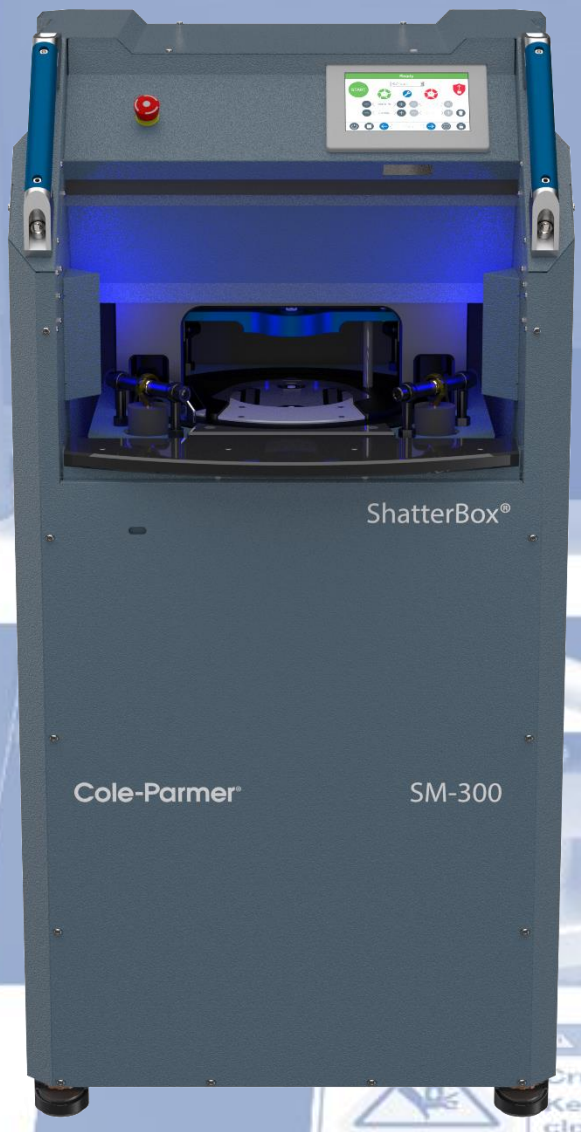
Cole-Parmer®

SM-200/SM-300 Shatterbox

Rock and Mineral Grinder (Ring and Puck Mill) for Spectroscopy Applications

Accessory Manual

For Product Information



ShatterBox®

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CAUTION

Hazardous materials are not appropriate for use with the SM-200 or SM-300 Shatterbox®. Reactive materials can generate heat and pressure and are not suitable for use in a closed vessel such as the Shatterbox® grinding dishes. Cole-Parmer® is available to offer guidance to our customers. However, users are responsible for knowledge and understanding of the potential hazards of the material with which they are working.

Cole-Parmer grinding dishes are not hermetically sealed. Purging a dish with an inert gas prior to grinding will not ensure exclusion of oxygen.

CARE AND CLEANING

Shatterbox® grinding containers should be cleaned before use to remove any surface residue remaining from the manufacturing process.

In general, Shatterbox® grinding dishes can be cleaned with an abrasive. Cole-Parmer® recommends using household cleanser**s** (such as Ajax® or Comet®) and water or a mixture of clean sand, household dishwashing detergent, and water.

Place ring and puck in the dish and fill the dish no more than halfway. Close with the lid and run it in the Shatterbox® for approximately 3 minutes. After removing the dish from the Shatterbox®, open it and discard the contents. Repeat this process once or twice, using a fresh quantity of the cleansing mixture each time. Finally, rinse the dish with clean water and dry thoroughly.

Note: It is particularly important to dry hardened steel containers immediately and thoroughly to prevent corrosion. They are not corrosion-proof and can rust if not dried after washing.

Another good technique is to run and discard a small sample of the material to be analyzed prior to running the actual analytical sample. This will help to remove any residues without introducing new contaminants. These techniques can also be used to clean dishes between sample runs to prevent cross-contamination.

