Experiment No. 02

Vickers Hardness Test

Microhardness Testing determines a material's hardness or resistance to deformation when test samples are unsuitable for macro-hardness. Microhardness testing is ideal for evaluating the hardness of microscopic/thin samples, complex shapes, individual phases of material, and surface coatings/platings.

Test Methods/Specifications:

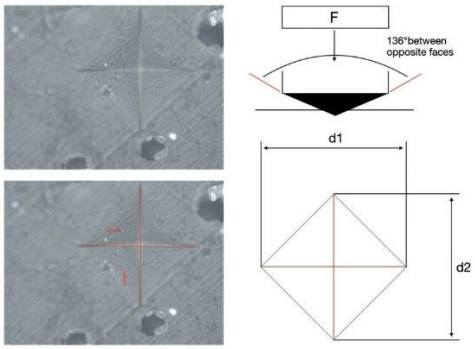
- **ASTM E92**

Test Processes:

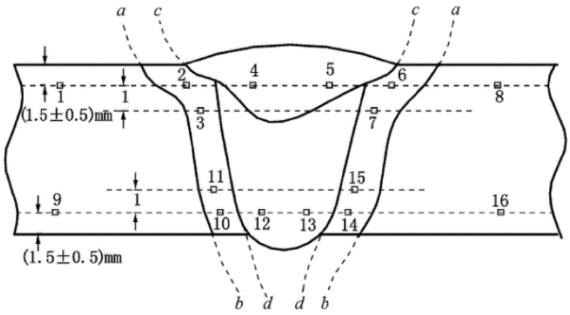
Microhardness testing, a Vickers (DPH) or Knoop (KHN) diamond indenter is pressed into the material's surface with a penetrator and a light load of up to 1000 grams. The result of applying the load with a penetrator is an indent or permanent deformation of the material surface caused by the shape of the indenter. Both the Knoop and Vickers hardness test methods use specific measurements from the indent, in conjunction with formulas, to calculate material hardness. Accurate measurement of the resulting indentation requires a special microhardness testing microscope because the indents are so small. Knoop – The Knoop hardness test is performed by applying the controlled force of 1000 grams or less for a specific period to an indenter in a rhombus shape (elongated four-sided pyramid). The hardness of the material is determined by the depth to which the Knoop indenter penetrates. The impression is measured microscopically and, when combined with the amount of the test load, can be used to calculate the hardness value on the Knoop scale. Knoop hardness numbers are often cited in conjunction with specific load values. Vickers – The Vickers hardness test can be performed on micro and macro scales with a maximum test load of up to 50 kilograms. Like Knoop microhardness testing, these tests are performed by applying controlled pressure for a standard time but with a square-based diamond pyramid indenter. The diagonal of the resulting indention is measured under a microscope, then this measurement and the test load are used in a specific formula to calculate the Vickers hardness value.

HV10 Hardness Measurement:

$$HV = 1.854 \times \frac{F}{d^2} \quad \rightarrow \quad d = \frac{d_1 + d_2}{2}$$



Experimental work:



Discussions:

1. Why do we use the Vickers Hardness HV test rather than other hardness testing methods, e.g., Rockwell?
2. What do the measurements of hardness values represent? Why?
3. Analyze the difference in the hardness values in different zones of the weldment.
4. Is the zones' hardness values different? Why does this difference happen?
5. Does the grain size affect the hardness values?