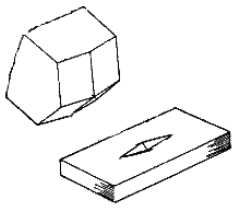
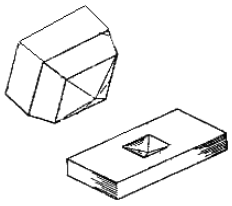
MICROINDENTATION HARDNESS TESTING

DESCRIPTION OF TECHNIQUE

Microindentation hardness testing (or microhardness testing) is a method for measuring the hardness of a material on a microscopic scale. A precision diamond indenter is impressed into the material at loads from a few grams to 1 kilogram. The impression length, measured microscopically, and the test load are used to calculate a hardness value. The hardness values obtained are useful indicators of a material's properties and expected service behavior. Conversions from microindentation hardness values to tensile strength and other hardness scales (e.g., Rockwell) are available for many metals and alloys.



Knoop Indenter



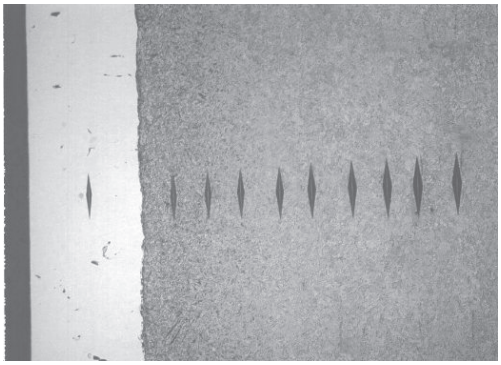
Vickers Indenter

The indentations are typically made using either a square-based pyramid indenter (Vickers hardness scale) or an elongated, rhombohedral-shaped indenter (Knoop hardness scale). The tester applies the selected test load using dead weights. The length of the hardness impressions are precisely measured with a light microscope using either a filar eyepiece or a video image and computer software. A hardness number is then calculated using the test load, the impression length, and a shape factor for the indenter type used for the test.

ANALYTICAL INFORMATION

Bulk Hardness - Randomly-located impressions measure the representative bulk hardness value of a relatively homogeneous material.

Localized Hardness - Impressions are made at specific sites located using the light microscope to determine the hardness at discrete features or phases in the sample. Hardness can be measured for features less than 0.1 mm across.



Knoop Microindentation Hardness Survey for Chromium-Plated, Case-Hardened Steel

Hardness Survey - A series of hardness impressions are made along a line from a surface or a specific point in the sample to systematically measure the hardness variation within a sample.

Thin Coatings - The hardness of coatings as thin as a few microns can be determined by measuring directly on the coated surface of a sample. Coating thickness must be known to assess accuracy of these measurements.

TYPICAL APPLICATIONS

- Bulk hardness of small or thin samples
- Heat treated steel case depth evaluation
- Decarburization in steels
- Evaluation of welds
- Hardness of thin coatings
- Evaluation of machinability

SAMPLE REQUIREMENTS

Most microindentation hardness testing is performed on samples that have been metallographically mounted and polished. These samples are usually no larger than about 1 in. (25 mm) by 1 in. (25 mm) by 1/2 in. (12 mm) thick. Larger samples can be tested with special fixturing. Thin, flat samples, such as sheet material, can be tested without mounting or preparation if the surface finish is suitable.

The ideal surface finish is a high-quality metallographic polish. Where polishing is not feasible, the surface finish must be sufficiently smooth and reflective to clearly resolve the microscopic hardness impression with the measuring microscope. The specific finish requirement depends on the material and test load.

Microhardness Tester