

pulverisette 5

classic line



Planetary Mill

- Rapid grinding of laboratory samples down to $< 1 \mu\text{m}$
- Suitable for grinding hard to soft materials
- Grinding in suspension possible

milling sample
planetary ball mill preparation
for your lab

FRITSCH

Application

Field of application

For comminution of solid matter in suspension down to colloidal fineness, crushing of dry laboratory samples and mixing and perfect homogenising of emulsions and pastes.

useful capacity: up to 4 x 225 ml,
feed size < 10 mm edge length,
final fineness approx. < 1 µm

Examples of application

Geology and mineralogy

stones, pebbles, sand, minerals

Ceramics

porcelain, sintered ceramic, clay, fireclay

Chemistry

plant protectives, fertilisers, slats, inorganic and organic materials

Biology

plants, leaves, freeze-dried samples

Medicine, pharmacology and galenite research

eye therapeutics, jellies, crèmes, extracts, drugs, pastes, dragées, tablets

Nuclear research

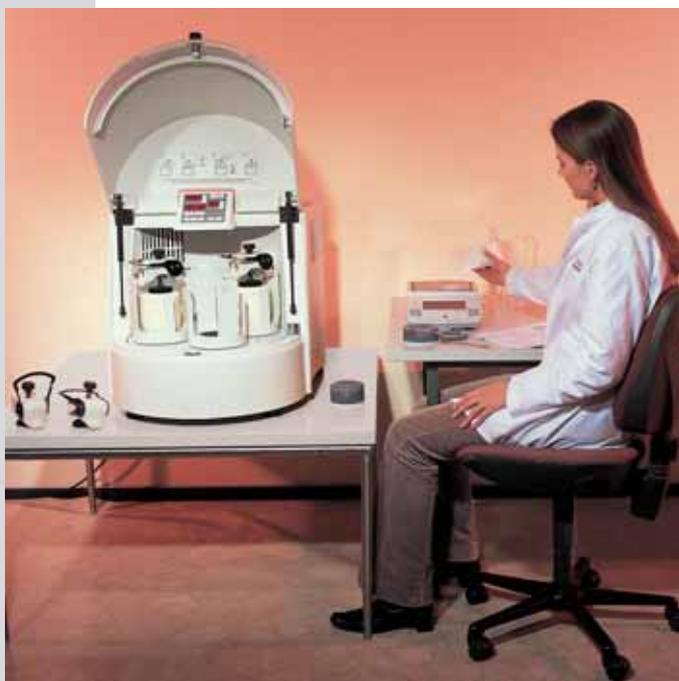
radioactive samples

Material technology

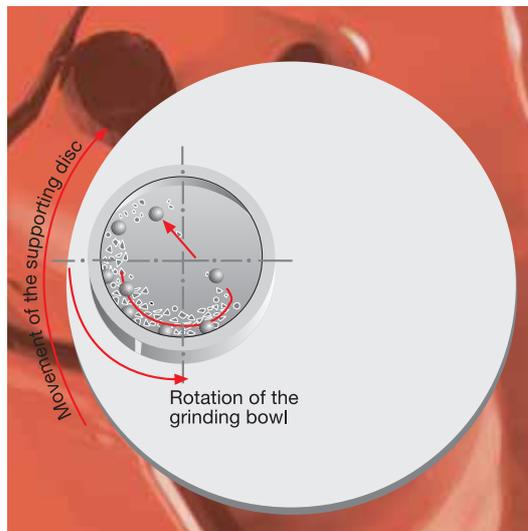
pigments, precious materials, new materials, alloys, mechanical activation

Analytic preparation

spectroscopy, X-ray fluorescence, X-ray structure analysis, chromatography



quality control
fine grinding
Planetary Mill



working principle



pulverisette 5 with 4 grinding bowl fasteners



pulverisette 5 with 2 grinding bowl fasteners

Method of operation

In the pulverisette 5 laboratory planetary mill, the sample material is primarily crushed by the high-energy impact of grinding balls together with friction between the balls and the wall of the grinding bowl.