MIXING AND GRINDING

Since grinding containers are chosen for specific tasks, there is no “standard” Shatterbox® grinding container. In general, grinding times average two-to-five minutes, with resultant particle size well below 200 mesh, and in some cases below 10 microns. Typical samples include cements, soils, ceramics, slag, rocks, and ores, but the Shatterbox® has also ground sulfur pellets, dried marsh-grass, pharmaceuticals, animal feed, and many other materials. To maximize grinding capability and minimize contamination, grinding containers are available in hardened steel, tungsten carbide, alumina ceramic, and zirconia ceramic. For samples that cake during mixing, a slurry with 3650 Prep-Aid Vertrel® XF, a liquid fluorocarbon grinding aid. It evaporates after grinding without leaving any residue. If caking is due to static charge, a small amount of cellulose (10%) can be added to the dish.

When developing a procedure for your combination of Shatterbox® and grinding container, try a sample size near the middle of the given range(s). Grind for two minutes in steel or tungsten carbide, or five minutes in alumina or zirconia. If grinding is not satisfactory but the sample is not caking, try increasing the grinding time or decreasing the sample size, or both.

Caution: Always use grinding ring and puck that match the material of the container, e.g. steel ring and puck for a steel container, etc. This will limit contamination. An inappropriate choice of ring and puck, such as tungsten carbide puck in an alumina dish, can damage the dish.

GRINDING DISHES

CHOICE OF GRINDING DISH MATERIAL

Tip: To lift grinding containers easily in and out of Shatterbox® see page 7 for selection of container handles. The handle assembly fastens to the container and can remain affixed during cleaning or storage.

Every grinding container material has its benefits and drawbacks. Some will contaminate a sample fairly heavily, others lightly; some will grind a sample more rapidly than others.

Often the prime consideration in choosing the container material is whether it will contaminate the sample with elements of interest in the analysis. Thus, steel mills looking for iron in slag will choose tungsten carbide over steel, while a geochemist doing trace-element determinations in igneous rocks might avoid both zirconia ceramic for its major elements Zr, minor elements Hf and Y, and tungsten carbide for the small amounts of Ti, Ta, and Nb present.

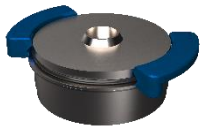
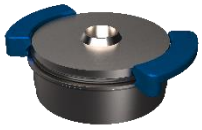
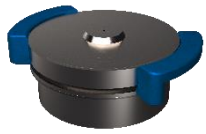
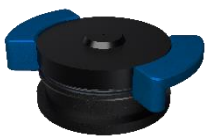
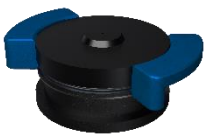
Performance is also important: the denser the grinding-container material, the more rapid the grinding. Tungsten carbide is the densest, followed by steel, zirconia ceramic, and alumina ceramic. Of these, steel is the most prone to wear if the samples are hard; however, it is the only material of the four warranted against breakage. The following summary of properties may be helpful:

- Steel: extraordinarily durable and relatively inexpensive, but subject to unusual wear when used to grind hard materials (quartz and feldspar, glasses and slag). Grinds rapidly but tends to contaminate. Caution: Avoid halide-releasing compounds. They corrode steel.
- Tungsten Carbide: grinds very rapidly and wears well, but is subject to occasional breakage. It is harder than most samples other than the hardest refractories, but contaminates moderately.
- Zirconia Ceramic: harder than steel and most slag and mineral samples, but is neither as heavy nor as hard as tungsten carbide. Grinds fairly rapidly with low contamination levels.
- Alumina Ceramic: harder than tungsten carbide, but is comparatively lightweight. It grinds fairly slowly with low contamination levels.

