믹서 밀 MM 400

진정한 다목적 분쇄기

The Mixer Mill MM 400 is a true multipurpose mill designed for dry, wet and cryogenic grinding of small volumes up to 2 x 20 ml. It mixes and homogenizes powders and suspensions with a frequency of 30 Hz within seconds – unbeatably fast and easy to operate.

The compact benchtop unit is suitable for classic homogenization processes, as well as for biological cell disruption for DNA/RNA and protein extraction. Long processing times up to 99 hours make the MM 400 ideally suited for research applications, for example in mechanochemistry.

With regard to performance and flexibility of this mill, there is no equivalent technology available in the market.

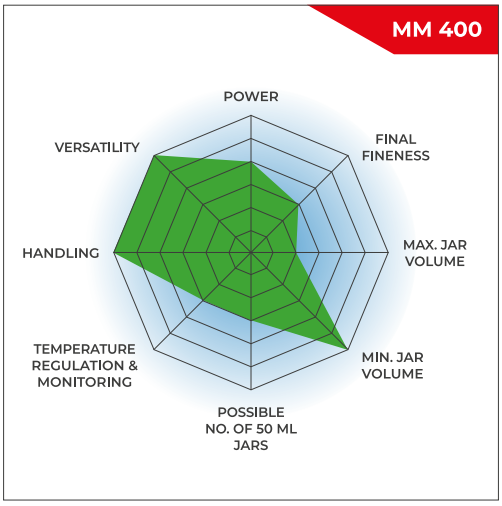
You may also be interested in the mixer mill models MM 500 nano and MM 500 vario which operate with the same functional principle at a frequency of 35 Hz but provide substantially higher performance. For applications which require cooling or heating the sample, the Mixer Mill MM 500 control is the perfect choice. Each RETSCH mixer mill has a specific application focus.

비디오 시청 클릭

제품 비디오

THE MOST VERSATILE ALL-ROUNDER OF BALL MILLS

- Max. speed 30 Hz
- Horizontal oscillation causes strong impact effects for effective sample processing
- Up to 8 mm feed size and 5 µm final fineness
- 2 grinding stations for jars of min 2 ml and max 50 ml, adapter for 10 x 2 ml single use vials and 4 x 50 ml conical centrifugation tubes
- Steel jars can be precooled manually in liquid nitrogen
- Calibrated speed and time, small benchtop model, storable SOPs and cycle programs, 7 different jar materials



성능 및 디자인

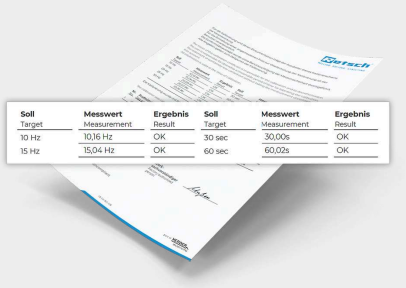
- 최대 30 Hz와 충격력 및 마찰력이 사용된 강력한 분쇄와 균질화
- 회당 최대 20 개의 시료 작업이 가능한 2 개의 분쇄 스테이션 장착
- Memory for 12 Standard Operating Procedures (SOP) and 6 program cycles
- Convenient touch display, significant noise reduction

타의 추종을 불허하는 범용성

- 3 가지 분쇄 모드 : 건식, 습식 또는 냉동
- 예를 들어 XRF 분석을 위한 펠렛화 전 플라스틱 용기에서 분말 시료와 바인더를 혼합합니다.
- 기계 화학과 같은 응용 분야 또는 볼 분쇄를 통한 생물학적 시료 파괴에 적합합니다.
- Extraction of pesticides (QuEChERS) and herbal ingredients

믹서 밀 MM 400

CALIBRATION ENSURES REPRODUCIBLE RESULTS



Reproducibility is paramount in the process chain from sampling to analysis. Lab equipment which can be calibrated guarantees reproducible results with minimum standard deviation every time. This is particularly useful when comparing results produced at different locations.

