

PM Series – Grind Sizes Down to the Nanometer Range

The powerful and versatile planetary ball mills meet and exceed all requirements for fast and reproducible grinding down to the submicron range. They are used for the most demanding tasks, from routine sample processing to colloidal grinding and mechanical alloying. The extremely high centrifugal forces of the planetary ball mills result in exceptional pulverization energy and therefore short grinding times.

The planetary ball mills are available in versions with 1, 2 and 4 grinding stations. The freely selectable parameter settings, comprehensive range of grinding jars made from top-quality materials as well as the numerous possible ball charge combinations (number and ball size) allow for individual adaptation to a particular size reduction task and are the basis of unmatched versatility in the PM range.

All RETSCH planetary ball mills feature programmable starting time, power failure back-up with storage of the remaining grinding time and automatic grinding chamber ventilation which also cools the grinding jars during operation. Grinding parameters are easily selected and stored via a single button and a graphic display.

The mills – which are available in 7 different versions – are characterized by maximum performance, safety and reliability.

Benefits

- Efficient grinding process for excellent results down to the submicron range
- Reproducible results due to energy and speed control
- Memory for 10 Standard Operating Procedures (SOP)
- Suitable for long-term trials and continuous use
- Different speed ratios available (1:-1; 1:-2; 1:-2.5; 1:-3)
- Grinding jar volumes from 12 ml to 500 ml, in 8 different materials
- Automatic direction reversal helps to avoid caking
- Free-Force-Compensation-Sockets for perfect stability on the bench

Video on www.retsch.com/pm

10 mm
▽
100 nm*



Planetary Ball Mill PM 400 / PM 400 MA

Range of Models

Planetary Ball Mill PM 100

This ball mill is equipped with one grinding station and pulverizes and mixes a large number of materials. It can be operated with grinding jar volumes from 12 ml to 500 ml. Thanks to the Free Force Compensation Socket (FFCS) technology the vibrations of the mill are compensated. If the PM 100 is placed on a suitable laboratory bench, it can be left unattended during operation.

Planetary Ball Mill PM 100 CM

This version features the same performance data as the classical PM 100; however, the speed ratio of sun wheel to grinding jar is 1:-1 instead of 1:-2. This results in a different ball movement which leads to the sample being pulverized rather by pressure and friction than by impact. This not only reduces abrasion but also heat built-up inside the grinding jar. Hence it is possible to process agglomerating materials in a more gentle way.

Planetary Ball Mill PM 200

The PM 200 possesses 2 grinding stations for grinding jars with a nominal volume of 12 ml to 125 ml. The larger sun wheel diameter results in a higher energy input compared to the PM 100.

Planetary Ball Mill PM 400

The PM 400 is a robust floor model with 4 grinding stations for grinding jars with a nominal volume of 12 ml to 500 ml. It can process up to 8 samples simultaneously which results in a high sample throughput.

Model PM 400 MA

To generate the high energy input which is required for mechanical alloying of hard-brittle materials, the PM 400 is available as "MA" type with a speed ratio of 1:-2.5 or 1:-3.



Pressure and Temperature Measuring System GrindControl

Due to their high energy input Planetary Ball Mills are frequently used for the development of new materials by mechanical alloying. The processes and reactions which take place in the grinding jar during grinding can be measured and monitored with the software controlled GrindControl system. It is available with a stainless steel grinding jar of 250 ml or 500 ml. Jar and PC communicate via a robust and secure wireless connection. The measurement data can be recorded with different sampling rates; the longest interval is 5 seconds, the shortest 5 milliseconds. The complete system – including accessories such as the grinding jar and a conversion kit for gassing – is delivered in an aluminum case.

Measurement ranges: Gas pressure: up to 500 kPa, Temperature: 0–200 °C



Grinding Jars „comfort“



The “comfort” range of grinding jars has been specially designed for extreme working conditions such as long-term trials, wet grinding, high mechanical loads and maximum speeds as well as for mechanical alloying.