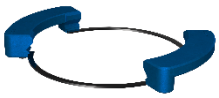
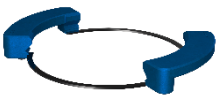
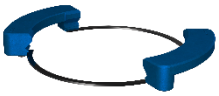
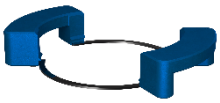
DISHES

Avoid grinding large chunks of sample, as these can either jam the grinding container or damage it; even if they grind satisfactorily, they will probably not grind consistently. We recommend reducing the sample size to at least ¼ in. for the tungsten carbide and steel grinding containers, and to 1/8 in. for the alumina and zirconia ceramic grinding containers.

	8501 Hardened Steel Grinding Container	
	Hardness: Major Elements (Minor): Outer Dimensions (diameter & height): Weight: Complete with: Recommended Load:	MoHS = 5½ - 6, Rockwell C = 60 – 65 Fe (Cr, Si, Mn, C) 17.5 cm x 7.5 cm 8 kg (17.6 lb) Dish, Lid, Ring, Puck & O-Ring (*#51805*) 25 – 75 g, 20 – 50 mL
	8504 Tungsten Carbide Grinding Container	
	Hardness: Major Elements (Minor): Outer Dimensions (diameter x height): Weight: Complete with: Recommended Load:	MoHS = 8½ W, C, Co (Ta, Ti, Nb) 17.5 cm x 8 cm 12.5 kg (27.5 lb) Dish, Lid, Ring, Puck, & O-ring (*#51805*) 25 -75 g, 20 - 60 mL
	Tungsten carbide is an extremely hard, but also very brittle material. The (*#8504*) container must be sold without a warranty against breakage. Care must therefore be taken to prevent breakage. Do not drop.	
	8505 Alumina Ceramic Grinding Container	
	Hardness: Major Elements (Minor): Outer Dimensions (diameter x height): Weight: Complete with: Recommended Load:	MoHS = 9 Al (Si, Ca, Mg) 15.2 cm x 8 cm 5 kg (11 lb) Dish, Lid, Puck, & O-ring (*#51806*) 20 - 40 g, 15 - 40 mL
	Alumina is fragile, the (*#8505*) container must be sold without a warranty against breakage. Care must therefore be taken to prevent breakage. Do not drop.	
	8506 Zirconia Grinding Container	
	Hardness: Major Elements (Minor): Outer Dimensions (diameter x height): Weight: Complete with: Recommended Load:	MoHS = 8½ Zr (Y, Hf, Mg) 15.2 cm x 8 cm 6 kg (13.2 lb) Dish, Lid, Puck, & O-ring (*#51806*) 20 - 40 g, 15 - 40 mL
	8507 Small Hardened Steel Grinding Container	
	Hardness: Major Elements (Minor): Outer Dimensions (diameter x height): Weight: Complete with: Recommended Load:	MoHS = 5½ Rockwell: C = 60 – 65 Fe (Cr, Si, Mn, C) 9 cm x 5.4 cm 1.9 kg (4.2 lb) Dish, Lid, Puck, & Gasket (*#25869*) 5 - 15 g, 5 - 20 mL
	Requires (*#8507R*) Rack to operate one or three simultaneously	