The grinding bowls with material and balls rotate around their own axis on a counter-rotating supporting disc. The centrifugal forces caused by the rotation of the grinding bowls and supporting discs work on the contents of the grinding bowls.

The force resulting from rotation of the grinding bowl when the mill is started causes the rotating balls to rub against the inside wall of the bowl thus crushing the material.

At a certain point in time the stronger centrifugal force of the supporting disc causes the grinding material and balls to separate from the inner wall of the grinding bowl. The grinding balls cross the bowl at high speeds impacting with the grinding material on the opposite wall - creating size reduction by impact.

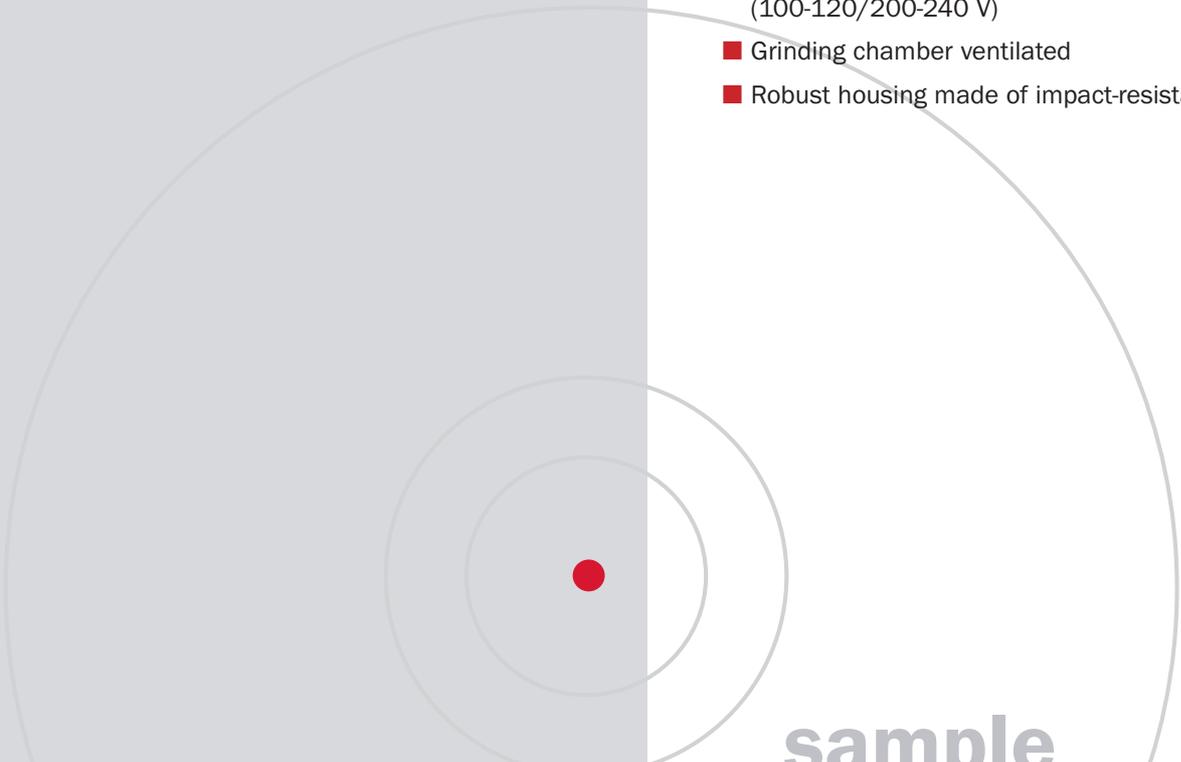
Features

Advantages

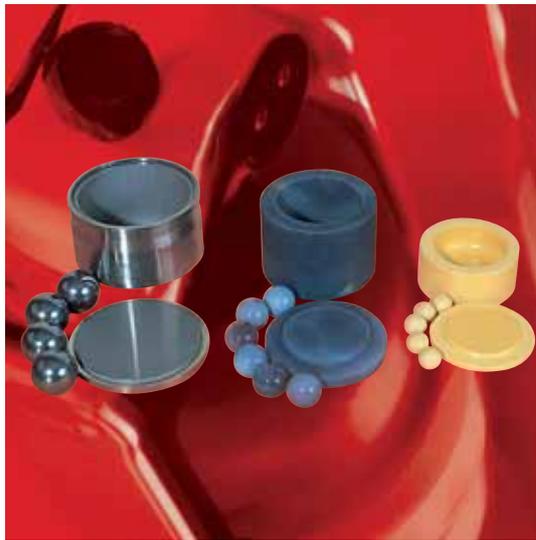
- Final particle size < 1 µm achievable
- High-energy effect of grinding balls
- No-loss grinding - including suspensions
- Simultaneous grinding of up to 8 small or 4 large grinding bowls
- Reproducible grinding results due to precision quartz time control, speed control and fixed transmission ratio
- Quick, secure fastening of the grinding bowls
- Ease of cleaning
- Analytically pure grinding materials for contamination-free grinding
- Choice of 8 different materials for grinding bowls and balls
- Grinding bowls with surface sealing ring
- Safety tested and CE mark
- 2 year guarantee

Design Characteristics

- Constant transmission ratio of support disc achieved by toothed drive belt
- Microprocessor speed control (up to 400 rpm)
- Digital display of actual rotational speed of supporting disc
- Reversing option
- Programmable grinding and cooling times and grinding sequences; grinding time can be set to the exact number of seconds for short-time operation
- Membrane keyboard
- RS232 interface for data transfer of process parameters (Validation)
- Gas pressure springs for easy opening of the grinding chamber cover
- Grinding chamber hood safety lock with stoppage surveillance
- Power-save-function (electricity-saving mode)
