# Kriogeniczne mielenie podzespołów komputerowych i elektronicznych

**The use of Cryogenic grinding to comply with the RoHS/WEEE Directive**



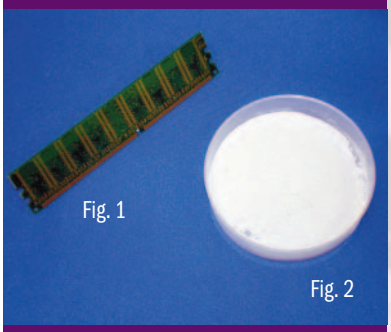

Fig. 1

Fig. 2

Recently a customer came to us with two samples. He had to "homogenize" two different types of computer memory boards, prior to analysis for cadmium, mercury, lead, and hexavalent chromium, in order to comply with the Restriction of Hazardous Substances (RoHS) Directive of the European Union for all electrical and electronic equipment (EEE).

The customer had samples of both the small "flash sticks" that act as portable memories for laptops, and the larger RAM boards that are permanently installed in CPUs. His sources could not always give him RoHS/WEEE compliance certificates for these boards. Therefore he needed to analyze them himself to comply with the Directive. As a large supplier of such memory boards, our customer had been researching different ways to prepare them for analysis. He contacted SPEX SamplePrep because of our experience in cryogenic grinding using our cryogenic Freezer/Mills®.

Why pulverize? These samples (Fig. 1) are printed circuit boards that are composites of many materials: metals, resins, substrates, etc. A small piece taken from a board here or there at random would not be representative of the whole board, much less an entire batch of boards. Hence, sampling many boards, and in effect homogenizing them, assures that the sample used for analysis is representative of the batch. But memory boards are made to be rugged and durable over a wide range of conditions, and are very difficult to grind into a powder. Further, some of the components may be more fragile than others. Metals, resins and other materials all have distinct and different properties when put through conventional laboratory mills. And when all of these components are part of the same integral memory board, it is impractical to be stripped and broken down into its different parts, each suited for its own special type of mill. Some components may grind at room temperature, and some may not, some may require a shearing action and others abrasion, etc.

Cryogenic milling in a SPEX SamplePrep Freezer/Mill® is the solution for this customer's problem: how to pulverize the boards. The general principle behind cryogenic grinding is to chill samples until they are brittle, then break them up through impact, crushing, or shearing. In the case of a SPEX Freezer/Mill®, the sample is placed in a grinding vial, and the vial is then immersed in liquid nitrogen until the contents are thoroughly chilled, usually a matter of 10 or 15 minutes. The sample inside the vial is pulverized and because the sample is isolated in a closed grinding vial, cross-sample contamination is easily controlled and sample integrity is maintained.

How did we grind this customer's "flash sticks" and RAM boards? The samples were first cut into manageable pieces, chilled for 20 to 30 minutes, and ground for 8 to 10 minutes in the medium-sized 6751 Vials, which fit one at a time in the 6750 Freezer/Mill® and four at a time in the larger 6850 Freezer/Mill®. The results were a fine, uniform powder (Fig. 2) that can then be used for XRF analysis. This solved the customer's problem and will result in the purchase of one or more Freezer/Mills® from SPEX SamplePrep.

Cryogenic grinding is the best and easiest way to grind many of the electrical and electronic components for RoHS. RoHS/WEEE states that if the component can be mechanically separated, then each component is subject to the RoHS limits. The definition of exactly what this means will be an ongoing process for many years. The SPEX SamplePrep family of mills and grinders can help and in some cases they are the only solution to preparing these components for analysis. **Cryogenic grinding in a Freezer/Mill® can quickly pulverize polymer and resin components, including the board material itself.**

SPEX SamplePrep offers free test grinding of your samples in our demo lab, or we can place a demo unit in your laboratory so you can evaluate the best SPEX SamplePrep mill for your application. Please contact one of our sales specialists at 1-800 522-7739 X 465, or e-mail us at sampleprep@spexcsp.com.

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## 6750-115 Freezer/Mill®

For 115 V/60 Hz operation. Cryogenic impact grinder with self-contained liquid nitrogen tub, insulated case, speed control, and programmable timer. Grinds samples in 0.1g-5.0g range. 6754 Extractor/Vial Opener and 6755 Vial Rack are included; grinding vials and accessories must be purchase separately. Liquid nitrogen necessary for operation.