The MM 400 is the first laboratory mill which can be calibrated. RETSCH initially calibrates time and frequency of the mill and offers a regular calibration service to ensure reproducible milling processes.

This functionality is particularly suitable for

- Testing labs with different locations
- Accredited labs applying ISO/IEC 17025 or ISO 9000ff
- Pharmaceutical products

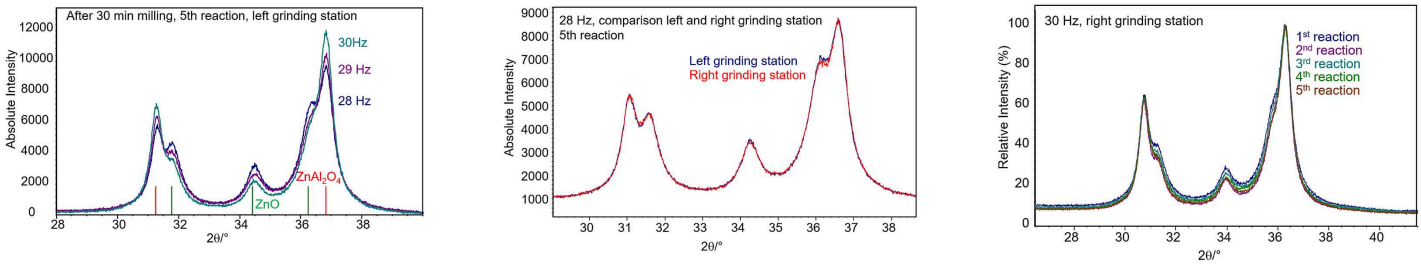
믹서 밀 MM 400

REPRODUCIBILITY OF MECHANOCHEMICAL REACTIONS IN THE MIXER MILL MM 400

Reproducibility is a fundamental principle of scientific research and is essential for ensuring the credibility and reliability of scientific findings. The Mixer Mill MM 400 was tested regarding the reproducibility within a mechanochemical reaction, and it could be proven that it provides excellent reproducibility during several repetitions, for both clamping positions, and also between different devices. [1]

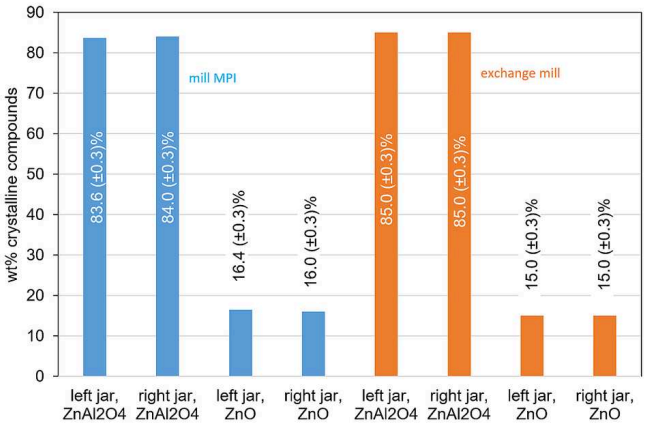
Minor variations of the frequency from 30 Hz to 29 Hz or 28 Hz have an influence on the yield of the reaction. It is of fundamental interest that the mixer mill maintains a set value, e.g. 30 Hz, and does not deviate from it. A premise which is fulfilled by the MM 400 which comes with a calibration certificate.

The mechanochemical reaction γ-Al_2O_3 + ZnO -> $ZnAl_2O_4$ was conducted for 30 min using 25 ml grinding jars, 2 x 15 mm grinding balls, 1 g educts, at 28 Hz, 29 Hz and 30 Hz five times in a row. The comparison between left and right clamping station showed highly reproducible results, also the comparison between the 5 trials.