- Overload protection with automatic speed alignment and display
- Maintenance-free drive with electronically controlled three-phase motor (1.5 kW) with frequency converter and permanently lubricated bearings
- Built in selection of mains voltage available (100-120/200-240 V)
- Grinding chamber ventilated
- Robust housing made of impact-resistant plastic



sample
preparation
ball mill grinding



grinding bowls and balls

Accessories

Grinding bowls and balls

Grinding bowls and balls are available in 8 different materials to avoid contamination of samples due to unwanted abrasion of grinding elements.

Material	Density g/cm ³	Abrasion resistance	Material to be ground
Agate 99.9 % SiO ₂	2.65	good	soft to medium-hard samples
Silicon nitride 91 % Si ₃ N ₄	3.1	extremely good	abrasive samples, iron-free grinding
Sintered corundum 99.7 % Al ₂ O ₃	> 3.8	fairly good	medium-hard, fibrous samples
Sintered corundum-2 97 % Al ₂ O ₃	> 3.8	fairly good	medium-hard, fibrous samples
Zirconium oxide 94.2 % ZrO ₂	5.7	very good	fibrous, abrasive samples
Stainless steel bowls: 17-19 % Cr + 8-10 % Ni balls: 12.5-14.5 % Cr + 1 % Ni	7.8	fairly good	medium-hard, brittle samples
Tempered steel bowls: 11-12 % Cr balls: 1-1.65 % Cr	7.9	good	hard, brittle samples
Hard metal tungsten carbide 93.8 % WC + 6 % Co	14.95	very good	hard, abrasive samples

Recommended number of balls per grinding bowl

Grinding bowl/ useful capacity	80 ml 1-30 ml	250 ml 30-125 ml	500 ml 80-225 ml
Balls			
5 mm	250	1200	2000
10 mm	30	50	100
15 mm	10	45	70
20 mm	5	15	25
30 mm		6	10
40 mm			4

The quoted number of balls per bowl is the minimum quantity; depending on the material behaviour it shall be possibly increased.

Normally grinding bowls and balls of the same material are used. To shorten the grinding time, larger or heavier balls (higher density) can be used (high grinding energy): e.g. tungsten carbide balls in the steel grinding bowl or zirconium oxide balls in the silicon nitride bowl.

Smaller grinding balls (0.5-4 mm dia.) to archive a fineness down to the Nanometer-range are available on request!

