the Transverse Direction)

■ Measurement Results (1)

The depth of the hardened layer was measured in the area of the root of the threaded section in the direction parallel to the axis of the screw. Fig. 4 shows the test specimen surface taken using the Stage Viewer function and the measurement positions, and Fig. 5 schematically shows the measurement positions. The starting position was 100 µm from the surface, and test positions were set on two parallel lines indenting alternately so that the interval of depth from the surface was 100 µm. The Pattern Setting function has many test pattern templates for setting consecutive test positions. Therefore, the test positions can be easily set by inputting the values within the red outline shown in Fig. 5.

The test results in Fig. 6. show that the hardness drops rapidly at a depth from the surface of 0.9 to 1.2 mm. Fig. 7 shows images of the indentations. The sizes of the indentations vary even though the force was the same.

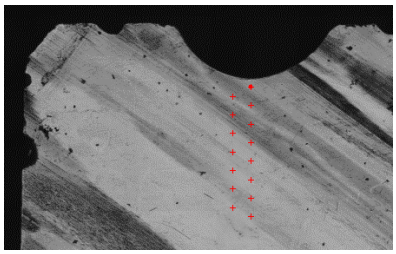

Fig. 4 Image of Surface of Test Specimen Showing Measurement Positions
(Taken Using Stage Viewer Function,
Red Symbols Are Measurement Positions)

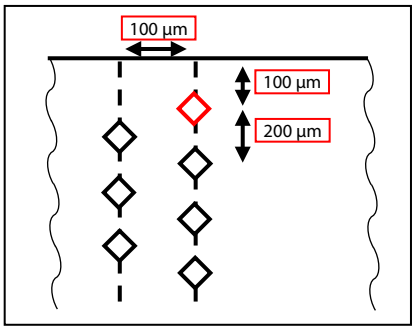

Fig. 5 Schematic View of the Measurement Positions
(Diamond Shapes Are Indentation Positions)

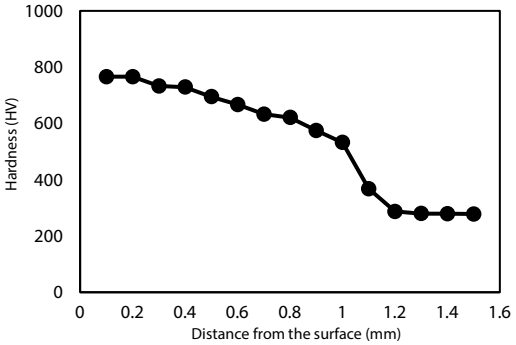

Fig. 6 Measurement Results

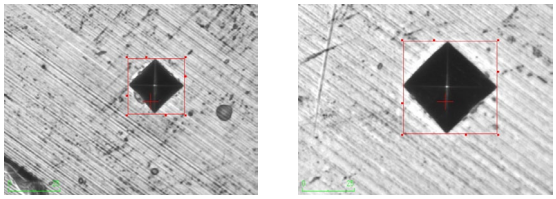

Fig. 7 Indentations (Left: 1st Indentation, Right: 15th Indentation)

■ Measurement Results (2)

When the Edge Detection function is used, the edge of the test specimen is automatically recognized and drawn over the specified range. Using the edge image produced by this drawing, complex "pattern setting" can be easily performed.

Measurements were performed on the crest of the screw threads in the direction transverse to the axis of the screw. When measuring the depth of the hardened layer of the test specimen, it was necessary to set the measurement positions from the edge of the test specimen towards the position of the center of the shank of the screw, which had a circular shape. In this case calculating the center of the circle from the edge image can be used for setting the measurement positions. Fig. 8 is an image of the surface of the test specimen showing the measurement positions. The spacing between the measurement positions was the same as in the previous test.

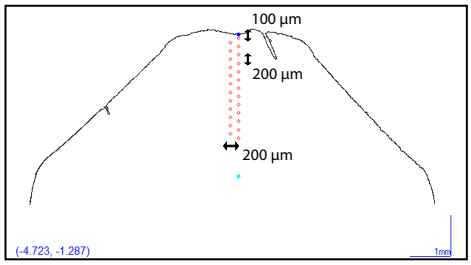

Fig. 8 Edge Image Showing Measurement Positions
(Red Symbol: Measurement Position,
Light Blue Symbol: Center of Screw Shank)

Fig. 9 shows the measurement results displayed by the software. With such a graph, preparation of the change in the hardness curve, and checking the depth of the hardness specified as the effective hardness layer depth can be performed.

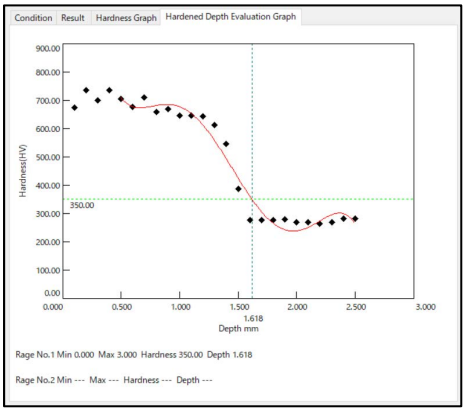

Fig. 9 Hardened Depth Evaluation Graph

■ Conclusion

The depth of the hardened layer of a screw shank that had been quenched was measured in accordance with ISO 18203 (JIS G 0559) using the HMV-G31-FA Series Micro Vickers Hardness Tester. The test demonstrated that by using the Stage Viewer, Pattern Setting, and Edge Detection functions, it is possible to efficiently set the measurement positions even for parts with complex shapes.

01-00406-EN First Edition: Mar. 2023

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