SHIMADZU

Application News

Material Testing System No.250

Hardness Test on Extra Fine Wire by Shimadzu DUH-W201S Dynamic Ultra Micro Hardness Tester

A well-known method of testing the hardness of micro-diameter wire is to grind the test surface of the wire specimen imbedded in resin and test the cross-section area of the wire. Though the hardness test by imbedding the specimen in resin is reliable, it is not a simple method since it involves imbedding the specimen in resin and grinding the specimen.
The following introduces an example of a hardness test performed using the Shimadzu Dynamic Ultra Micro Hardness Tester without using the resin-imbedded method.

1. Specimen

1) Specimen name	Extra Fine wire	
	W	SUS
2) Specimen No.	No.1	No.2
3) Wire dia. (μm)	ϕ20	ϕ30
4) Material	Tungsten	Stainless steel

2. Test conditions

1) Testing machine	Shimadzu DUH-W201S Dynamic Ultra Micro Hardness Tester (See Fig. 1)
2) Indenter	Berkovich indenter (made of diamond)
3) Test type	Load-unload test
4) Test force (mN)	9.8
5) Loading rate (mN/sec)	0.711
6) Holding time (sec)	5
7) Test method	Both ends of the wire were fixed in place on an Si wafer with cellophane tape, and the hardness of the top of the cylindrical part of the wire was tested. (See Fig. 2)

Fig. 1 Overview of DUH-W201S

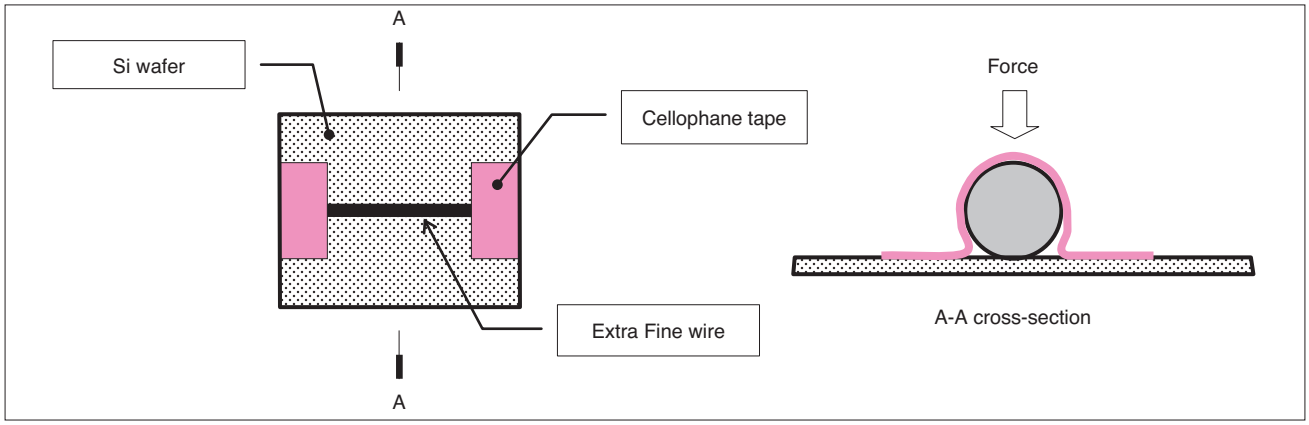

Fig. 2 Conceptual diagram

3. Test results

1) Table 1 summarizes the results (mean values) of testing by the test conditions in section 2.
For hardness values, correction for sylindrical surface was not taken into consideration.

Table 1 Hardness Measurement Results (Mean Values)

Specimen Name		Specimen No.	Maximum Force [mN]	Maximum Depth [μm]	Dynamic Hardness [DHT115-1]
Super-fine wire	W	No.1	9.82	0.208	874.717
	SUS	No.2	9.85	0.243	644.253

Remarks) The calculation expression for dynamic indentation hardness is as follows:
$DHT115\text{-}1 = 3.8584P/h^2$
where,
DHT115-1 : Dynamic hardness of triangular pyramid indenter at load end
P : Maximum Force (mN)
h : Maximum Depth (μm)

2) Fig. 3 shows the force-depth graph after testing.

