



SPEX® SamplePrep®

HANDBOOK

OF SAMPLE PREPARATION & HANDLING

13TH EDITION • WWW.SPEXSAMPLEPREP.COM



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SPEX SamplePrep, LLC has been providing superior sample preparation equipment and supplies since 1954. Our mission is to provide quality products backed by exceptional service and expertise. Our equipment is used to prepare samples for a wide range of analytical technologies including XRF, ICP, GC-MS and PCR. Much of our equipment is also used for cutting-edge research in pharmaceuticals, superconductors, polymers, forensics, genetics and biotechnology.

OUR PRODUCTS

Freezer/Mill®

Uniquely designed to cryogenically grind samples normally considered difficult or impossible to pulverize at ambient temperature.

Geno/Grinder®

Used for high-throughput cell disruption and tissue homogenization.

Mixer/Mill®

High-energy ball mills for pulverizing brittle materials, mixing powders and emulsions, mechanical alloying, and nanomilling.

X-Press® and SPEX Carver® Presses

Laboratory presses ideal for pressing sample disks for XRF, IR, and OES.

Katanax® Electric Fusion Fluxers

Automated electric fluxers for borate fusions of cement, ores, ceramics and other materials for analysis by XRF, AA, ICP and wet chemistry.

ShatterBox®

Ring and puck mills used for rapidly pulverizing brittle materials such as cement, slag, ores, ceramics, etc.

XRF Accessories

Spec-Caps® for supporting pressed disks, disposable X-Cells® and window film for liquid samples, Prep-Aid® Binders and Grinding Aids.

OUR CUSTOMERS

For the past six decades, SPEX SamplePrep's customers have relied on our unique knowledge and expertise to select the proper products for their sample preparation needs. Our exceptional sales and service teams recommend and support reliable sample preparation equipment for the following fields:

- Cement Manufacturing
- Mining
- Geology and Mineralogy
- Polymers & Plastic
- RoHS/WEEE
- Medicine and Genetics
- Pharmaceuticals & Drug Testing
- Environmental Protection & Remediation
- Cosmetics
- Food & Agriculture
- Forensics & Crime Scene Investigation
- Materials research

ShatterBox®



THE SHATTERBOX®

The **ShatterBox®** is a ring & puck mill with soundproof enclosure that accommodates sample sizes ranging from 2 to 100 grams. Ideal for pulverizing dry, brittle samples and slurry grinding. It swings a dish-shaped grinding container, with a puck and (typically) a ring inside, in a tight high speed circle. The sample is quickly crushed between the wall and floor of the container and the moving puck/ring grinding elements. Smaller grinding containers and those made with ceramics have a puck-shaped grinding element; larger containers have a ring and puck. Grinding containers are fitted with a gasket to prevent sample loss during grinding. The ShatterBox holds one large or three small grinding containers.

APPLICATIONS

Rapid dry or wet grinding to analytical fineness of hard, brittle samples.

SAMPLE TYPES

- Pharmaceuticals
- Ores
- Minerals
- Rocks
- Slag
- Ceramics
- Dried Plant
- Soil



Demo and Sample Test Programs are available for this product. See pages 110-111 for more details

8530

ShatterBox®

Part number:
8530-115 & 8530-230

For video, scan with your smart phone or visit www.youtube.com/sampleprep



The **8530 ShatterBox[®]** is a ring & puck mill with sound-proof enclosure. Accommodates sample sizes ranging from 2 to 100 grams. Ideal for pulverizing dry, brittle samples and slurry grinding.

FEATURES & SPECIFICATIONS

1. Programmable, 10-minute electronic timer with LCD display and environmentally safe, push-button membrane switch.
2. Lid locks down when mill is running. Soundproof enclosure reduces noise levels.
3. Lockable casters enable easy movement of the mill.
4. Cam-action lever requires only moderate hand pressure to secure the grinding dish in the ShatterBox and is adjustable for containers of different heights.
5. Swings a dish-shaped grinding container in a tight high-speed circle.

Voltage	115V/60Hz or 230V/50Hz	Weight	225 lbs. gross (102 kg)
CE Approved	Yes	Motor	1/2 hp @ 835 RPM
Dimensions	19 in (48 cm) x 19 in (48 cm) x 40 in (102 cm)	Power Cord	3-prong grounded plug 115V, 60Hz. 2-prong European cord for 230V, 50 Hz.

8500
ShatterBox®

Part number:
8500-115



For video, scan with
 your smart phone or
 visit www.youtube.com/sampleprep

The **8500 ShatterBox®** is an unenclosed ring & puck mill without a sound proof enclosure that accommodates sample sizes ranging from 2 to 100 grams. Ideal for pulverizing dry, brittle samples and slurry grinding.

FEATURES & SPECIFICATIONS

1. Cam-action lever requires only moderate hand pressure to secure the grinding dish in the ShatterBox and is adjustable for containers of different heights.
2. Swings a dish-shaped grinding container in a tight high-speed circle.
3. Perforated metal skirt provides ventilation for continuous operation, and a rubber cover protects against dust.
4. Includes an anti-skid wood/rubber floor mount and an extra set of drive belts. Timer not included.