- Grinding jar sizes from 12 ml to 500 ml
- Hardened steel, stainless steel, tungsten carbide, agate, sintered aluminium oxide, silicon nitride, zirconium oxide, PTFE
- Gas-tight, dust-proof and pressure-resistant
- User-friendly gripping flanges on jar and lid
- Safe, non-slip seating with builtin anti-rotation device and conical base centering
- Optional safety closure device for gas-tight handling inside and outside of glove boxes
- Optional aeration lid creates an inert atmosphere in the grinding jar
- Grinding jars may be stacked in the PM 100, PM 100 CM and PM 400

Safety

The planetary ball mills feature a Safety Slider which ensures that the mill can only be started after all grinding jars have been securely fixed with a clamping device. The self-acting lock ensures that the grinding jars are seated correctly and securely.

Thanks to the automatic cover closure, the machine does not start unless the cover is properly closed. It can only be opened when the mill is at a complete standstill. The Free-Force-Compensation-Sockets (FFCS) compensate vibrations and secure the stability of the mills on the bench.

Planetary Ball Mills at a Glance

Planetary Ball Mills			
			
Model	PM 100 & PM 100 CM	PM 200	PM 400 & PM 400 MA

Applications	nano grinding, pulverizing, mixing, homogenizing, colloidal milling, mechanical alloying
Fields of application	agriculture, biology, chemistry / plastics, construction materials, engineering / electronics, environment / recycling, geology / metallurgy, glass / ceramics, medicine / pharmaceuticals
Feed material	soft, hard, brittle, fibrous – dry or wet

Performance data

Feed size*	< 10 mm	< 4 mm	< 10 mm
Final fineness*	$d_{90} < 1 \mu\text{m}$	$d_{90} < 1 \mu\text{m}$	$d_{90} < 1 \mu\text{m}$
For colloidal grinding*	$d_{90} < 100 \text{ nm}$	$d_{90} < 100 \text{ nm}$	$d_{90} < 100 \text{ nm}$
Batch/sample volume*	max. 1 x 220 ml	max. 2 x 50 ml	max. 4 x 220 ml
with stacked grinding jars	max. 2 x 20 ml	-	max. 8 x 20 ml
No. of grinding stations	1	2	2 or 4
Suitable grinding jars „comfort“			
12 ml / 25 ml / 50 ml / 80 ml	1 or 2	2	2, 4 or 8
125 ml	1	2	2 or 4
250 ml / 500 ml	1	-	2 or 4
Speed ratio	1:-2 / 1:-1	1:-2	1:-2 / 1:-2.5 or 1:-3
Sun wheel speed	100–650 min ⁻¹	100–650 min ⁻¹	30–400 min ⁻¹
Effective sun wheel diameter	141 mm	157 mm	300 mm
G-force**	33 g	37 g	27 g
Digital grinding time setting (hours:minutes:seconds)	00:00:01 – 99:59:59	00:00:01 – 99:59:59	00:00:01 – 99:59:59
Interval operation	with optional direction reversal	with optional direction reversal	with optional direction reversal
Interval time	00:00:01 – 99:59:59	00:00:01 – 99:59:59	00:00:01 – 99:59:59
Pause time	00:00:01 – 99:59:59	00:00:01 – 99:59:59	00:00:01 – 99:59:59
Memory for Standard Operating Procedures (SOPs)	10	10	10
Measurement of energy input	✓	✓	✓
Serial interface	✓	✓	✓

Technical data

Drive power	750 W	750 W	1,500 W
W x H x D	630 x 468 x 415 mm	630 x 468 x 415 mm	836 x 1,220 x 780 mm
Net weight	approx. 80 kg / approx. 86 kg	approx. 72 kg	approx. 290 kg
More information on	www.retsch.com/pm100	www.retsch.com/pm200	www.retsch.com/pm400

*depending on feed material and instrument configuration **($1 \text{ g} = 9.81 \text{ m/s}^2$)

Typical Sample Materials

RETSCH planetary ball mills are perfectly suitable for size reduction of, for example, soil, chemical products, ores, glass, household and industrial waste, ceramics, sewage sludge, alloys, minerals, plants etc.



Application example:
Composite ceramics