Planetary Mill

Special accessories

Special accessories

Grinding in an inert atmosphere

- Special lid – Using a special lid for the grinding bowl, material can also be ground in an inert atmosphere. The cover is fitted with an inlet and outlet valve with quick-action vent.
- Additional lock-system - If the grinding bowl should be filled in a glove box, the additional lock-system must be used for the transport of the filled grinding bowl.
- Special lid and additional lock-system can also be combined.

GTM - Gas pressure and temperature measuring system

This system enables the laboratory planetary mill to be converted in an analytical measuring system. Continual monitoring of gas pressure and temperature enable thermal effects and physical and chemical reactions (pressure increase or decrease) to be monitored "in situ" in the grinding bowl. Without having to modify the mill itself, a grinding bowl is used with an integral radio transmitter in the lid.

A receiver transfers the data to a computer, and a WINDOWS™ program presents the measured values in graph form. In Excel™, the data is presented in tabular form.

Please ask for the detailed brochure on the gas pressure and temperature measuring system (GTM).



grinding in an inert atmosphere



pulverisette 5 with GTM-System

quality control
milling
pulverisette 5

Technical data

working principle	impact force
max. feed size (depending on the material)	10 mm
min. sample quantity	1 ml
max. sample quantity	
pulverisette 5 with 4 grinding bowl fasteners	900 ml
pulverisette 5 with 2 grinding bowl fasteners	450 ml
final fineness	< 1 µm
typical grinding time (e. g. for quartz sand up to < 40 µm)	10 min
grinding process	dry / wet
speed of the main disc	50 - 400 rpm
transmission ratio	$i_{\text{relative}} = 1 : -2.19$
electrical details	100-120/200-240 V/1~, 50-60 Hz, 1500/1300 Watt
motor-shaft-power according to VDE 0530, EN 60034	1.1 kW
weight	
pulverisette 5 with 4 grinding bowl fasteners	net: 120 kg, gross: 155 kg
pulverisette 5 with 2 grinding bowl fasteners	net: 100 kg, gross: 135 kg
dimensions w x d x h	table-top instrument: 58 x 67 x 57 cm
packing details	pallet-case: 100 x 72 x 83 cm

Special accessories

Order no.	Description
	Accessories for grinding in an inert atmosphere and for mechanical alloying
	Grinding bowls 500 ml volume with lid with 2 valves and seal ring
50.8000.00	agate, 500 ml volume
50.8200.00	stainless steel, 500 ml volume
50.8400.00	tempered steel, 500 ml volume
50.1230.16	replacement seal ring made of Viton for lid with 2 valves for all bowls of 500 ml volume
	Grinding bowls 250 ml volume with lid with 2 valves and seal ring
50.8100.00	agate, 250 ml volume
50.8300.00	stainless steel, 250 ml volume
50.8500.00	tempered steel, 250 ml volume
50.8600.00	hardmetal tungsten carbide, 250 ml volume
50.2230.16	replacement seal ring made of Viton for lid with 2 valves for all bowls of 250 ml volume
	Grinding bowls 80 ml volume with lid with 2 valves and seal ring
50.8800.00	stainless steel, 80 ml volume
50.8700.00	tempered steel, 80 ml volume
50.4230.16	replacement seal ring made of Viton for lid with 2 valves for all bowls of 80 ml volume
90.1400.00	additional lock-system (for the transport of the closed grinding bowl)