Voltage	115V/60Hz	Weight	135 lbs (61 kg)
Dimensions	13 in. (33 cm) x 13 in.(33 cm) x 23 1/2 in. (60 cm)	Motor	1/2 hp @ 835 RPM
Power Cord	3-prong grounded plug 115V, 60Hz.		

SHATTERBOX ACCESSORIES

GRINDING CONTAINERS



8501 Hardened Steel Grinding Container

Includes puck, ring, dish, O-ring gasket and lid. 6.9 in. diam. x 2.9 in. high, 17.5 lbs. (17.5 cm x 7.5 cm, 8 kg). Grinding load is 20-50 mL. Volume 270 mL.



8504 Tungsten Carbide Grinding Container

Includes puck, ring, dish, O-ring gasket and lid. 6.9 in. diam. x 3.2 in. high, 29 lbs. (17.5 cm x 8 cm, 12.5 kg). Grinding load 20-60 mL. Volume 240 mL.



8505 Alumina Ceramic Grinding Container

Includes puck, dish with O-ring gasket and lid. 6.3 in. diam. x 3.2 in. high, 11 lbs. (15.2 cm x 8 cm, 5 kg). Grinding load 15-40 mL. Volume 170 mL.



8506 Zirconia Ceramic Grinding Container

Includes puck, dish with O-ring gasket and lid. 6 in. diam. x 3.2 in. high, 13 lbs. (15.2 cm x 8 cm, 6 kg). Grinding load 15-40 mL. Volume 170 mL.



8507 Small Hardened Steel Grinding Container

Includes puck, dish with gasket, and lid. 3.6 in. diam. x 2.3 in. high, 4 lbs. (9 cm x 5.4 cm, 1.9 kg). Volume 90 mL. Grinding load 2-20 mL. Used with 8507R rack.



8508 Small Tungsten Carbide Grinding Container

Includes puck, dish and lid. 3.6 in. diam. x 2.3 in. high, 7.7 lbs. (9.2 cm x 5.9 cm, 3.5 kg). Grinding load 2-20 mL. Volume 80 mL. Used with 8507R rack.



8521 Large Hardened Steel Grinding Container

Includes puck, ring, dish with O-ring gasket and lid. 8 in. diameter x 3.3 in. high, 29 lbs. (20.3 cm x 8.2 cm, 13 kg). Volume 650 mL. Grinding load 30-100 mL.

RACKS AND HOLDERS



8507R Rack

Holds one or three 8507 or 8508 grinding containers in ShatterBox. Rack base plate has handles to lift Rack into or out of ShatterBox, and four locating pins for positioning one or three grinding containers. Rack lid is matched to ShatterBox clamp, and holds grinding containers down during operation. When 8507R Rack is used with three grinding containers, all three should be the same kind, either 8507 or 8508.

PREP-AID® GRINDING AID



3650 Prep-Aid Vertrel® XF

Liquid fluorocarbon grinding aid. Prevents caking, reduces contamination, evaporates after grinding. One-quart bottle.

GRINDING CONTAINER SPECIFICATIONS

Part Number	Material	Sample Volume	Typical Sample Weight	Suitable for Blending	Suitable for Slurry Grinding
8501	Hardened Steel	20-50 mL	50 g	Yes	Yes
8507	Hardened Steel	5-20 mL	15 g	Yes	Yes
8521	Hardened Steel	30-100 mL	90 g	Yes	Yes
8504	Tungsten Carbide	20-60 mL	50 g	Yes	Yes
8508	Tungsten Carbide	5-20 mL	15 g	Yes	Yes
8505	Alumina Ceramic	15-40 mL	40 g	Yes	Yes
8506	Zirconia Ceramic	15-40 mL	40 g	Yes	Yes

GRINDING TESTS WITH THE 8501 AND 8504 GRINDING CONTAINERS

Material	Form as Received	8501			8504		
		Time (min)	Amount (g)	% Passing 325 mesh	Time (min)	Amount (g)	% Passing 325 mesh
Asbestos	Fiborous	12	20	100	-	-	-
Cement (Portland raw mix)	>60 mesh	2.5	40*	100	-	-	-
Ferro-chromium	>100 mesh	5	25	100	-	-	-
Ferro-manganese	>200 mesh	3	25	100	-	-	-
Ferro-molybdenum	<80 mesh	4	25	100	-	-	-
Ferro-niobium	<80 mesh	3	25	100	-	-	-
Ferro-silicon	<80 mesh	4	25	100	-	-	-
Ferro-titanium	<80 mesh	6	25	100	-	-	-
Fiberglass	Thin sheets	2	10	100	2	15	100
Fluorite	>100 mesh	3	50	100	-	-	-
Garnet (synthetic)	Chunks	2	200	15	10	200	96
Glass	Chunks	6	35	100	2	35	100
Graphite Mineral Fiber	Fiber	2	15	100	-	-	-
Insulation	Fiber	4	15	100	-	-	-
Oil Shale	6.4mm	3	6	100	-	-	-
Pesticide	<100 mesh	15	50	100	-	-	-
Phosphate, raw mix	<60 mesh	2.5	40	100	-	-	-
Iron Powder	<80 mesh	6	5	68	-	-	-
Sand	<10 mesh	10	100	100	4	100	100
Slag, blast furnace	Chunks	1	19*	100	-	-	-

*Sodium alkylarylsulfonate added, 5% **Household detergent (Tide) added, 10%

SHATTERBOX® BEFORE & AFTER SAMPLES

The following samples were ground in the ShatterBox® using the same protocol.

