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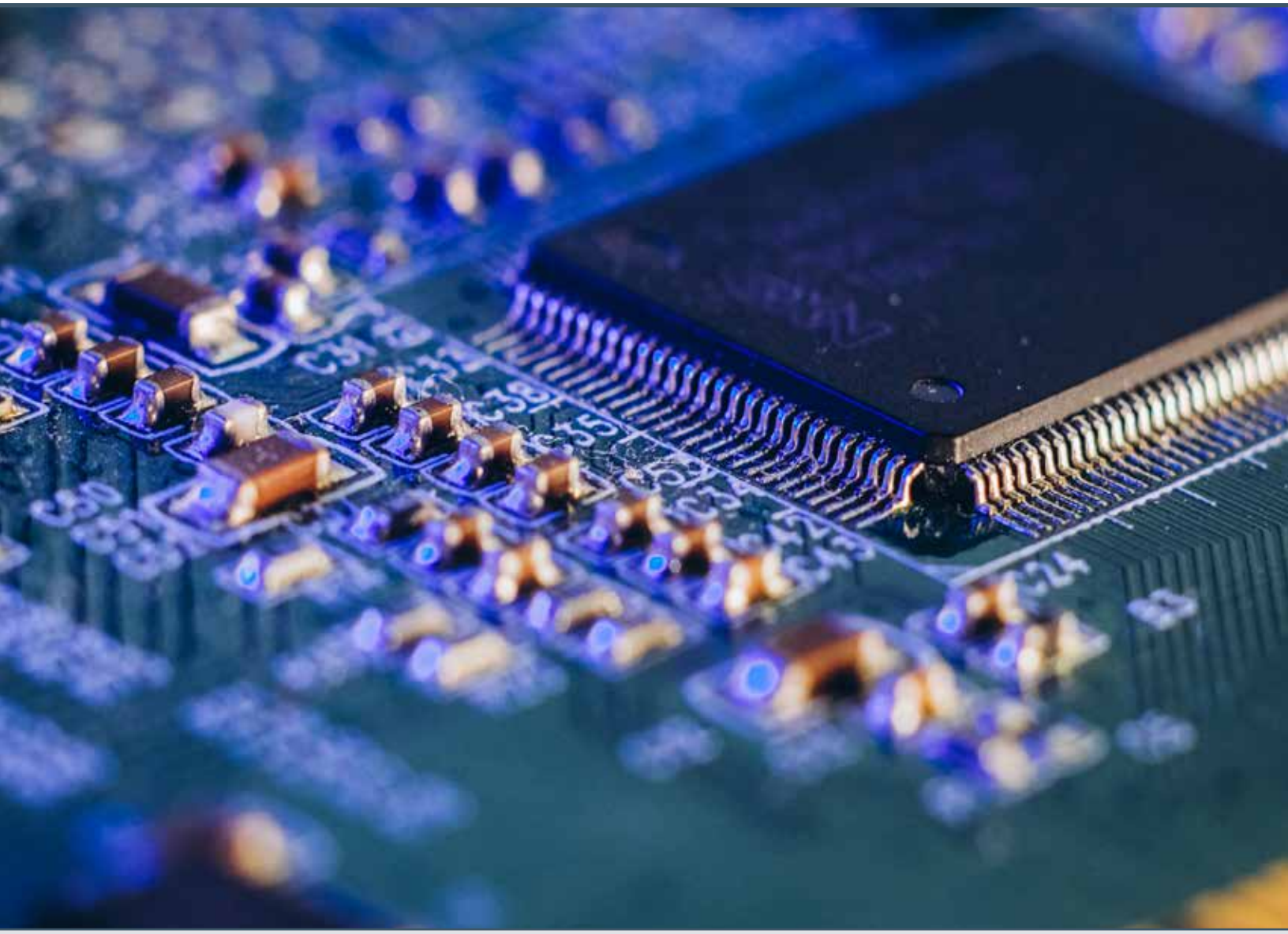
The Use of Cryogenic Grinding to Comply with the RoHS/WEEE Directive



SUBJECT (HT003): RoHS/WEEE

APPARATUS: Freezer/Mill®

APPLICATION: Cryogenic grinding of electronic and computer components

The Restriction of Hazardous Substances (RoHS) and Waste Electrical and Electronic Equipment (WEEE) directives of the European Union were introduced to minimize the accumulation of hazardous waste in landfills from the disposal electrical and electronic equipment. The concentration of hazardous substances such as lead, cadmium, mercury, chromium VI, polybrominated diphenyl ethers (PBDSs), and polybrominated biphenyls (PBBs) are restricted in electrical and electronic products and/or components.

