

Application News

Material Testing System DUH

No. SCA_300_035

A hardness measurement of surface treatment layer on a steel sample using Shimadzu Dynamic Ultra Micro Hardness Tester, Model DUH

Recent years have seen intensive requests for engineering materials with higher function ability and longer life, and as a result, surface treatment for such materials has become popular. Under this circumstance, hardness testers with micro load are enjoying an

increasing demand. In this regards, a test report is herein introduced on the hardness distribution measured from the sample surface toward depth direction with an interval of $2\ \mu\text{m}$, using Shimadzu Dynamic Ultra Micro Hardness Tester Model DUH.

■ Test Parameters

- 1) Sample: plating layer on a metal plate (See Fig. 1)
- 2) Indenter: tip angle 136° , square pyramid indenter (Vickers indenter)
- 3) Measuring mode: load-load-hold test (mode 1)
- 4) Test load: 2.0 gf
- 5) Loading speed: 0.029 gf/sec.
- 6) Load hold-time: 10 sec.

■ Test Method

- 1) Vickers Hardness
Testing procedures, the distance between the indentation center and the sample edge shall be 2.5 time the diagonal length or more (the diagonal length is $2.6\ \mu\text{m}$ or less). The test load was determined in accordance with this specification, and the tests were performed near the mid depth of the plating layer.
- 2) Hardness distribution measurements were performed at the location and with the depth intervals of $2\ \mu\text{m}$ starting from the sample surface as shown in Fig. 2

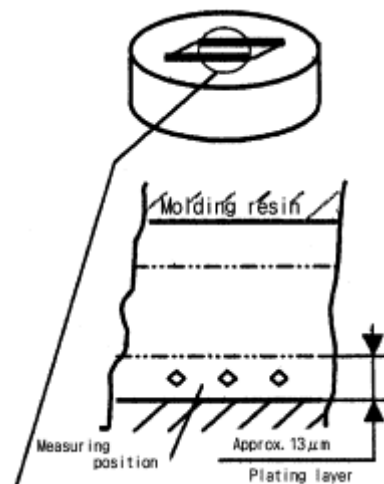


Fig. 1

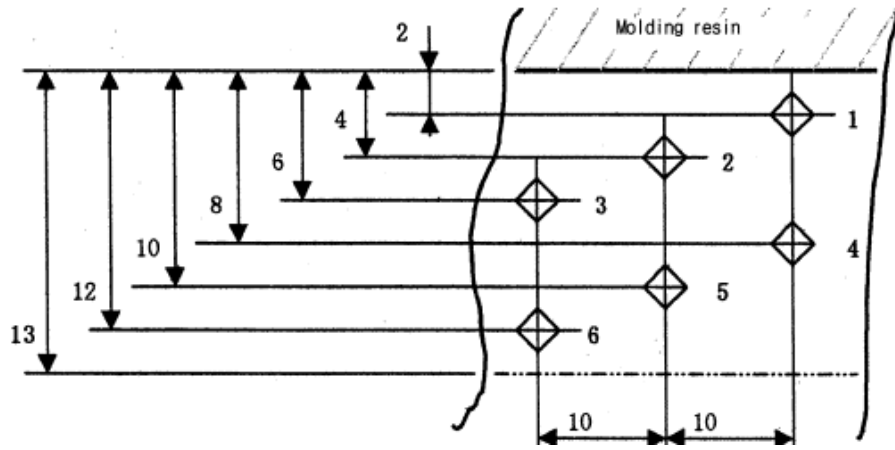


Fig. 2

■ Test Results

The average of five measurements is shown in Table 1, and the load-indentation depth curve is in Fig. 3

Test Load (gf)	Depth (µm)	Dynamic Hardness DHV
2,001	0,206	1065

Table 1 Hardness Test Result

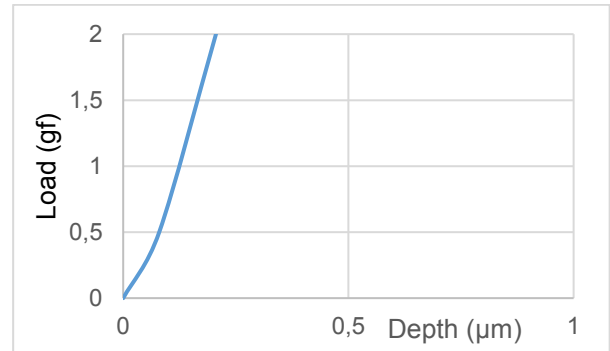


Fig. 3 Load-Indentation depth curve

Dynamic Hardness was determined by the following formula:

$$DHV = \frac{37,838 \cdot P}{h^2}$$

Where:

DHV: Dynamic hardness by Vickers Indenter

P: Test Load (gf)

H: Indentation depth (µm)

■ Test Results

Result of five tests with a depth interval of 2 µm is listed in Table 2.

Test Load (gf)	DHV					
	1	2	3	4	5	6
2,0	847	1001	1070	1103	966	925

Table 2 Hardness Distribution

..

- Dynamic hardness was determined by the same formula as item 1) above.

The Relation of depth and hardness is shown in Fig. 4.

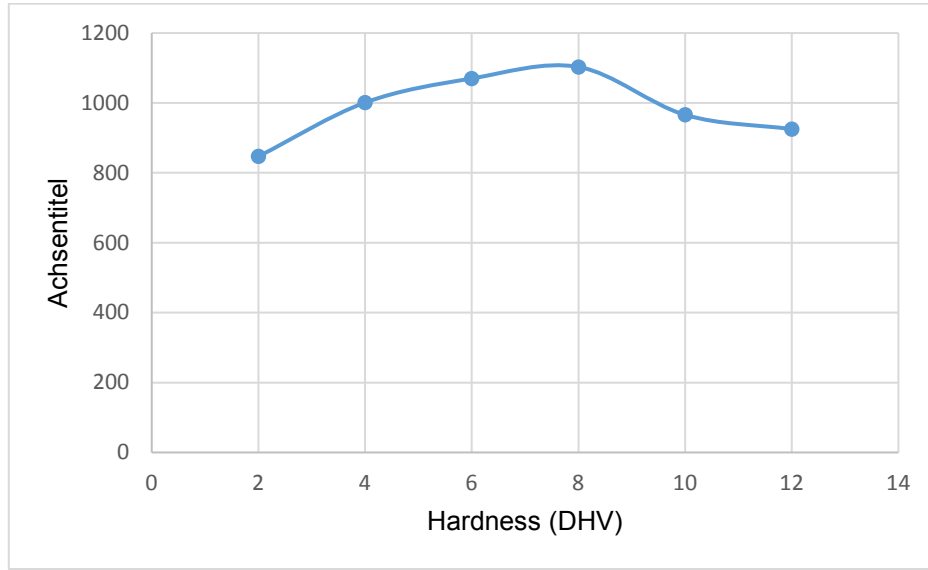


Fig. 4

Fig. 4 indicates a tendency that hardness increases as depth increases, reaches the max. at mid depth of the plating layer, and decreases thereafter.