1. Crush sample to approximately 1/4 inch chunks
2. Place 30 grams of sample in 8501 hardened steel grinding dish
3. Run the ShatterBox for 3 minutes.

GLASS



BEFORE



AFTER

GARNET-BEARING ROCK



BEFORE



AFTER

SANDSTONE

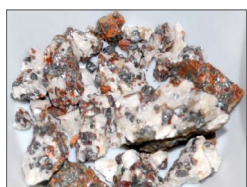


BEFORE



AFTER

ZINC ORE



BEFORE



AFTER

SHATTERBOX® TECHNICAL INFORMATION

Since its introduction over sixty years ago, the SPEX SamplePrep ShatterBox has become the most popular “swing mill” in the United States. Now as then, it is the most efficient way to pulverize up to 100 grams of brittle material to analytical fineness. There are two ShatterBox models, the full-sized, 8530 Enclosed ShatterBox, and the original 8500, which offers the same grinding performance as the 8530 but without the timer and cabinet.

APPLICATIONS

ShatterBoxes typically grind cement mix, rocks, slags, soils, ceramics, and ores, but have been used for hundreds of other materials including sulfur pellets, dried marsh-grass, and pharmaceuticals. The original SPEX SamplePrep swing mill, the 8500 ShatterBox, was developed for cement plants and steel mills with open, noisy lab conditions and is still used in many locations where the working environment requires a rugged, simple mill. The 8530 ShatterBox is ideal for labs concerned with minimizing noise and maximizing safety.

GRINDING CONTAINERS

The standard grinding containers, with a nominal volume of about 100 mL, are available in hardened steel (8501), tungsten carbide (8504), alumina ceramic (8505), and zirconia ceramic (8506). Typical grinding loads for samples such as cement, rock, or slag are 50 grams for the steel and tungsten carbide containers and 30 grams for the ceramic containers. Note that the actual capacity of the containers is much higher, and (for example) the steel container has been used for as little as 4 grams and as much as 100 grams. However, grinding efficiency decreases as the sample becomes more tightly packed.

There are also small grinding containers made of hardened steel (8507) and tungsten carbide (8508), which can be run either one or three at a time with the 8507R Rack. These grinding containers have about a fifth the capacity of the standard grinding containers and a typical sample size of 10 grams. An oversize steel grinding container (8521) is also available and has approximately a 150 mL capacity. This corresponds to a typical sample size of 75-100 grams.

GRINDING ACTION

The ShatterBox swings a dish-shaped grinding container in a tight, high-speed horizontal circle. Inside the container are the sample, a puck, and (in most containers) a ring. As these grinding elements swing free inside the container, the sample is rapidly crushed between the walls of the container, puck, and ring, and further reduced by the millstone-like action of the puck and ring against the container floor. Grinding times are usually between two and five minutes, with resultant particle size well below 200 mesh (approximately 50 microns). With grinding aids, smaller samples can be reduced below 10 microns.



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- See video demonstrations of our products.
- Learn about new and innovative sample prep methods.
- Get information on tradeshow and symposiums where we present our products.
- Pictures of before and after samples.



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HANDBOOK TIMELINE

1956-1983



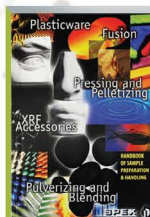
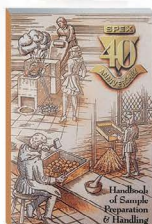
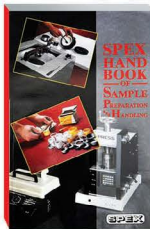
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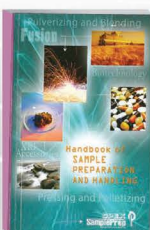
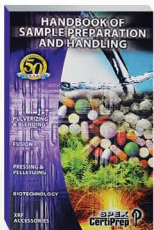
1985



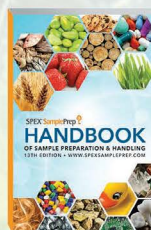
1990s



2000s



2014-
PRESENT





SPEX SamplePrep has been providing superior sample preparation equipment and supplies since 1954. This handbook, published since 1985, has been an important tool that provides our customers not only with information about our products, but also how they can be used in different techniques and applications. This is backed by our unique knowledge and expertise to help our customers select the most appropriate products for their sample preparation needs.

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