



## Ball Mill BM500

### 1 Milling in General

The main purpose of milling (as part of sample preparation) is the reduction of the sample size to receive a homogeneous and defined size distribution for subsequent analytical steps.

Milling is used in many application segments like metals, ceramics, polymers, stones, minerals, food, soils, pharmaceuticals and biological materials like cells.

The applied materials range from hard and brittle to soft, elastic and fibrous.

According to the diversity of sample materials different types of mills are available, differentiated by the method of size reduction.

Table 1: Method and principle of size reduction vs. type of mill

Method of size reduction	Principle	Type of mill
<b>Pressure</b>	Forces applied between two solid surfaces	Jaw crushers
<b>Impact forces</b>	Forces applied at one solid surface	Mixer mills, planetary mills
<b>Shearing</b>	Forces applied at solid surfaces moving in opposite	Rotor mills, ball mills, cross beater mills
<b>Cutting</b>	Forces applied between sharp edges (cutting surfaces)	Knife mills, shredders, cutting mills
<b>Friction</b>	Vertical pressure and concomitant movement of the second surface	Disc mills, mortar grinders

It is possible to combine different methods in one mill to receive better milling effects e.g. shearing principle combined with impact forces in rotor mills.

A rough selection between the different mills can be done according to the sample size. Above 40 mm crushers and shredders are typically used, below that value various mill types will be used depending on the sample properties (e.g. brittle, soft, elastic, breaking behavior,...), final fineness and amount of sample.

### 2 Ball Mill – The All-Rounder

#### 2.1 General

Ball mills are the all-rounders among the mills used for milling and homogenization of a broad range of sample materials. They can be used for dry, wet or cryogenic grinding. They cover inorganic as well as organic and biological samples in different feed sizes. This is advantageous for users handling a broad portfolio of applications as well as for those who do not perform milling regularly.

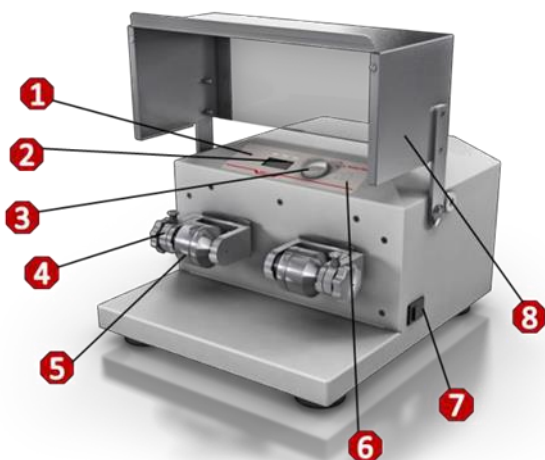
#### 2.2 Ball Mill BM500

Anton Paar's Ball Mill BM500 is a versatile laboratory ball mill. With its simplified handling principle it enables the quick processing of dry, wet and even cryogenic milling procedures.



Fig. 1 Ball Mill BM500

## 2.2.1 Features & Benefits



- 1 Control panel
- 2 Control LED
- 3 Rotary knob
- 4 Jar holders
- 5 Jar
- 6 Start/Stop button
- 7 Power switch
- 8 Safety hood

Fig. 2 Main components of the Ball Mill BM500

The Ball Mill BM500 is an easy-to-operate instrument which does not need special user training. Only one rotary knob enables all required settings for the subsequent milling procedure. By pushing and rotating the rotary knob frequency and time are set. Three front display LEDs inform about the status and the set parameters:



- Left LED Run signal light
- Middle LED (t) Time signal light
- Right LED (Hz) Frequency signal light

Fig. 3 BM500 Control panel with LEDs set to time mode

The Ball Mill BM500 can be operated in simultaneous mode. Two jar holders can be filled with jars and samples in parallel. This is beneficial if there is the need for a higher sample amount at once or for a backup sample for safety reasons.

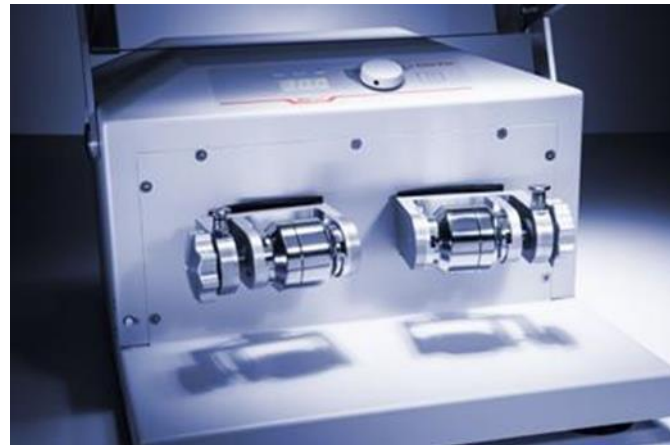


Fig. 4 Simultaneous operating grinding jars

The milling process is very quick and reproducible. Milling times between 5 seconds to 99 minutes can be set whereupon the necessary time depends on the characteristics of the original material and the required final fineness.