	8508 Small Tungsten Carbide Grinding Container	
	Hardness: Major Elements (Minor): Outer Dimensions (diameter x height): Weight: Complete with: Recommended Load:	MoHS = 8½ W, C, Co (Ta, Ti, Nb) 9.2 cm x 5.9 cm 3.5 kg (7.7 lb) Dish, Lid, & Puck 5 - 15 g, 5 - 20 mL
	Requires (*#8507R*) Rack to operate one or three simultaneously	
	8521 Large Hardened Steel Grinding Container	
	Hardness: Major Elements (Minor): Outer Dimensions (diameter x height): Weight: Complete with: Recommended Load:	MoHS = 5½ - 6, Rockwell: C = 60 – 65 Fe (Cr, Si, Mn, C) 20.3 cm x 8.2 cm 13 kg (28.7 lb) Dish, Lid, Ring, Puck, & O-ring (*#51811*) 50 - 150 g, 30 - 100 mL
SMALL CONTAINER HOLDER		
	**8507R Rack** Holds one or three (*#8507*) or (*#8508*) grinding containers. Rack base assembly and lid included rack with three grinding containers lifts easily in and out of Shatterbox®. Please note that (*#8507*) and (*#8508*) containers cannot be mixed during the same run.	
LARGE GRINDING CONTAINERS WITH HANDLE ASSEMBLY		
	**8501-H Hardened Steel Grinding Container With Handles** Hardened steel grinding container (*#8501*) assembled with handles. Handle assembly allows grinding container to be lifted easily in and out of Shatterbox®.	
	**8521-H Large Hardened Steel Grinding Container With Handles** Hardened steel grinding container (*#8521*) assembled with handles. Handle assembly allows grinding container to be lifted easily in and out of Shatterbox®.	
	**8504-H Tungsten Carbide Grinding Container Handles** Tungsten carbide grinding container (*#8504*) assembled with handles. Handle assembly allows grinding container to be lifted easily in and out of Shatterbox®.	
	**8505-H Alumina Ceramic Grinding Container Handles** Alumina grinding container (*#8505*) assembled with handles. Handle assembly allows grinding container to be lifted easily in and out of Shatterbox®.	
	**8506-H Zirconia Ceramic Grinding Container Handles** Zirconia container (*#8506*) assembled with handles. Handle assembly allows grinding container to be lifted easily in and out of Shatterbox®.	

LARGE GRINDING CONTAINER HANDLES (Only)

	**8511-01 Hardened Steel Grinding Container Handles** Holds one (*#8501*) hardened steel grinding container. Handle assembly allows grinding container to be lifted easily in and out of Shatterbox®. Dish sold separately.
	**8511-21 Large Hardened Steel Grinding Container Handles** Holds one (*#8521*) hardened steel grinding container. Handle assembly allows grinding container to be lifted easily in and out of Shatterbox®. Dish sold separately.
	**8511-04 Tungsten Carbide Grinding Container Handles** Holds one (*#8504*) tungsten carbide grinding container. Handle assembly allows grinding container to be lifted easily in and out of Shatterbox®. Dish sold separately.
	**8511-05 Alumina and Zirconia Ceramic Grinding Container Handles** Holds one (*#8505, #8506*) Alumina or Zirconia container. Handle assembly allows grinding container to be lifted easily in and out of Shatterbox®. Dish sold separately.
	**31688 Shatterbox® Friction Gasket** Durable rubber pad reduces operating noise and wear when placed under container.

BINDERS

Binders are usually blended with the sample after pulverizing and before pressing a disc for XRF Analysis. Their use should lead to a stable, crumble-proof disk achieve with a minimum of dilution, and contamination.

	**3642-150 Prep-Aid Cellulose Binder** < 20 µm powder. Recommend blending with sample at 10 to 15% by weight. 150 g container.
	**3642-450 Prep-Aid Cellulose Binder** < 20 µm powder. Recommend blending with sample at 10 to 15% by weight. 450 g container.
	**3644-150 Prep-Aid UltraBind®** < 20 µm powder. Recommend blending with sample at 10 to 15% by weight. 150 g container.
	**3644-450 Prep-Aid UltraBind®** < 20 µm powder. Recommend blending with sample at 10 to 15% by weight. 450 g container.
	**3644T-450 Prep-Aid UltraBind® Tablets** Each tablet weighs 0.5 g. Recommend blending with sample at 10 to 15% by weight.500 tablets per container.

	**3646-150 Prep-Aid Paraffin Binder** < 20 µm powder. Recommend blending with sample at 10 to 15% by weight. 150 g container.
	**3646-450 Prep-Aid Parafiin Binder** < 20 µm powder. Recommend blending with sample at 10 to 15% by weight. 450 g container.
GRINDING AID	
	**3650 Prep-Aid Vertrel® XF** A liquid fluorocarbon grinding aid. Improves the grinding results. Prevents caking, reduces contamination, and evaporates after grinding without leaving any residue. 1 QT bottle.