

How can I safely grind a heat-sensitive material?

Here are a few tips for safely grinding a heat-sensitive material:

1. Use a method that minimizes the energy introduced into the material during grinding, which will result in minimal heat generation.
2. Minimize material attrition (or friction of particles) during grinding.
3. Use integrated water-cooling methods to keep both the equipment and material cool during grinding.
4. Use cryogenic grinding.

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In the custom powder-milling business, this issue often comes up when evaluating a customer's product. Ask yourself the following questions:

- What's the targeted average particle size and distribution and the required dosing rate? This helps determine which pulverizer is suitable for your material.

- Is the heat-sensitive temperature issue a personnel and facility safety concern, or are you only concerned about material degradation? Will the material deflagrate if it gets too hot, or will it just change color or go off-grade? If personnel safety is an issue, stringent safety guidelines must be followed.

- What's the maximum allowable temperature? This helps determine if cryogenics are needed or if you can use an air-swept or jet mill.

- How friable (brittle, breakable) is the material? Mills with knives, pins, and hammers are typically good at cutting, shearing, or breaking material; jet mills are often used to break up material using high-velocity particle-on-particle impact.

Here are a few examples of how to safely grind heat-sensitive materials:

Problem 1 • Waxes used in paper coatings with a target particle size of 5 microns along with a narrow particle size distribution — With an ignition source, the powder can burn rapidly in air. The wax has an MP of 90°F and is

friable below that temperature. **Solution 1** • Choose a jet mill that uses compressed air to power the mill at 150 psig but cools to ambient temperatures. There's no heat added across a jet mill process as long as the air is kept cool and the material is not exothermic when milled. Jet mills produce narrow, highly classified particle size distribution curves.

Problem 2 • Seeds like psyllium or flax with a target particle size of 12 to 15 microns — When overheated, some health- and food-type products can lose nutritional or physical benefits. **Solution 2** • Choose an air classifying mill with blades to cut the seed. Make sure the mill has high airflow across it to cool and help classify the material.

Problem 3 • Temperature-sensitive materials, such as temperature-indicating inks that change properties and color at ambient temperatures — Very fine particles are required for efficient and reliable application of the ink to the substrate. **Solution 3** • Choose a cryogenically cooled nitrogen gas jet-milling system with a temperature-loop controller for the compressed gas. This will allow the material to be pulverized to a fine particle size without changing the original properties.

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What can I learn from grinding tests of my material in a manufacturer's test equipment?

You can learn a lot from grinding tests. Besides the basic information, like whether the manufacturer's equipment works well with your material, grinding tests can help you achieve your size reduction requirements, including the particle size, shape, and surface area you require and how best to achieve those goals. The tests may determine what grinding aids and formulations could work with your process, allowing you to choose which equipment fits your needs and price range. Also, a good testing lab will be able to scale up from the test to production size equipment.

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Equipment suppliers are a valuable source of information about equipment and processes. In light of this, we occasionally ask suppliers a question of concern to our readers. Answers reflect the suppliers' general expertise and don't promote the suppliers' equipment. If you have a question you'd like suppliers to answer, send it to Alicia Tyznik, Associate Editor, Powder and Bulk Engineering, 1155 Northland Drive, St. Paul, MN 55120; fax 651-287-5650 (atyznik@cscpub.com).