For samples containing volatile components or for soft samples milling under cryogenic conditions might be necessary.

The Ball Mill BM500 can be operated under cryogenic conditions by freezing the jars with liquid nitrogen.

**WARNING:** When working with liquid nitrogen please consider the specific safety precautions.

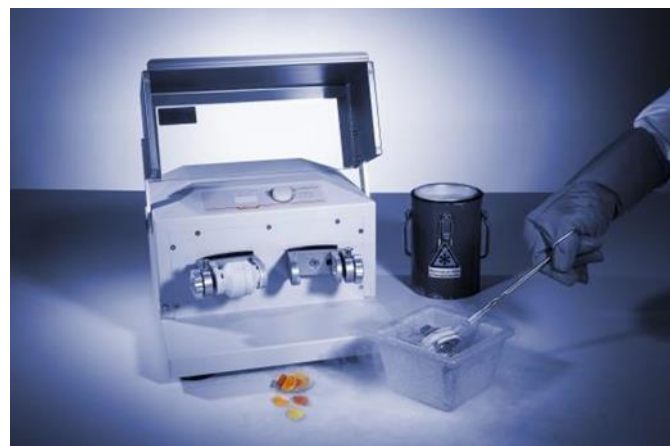


Fig. 5 Cryogenic grinding

## 2.2.2 Applications

The Ball Mill BM500 is suitable for samples ranging from metals and rocks to food, biological and environmental materials. The shape of the sample does not matter, the Ball Mill BM500 easily manages grains, pellets and fibers as well as voluminous samples like wool, grass, and leaves.



Fig. 6 Typical samples

Table 2 gives you an overview of the broad range of applications covered by the Ball Mill BM500.

Table 2: Typical Applications

Application Field	Material	Recommended Jars	Recommended Balls
<b>Geology</b>	e.g. Clay mineral, Granite, Marble	Stainless steel, 50 ml	Stainless steel, 1 x 25 mm
<b>Pigments</b>	e.g. Titanium dioxide	Stainless steel, 25 ml	Stainless steel, 1 x 25 mm
<b>Ceramics II</b>	e.g. Ceramic compacts	Tungsten carbide, 25 ml	Tungsten carbide, 1 x 15 mm
<b>Environment</b>	e.g. Humus	PTFE, 50 ml	Agate, 4 x 10 mm
<b>Nutrition</b>	e.g. Egg shell, potato, tangerine	PTFE, 50 ml	Agate, 4 x 10 mm
<b>Pharmacy</b>	e.g. Tablet grinding	Stainless steel, 50 ml	Stainless steel, 1 x 25 mm
<b>Forensic I</b>	e.g. Cannabis stalk	Stainless steel, 50 ml	Stainless steel, 1 x 25 mm
<b>Forensic II</b>	e.g. Cannabis plant	Adaptor for 4 x 50 ml Falcon tubes	Stainless steel, 7 x 10 mm
<b>Polymers</b>	e.g. Polyamide, PA6	Stainless steel, 50 ml	Stainless steel, 1 x 25 mm

### 2.2.3 Accessories

Essential for covering different applications is a broad range of accessories. This enables you to mill almost any sample material to the desired fineness for your subsequent analysis. The use of the right accessory material (jars and balls) prevents contamination of the sample, which is of utmost importance for e.g. trace elemental analysis.

The Ball Mill BM500 offers a broad portfolio of grinding accessories in different sizes.



Fig. 7 Selection of grinding jars and balls

### 2.2.4 Reasons to buy the Ball Mill BM500

- One-knob handling for all settings
- Quick results – milling within seconds
- Simultaneous operation of two samples
- Versatile accessories
- One instrument for almost every application
- Cryogenic milling for sensitive materials
- Robust milling motor
- Stable also in highest operation mode – no walking over the bench due to vibrations
- Out-of-the box instrument, no training required
- High safety features like jar untighten protection, stainless steel safety hood and opening protection during run

## 2.3 Specifications

Table 3: Specifications

<b>Power supply</b>	230 V ±10 % - 50/60 Hz 115 V ±10 % - 50/60 Hz
<b>Rated power</b>	200 W
<b>Vibrational frequency regulation</b>	Digital, from 3 Hz to 30 Hz (180 min <sup>-1</sup> to 1800 min <sup>-1</sup> ), in 0.1 Hz steps
<b>Time</b>	5 s to 99 min, timer HOLD function, in 1 s steps (below 10 min),
<b>Final fineness</b>	1 µm (final fineness depends on sample material and grinding configuration)
<b>Feed size of sample</b>	Grain <8mm Balls <25 mm in diameter
<b>Max. volume of milling cups</b>	2 x 50 mL
<b>Ambient temperature</b>	5 °C to 40 °C
<b>Humidity</b>	<85 % RH, non-condensing
<b>Dimensions W x D x H</b>	385 mm x 420 mm x 240 mm (465 mm with hood open)
<b>Weight</b>	42 kg