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 is an ongoing process. One thing is certain, in order to get an accurate result, these products and components must be reduced to homogeneous, representative samples.

Many components such as circuit boards, wire, solder, polymers, and resins are difficult, if not impossible, to grind using traditional methods. Cryogenic grinding in the Freezer/Mill is the easiest way to homogenize these materials. Using cryogenic grinding to chill samples until they are brittle, and then break them up through impact, crushing, or shearing allows the toughest samples to be ground.

Consider analyzing circuit boards (Figure 1): a small piece taken from a board at random would not be representative of the whole board. Sampling many boards and homogenizing them assures that the sample used for analysis is representative of the batch.

The sample is cut into manageable pieces, these are then placed in the appropriately sized chromium-free grinding vial (item number 6771, 6871 or 6883). This vial also contains a magnetically driven Cr-free impactor. The vial is then loaded into the Freezer/Mill and immersed in liquid nitrogen until the contents are thoroughly chilled, usually a matter of 10–15 minutes. For high-throughput applications, up to 3 additional vials can be chilled in the pre-cool chamber inside the mill. The sample inside the vial is then pulverized and because the sample is isolated in a closed grinding vial, cross sample contamination is easily controlled and sample integrity is maintained. Grinding time can vary depending on the type of sample but a grinding time of approximately 10 minutes can be expected. The resultant fine, uniform powder (Figure 2) can then be used for XRF, ICP or other types of analysis.

Before and After Samples – Circuit Boards

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CG-200 Freezer/Mill

The small cryogenic mill processes samples ranging from 0.1 to 5 grams. Touch screen user interface stores up to 20 user-defined grinding programs for easy, quick recall. Unit also includes run history, training videos, manuals and accessories.

6771 Small Cr-Free Grinding Vial Set – ideal for RoHS/WEEE testing of electronic components for chromium. This Cr-free grinding vial set includes one small Cr-free steel impactor, two small Cr-free, ASTM 06 steel end-plugs, and one pack of 3 small polycarbonate center cylinders.

Voltage	115 VAC, 60 Hz or 230 VAC, 50 Hz
Dimensions	48.0 x 27.0 x 32.0 cm (19.0 x 10.5 x 12.8 in)
Weight	8.6 kg (18.9 lb) (empty without vial or coolant)
Power Cord	3-prong grounded plug for 115 VAC, 60 Hz 2-prong European plug for 230 VAC, 50 Hz

CG-400 Freezer/Mill

The large cryogenic mill grinds 0.1 to 100 grams of sample. Touch screen stores up to 20 user-defined grinding programs for easy, quick recall. Unit also includes run history, training videos, manuals, and accessories

6883 Mid-Size Cr-Free Grinding Vial Set – ideal for grinding electronic components to test for chromium under RoHS/WEEE directives. One grinding vial includes one mid-size Cr-free steel impactor, two mid-size Cr-free steel end-plugs, and one pack of 4 mid-size polycarbonate center cylinders. Sample capacity up to 25 mL.

6871 Large Cr-Free Grinding Vial Set – ideal for grinding electronic components to test for chromium under RoHS/WEEE directives. This grinding vial set includes one large Cr-free steel impactor, two large Cr-free steel end-plugs, one pack of 3 large plycarbonate center cylinders.

Voltage	115 VAC, 60 Hz or 230 VAC, 50 Hz
Dimensions	52.0 x 55.0 x 46.0 cm (20.5 x 21.5 x 18.0 in)
Weight	20 kg (44 lb) (empty without vial or coolant)
Power Cord	3-prong grounded plug for 115 VAC, 60 Hz 2-prong European plug for 230 VAC, 50 Hz

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