

Tips:

## What hardness ratings mean for you

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**Do you need to select wear parts such as hammermill blades, conveyor skirtboards, or pneumatic conveying pipeline elbows? Or do you handle an abrasive powder or solid that requires equipment lined with wear-resistant material? One factor you need to consider is the hardness rating of the wear parts or liner. Here's some information on what a hardness rating means and how it can affect your equipment selection.**

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**W**ear from the constant flow of a dry powder or solid can shorten the life of your processing and handling equipment, but the effects can be especially dramatic if your powder is abrasive. Using wear-resistant parts or liners made from metal, non-metal materials (such as polymers, rubber, and cast basalt), and ceramics can reduce such wear.

For instance, a metal skirtboard resists high impacts on a mechanical conveyor. Brazed tungsten carbide can be used to tip hammermill blades. Polymer can line deflector plates inside pulverizers, and ceramic grinding media are used in ball mills. Although you need to consider several factors when selecting equipment that will resist wear, one of the most important is hardness of the equipment's construction materials.

### Defining hardness

Hardness is a material's level of resistance to indentation or other damage.

The material's hardness is determined by any of several hardness tests.

### Testing for hardness

An equipment manufacturer uses a hardness test to measure the relative hardness of its wear parts or liners according to one of several test scales. Most of the tests measure an indentation's depth in the material. In such a test, a fixed force is applied to a given indenter positioned against the material. The indenter leaves an indentation in the material based on the material's hardness; the smaller the indentation, the harder the material.

There are over 30 different hardness tests; common ones are Rockwell, Brinell, Vickers, and Knoop. Each uses a different test apparatus and method. For a specific test, the resulting hardness is expressed as a number of particular units. For instance, 550 HV<sub>500</sub> is a Vickers hardness number that indicates a value of 550 on the Vickers scale with a test force of 500.

### Using hardness ratings to select equipment

You need to select a wear-resistant part or liner with a hardness rating high enough to handle your powder, particularly if it's abrasive. To ensure you make the right choice, know your powder and application.

In many cases you can approximate your powder's hardness based on the Mohs hardness scale (Table I), an empirical scale consisting of 10 minerals. This will give you some idea of the powder's abrasiveness. Consider other factors too. What shape are the particles? Will your powder slide freely over the equipment surface or crush against it as the result of

compressive forces? How fast will the powder be moving?

Testing your powder's characteristics under your operating conditions is the best way to select a wear part or liner that's hard enough to handle the powder. Although the equipment manufacturer typically has facilities for testing your powder, "you need to be careful about how they do the test and what they're measuring," cautions Herman Purutyan, project engineer at Jenike & Johanson, Inc. For instance, if you're choosing a wear-resistant liner for a conical hopper, it's best to test the powder flowing at various pressures over the liner material. This is because stresses aren't the same throughout the hopper and cause wear at different rates at different locations along the walls. Specially designed wear testers are available for making such measurements.

Based on the information about your application, the equipment manufacturer can recommend a wear part or liner with a hardness rating — as well as other characteristics — suitable for your powder or solid. **PBE**

### Sources

Information on equipment hardness testing from New Age Industries, a hardness testing equipment manufacturer located in Willow Grove, Pa. (215/657-6040), and Poly Hi Solidur, a manufacturer of abrasion-resistant liners in Fort Wayne, Ind. (219/479-4100).

Information on powder testing from previous PBE articles and Jenike & Johanson, Inc., a solids flow consulting firm located in Westford, Mass. (508/392-0300).