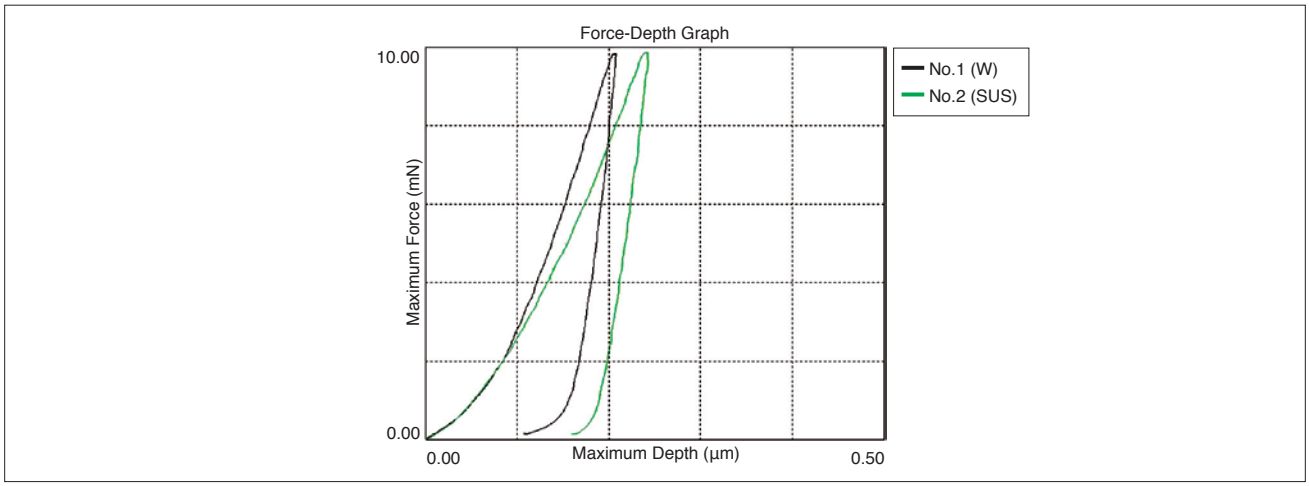

Fig. 3 Force-Depth Graph

3) The order of specimen hardness in 1) is as follows: No. 1 (tungsten) > No. 2 (stainless steel)
4) Figs. 4 and 5 show images of the indentation.

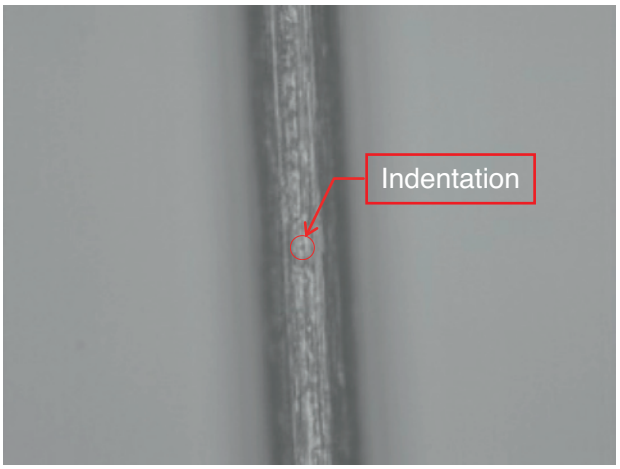

Fig. 4 Indentation in Tungsten

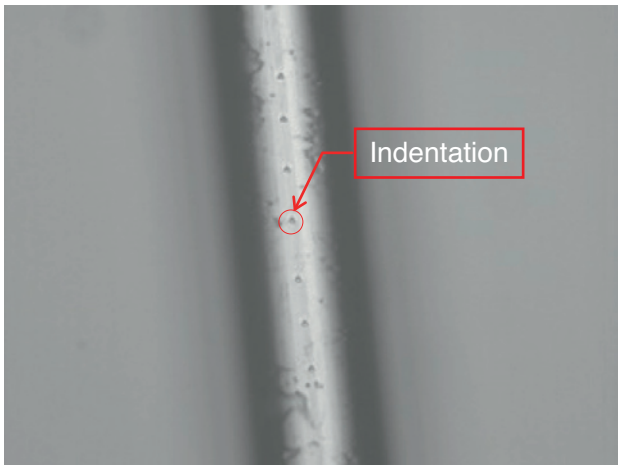

Fig. 5 Indentation in Stainless Steel

4. Summary

The Shimadzu DUH-W Dynamic Ultra Micro Hardness Tester allows specimen hardness to be simply evaluated without imbedding the specimen in resin.

SHIMADZU
SHIMADZU CORPORATION. International Marketing Division
3. Kanda-Nishikicho 1-chome, Chiyoda-ku, Tokyo 101-8448, Japan Phone: 81(3)3219-5641 Fax. 81(3)3219-5710
Cable Add.:SHIMADZU TOKYO

Related Solutions

- Price Inquiry
- Product Inquiry
- Technical Service / Support Inquiry
- Other Inquiry