Ordering data

Order no.	Description
05.5000.00	Planetary Mill pulverisette 5
05.6000.00	without grinding bowls and balls, incl. "safe lock" clamping system
	with 4 grinding bowl fasteners for 100-120/200-240 V/1~, 50-60 Hz, 1500/1300 Watt
	with 2 grinding bowl fasteners for 100-120/200-240 V/1~, 50-60 Hz, 1500/1300 Watt
	The voltage specified on the order will be set by the factory.
	Grinding bowls
	Grinding bowls 500 ml volume with lid and seal ring
50.1050.00	agate
50.1060.00	sintered corundum (99.7 % Al ₂ O ₃)
50.1070.00	sintered corundum-2 (97 % Al ₂ O ₃)
50.1310.00	silicon nitride, with steel casing
50.1110.00	zirconium oxide
50.1100.00	stainless steel
50.1090.00	tempered steel
50.1010.20	replacement seal ring PTFE 110/101 mm dia. for silicon nitride bowls of 500 ml volume
50.1230.20	replacement seal ring PTFE 116/100 mm dia. for all other bowls of 500 ml volume
	Grinding bowls 250 ml volume with lid and seal ring
50.2055.00	agate, with steel casing
50.2060.00	sintered corundum (99.7 % Al ₂ O ₃)
50.2070.00	sintered corundum-2 (97 % Al ₂ O ₃)
50.2310.00	silicon nitride, with steel casing
50.2110.00	zirconium oxide
50.2100.00	stainless steel
50.2090.00	tempered steel
50.2080.00	hardmetal tungsten carbide, with steel casing
50.2010.20	replacement seal ring PTFE 85/76 mm dia. for agate and silicon nitride and agate bowls of 250 ml vol.
50.2230.20	replacement seal ring PTFE 90/75 mm dia. for all other bowls of 250 ml volume
	Grinding bowls 80 ml volume with lid and seal ring
50.4050.00	agate
50.4060.00	sintered corundum (99.7 % Al ₂ O ₃)
50.4310.00	silicon nitride
50.4110.00	zirconium oxide
50.4100.00	stainless steel
50.4090.00	tempered steel
50.4080.00	hardmetal tungsten carbide, with steel casing
50.4230.20	replacement seal ring PTFE 80/65 mm dia. for all bowls of 80 ml volume
90.1120.09	adapter for grinding bowl of 80 ml volume (essential, if only one grinding bowl is inserted in the grinding bowl holder)
	Grinding balls
	Grinding balls 40 mm dia. for grinding bowls 500 ml
55.0400.06	sintered corundum (99.7 % Al ₂ O ₃)
55.0400.31	silicon nitride
55.0400.27	zirconium oxide
55.0400.10	stainless steel
55.0400.09	tempered steel
55.0400.08	hardmetal tungsten carbide
	Grinding balls 30 mm dia. for grinding bowls 500 ml, 250 ml
55.0300.05	agate, polished
55.0300.06	sintered corundum (99.7 % Al ₂ O ₃)
55.0300.31	silicon nitride
55.0300.27	zirconium oxide
55.0300.10	stainless steel
55.0300.09	tempered steel
55.0300.08	hardmetal tungsten carbide
	Grinding balls 20 mm dia. for grinding bowls 500 ml, 250 ml, 80 ml
55.0200.05	agate, polished
55.0200.06	sintered corundum (99.7 % Al ₂ O ₃)
55.0200.31	silicon nitride
55.0200.27	zirconium oxide
55.0200.10	stainless steel
55.0200.09	tempered steel
55.0200.08	hardmetal tungsten carbide
	Grinding balls 15 mm dia. for grinding bowls 500 ml, 250 ml, 80 ml
55.0150.05	agate, polished
55.0150.06	sintered corundum (99.7 % Al ₂ O ₃)
55.0150.31	silicon nitride
55.0150.27	zirconium oxide
55.0150.10	stainless steel
55.0150.09	tempered steel
55.0150.08	hardmetal tungsten carbide
	Grinding balls 10 mm dia. for grinding bowls 500 ml, 250 ml, 80 ml
55.0100.05	agate, polished
55.0100.06	sintered corundum (99.7 % Al ₂ O ₃)
55.0100.31	silicon nitride
55.0100.27	zirconium oxide
55.0100.10	stainless steel
55.0100.09	tempered steel
55.0100.08	hardmetal tungsten carbide
	Grinding balls 5 mm dia. for grinding bowls 500 ml, 250 ml, 80 ml
55.0050.05	agate, polished (100 pieces weigh approx. 17 g)*
55.0050.27	zirconium oxide (100 pieces weigh approx. 38 g)*
55.0050.10	stainless steel (100 pieces weigh approx. 51 g)*
55.0050.09	tempered steel (100 pieces weigh approx. 52 g)*
55.0050.08	hardmetal tungsten carbide (100 pieces weigh approx. 97g)*
	*due to the indication of weight, the high number of balls per grinding bowl can be weight.