*6750 Freezer/Mill*

## 6750-230 Freezer/Mill®

For 230 V/50 Hz operation. Same as 6750-115 but for 230 V/50 Hz operation. CE approved. Supplied with continental European CEE 7/7 two-prong plug.

| Specifications: | |
|---|---|
| Dimensions: | 12 in. (30 cm) x 12½ in. (32 cm) x 9 in. (23 cm) |
| Weight: | 12 lbs. (5.4 kg) net; 18 lbs. (8.2 kg) gross |
| Voltage: | 115 V/60 Hz or 230 V/50 Hz |

## 6850-115 Freezer/Mill®

For 115 V/60 Hz operation. Our larger cryogenic impact grinder with self-contained liquid nitrogen tub, liquid nitrogen level sensor, insulated case, speed control, and programmable timer. Grinds single samples up to 100g with 6801 Vial; will also hold four 6751 Vials simultaneously. Accessory Packages must be chosen to match choice of vials. Grinding vials and accessories must be purchase separately. Liquid nitrogen necessary for operation. Optional Auto-Fill System available for maintaining liquid nitrogen level.


*6850 Freezer/Mill*

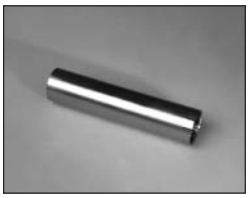
## 6850-230 Freezer/Mill®

For 230 V/50 Hz operation. Same as 6850-115 but for 230 V/50 Hz operation. CE approved. Supplied with continental European CEE 7/7 two-prong plug.

| Specifications: | |
|---|---|
| Dimensions: | 23 in. (58 cm) x 21 in. (53 cm) x 23 in. (58 cm) |
| Weight: | 102 lbs. net (46 kg); 120 lbs. gross (55 kg) |
| Voltage: | 115 V/60 Hz or 230 V/50 Hz |

# Grinding Containers and Accessories for the 6750 SPEX SamplePrep Freezer/Mill®

*6751 Grinding Vial Set*



*6752 Steel Center Cylinder*

*6753 Microvial Set*

*6754 Extractor/Vial Opener*

### 6751 Grinding Vial Set

Set includes stainless steel impactor and two end plugs, plus four polycarbonate center cylinders (6751C4). Makes one complete vial plus three spare center sections. Transparent plastic allows visual check of grinding progress. Sample capacity 0.5 ml to 4.0 ml.

### 6751C4 Polycarbonate Center Cylinder

For 6751 vial set; sold in units of 4. Also sold in units of 20, 6751C20. Polycarbonate is durable and transparent but should not be cleaned with organic solvents.

### 6752 Steel Center Cylinder

For 6751 vial set. Replaces 6751C when sample contact with plastic is not advised. Made of nonmagnetic stainless steel.

### 6753 Microvial Set

Three 6753V Microvials with holder. Each 6753V has stainless steel end plugs, center cylinder and impactor. Holder contains three 6753V Microvials for simultaneous operation. Sample capacity 0.1 – 0.5 ml each.

### 6754 Extractor/Vial Opener

The Extractor/Vial Opener lifts vial sets in and out of the Freezer/Mill, and is used to remove the vial end plugs from the center section. One 6754 is supplied with each 6750 Freezer/Mill and the 6800B and 6800C Accessory Package.

### 6755 Vial Rack

For 6751 vial set. Glass-reinforced acetal rack holds up to sixteen 6751 vial sets for storage and handling. One 6755 Vial rack supplied with each 6750 Freezer/Mill, and the 6800B and 6800C Accessory Packages.

# Grinding Containers and Accessories for the 6850 SPEX SamplePrep Freezer/Mill®

*6801 Grinding Vial Set*

*6804 Extractor/ Vial Opener*

*6900 Cryogenic Gloves*

### 6801 Grinding Vial Set

Set includes stainless steel impactor and two end plugs, plus four polycarbonate center cylinders (6801C4). Makes one complete vial plus three spare center sections. Transparent plastic allows visual check of grinding progress. Sample capacity up to 50 ml.

### 6801C4 Polycarbonate Center Cylinder

For 6801 vial set; sold in units of 4. Also sold in units of 20 (6801C20). Polycarbonate is durable and transparent but should not be cleaned with organic solvents.

### 6804 Extractor/Vial Opener

The Extractor/Vial Opener lifts vial sets in and out of the Freezer/Mill, and is used to remove the vial end plugs from the center section. Lever assists end-plug extraction. One 6804 is supplied with the 6800A and 6800C Accessory Packages.

### 6805 Vial Rack

For 6801 vial set. Epoxy-coated, steel wire rack holds up to six 6801 vial sets for storage and handling. One 6805 Vial Rack supplied with the 6800A and 6800C Accessory Packages.

### 6900 Cryogenic Gloves

Designed to protect the hands and arms from hazards associated with ultra-cold materials. These multi-layer-insulated gloves are lightweight and flexible, allow excellent dexterity, and are comfortable to wear for extended periods of time. Available in small, medium, large, and extra-large. Sold in pairs.