XRD patterns after the mechanochemical reaction γ-Al_2O_3 + ZnO -> $ZnAl_2O_4$: Left: Grinding at 28 Hz, 29 Hz and 30 Hz, results after 5th reaction. Middle: Comparison left and right grinding station at 28 Hz 5th reaction each. Right: Reaction 1 to 5 at 30 Hz, right grinding station. Results presented by the group of Claudia Weidenthaler. [8]

The experiments were repeated using another MM 400 device to compare the results between the two mills. Again, the excellent reproducibility was verified for the 5 tests conducted at 30 Hz, for both, left and right grinding station.



Almost identical results (weight % of educts and product) and reproducibility are obtained with a different MM 400 device. Results presented by the group of Claudia Weidenthaler. [1]

믹서 밀 MM 400

생물학적 응용과 세포 파괴에 대한 솔루션

Mixer mills are frequently used for homogenizing biological samples. The so-called bead beating with small glass beads is an established method for cell disruption of yeasts, microalgae or bacteria. The sample is only moderately warmed in the process which can be reduced to a minimum by pre-cooling.

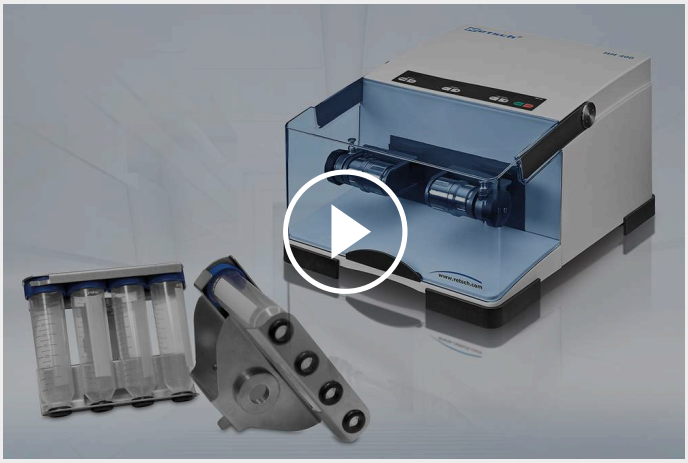
The MM 400 allows for efficient cell disruption of up to 240 ml cell suspension for DNA/RNA and protein extraction. For accurate diagnosis of infections, it is possible to isolate intact bacteria from tissue in 8 x 30 ml

bottles or 10 x 5 ml vials by using adapters.

The MM 400 can be operated with a range of adapters for single-use vials with the following capacities:

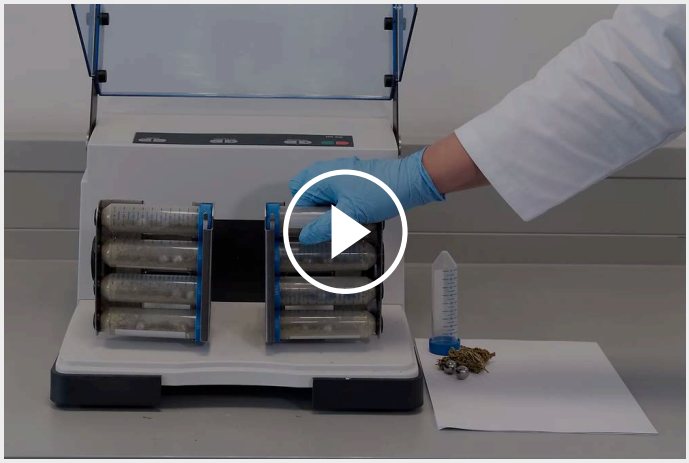
20 x 0.2 ml / 20 x 1.5 or 2 ml / 10 x 5 ml / 8 x 30 ml / 8 x 50 ml

For the pulverization of 25 to 30 g plant material, such as cannabis flower, conical centrifuge tubes are best suited. Up to 8 tissue samples, like fresh liver in buffer solution, can also be homogenized in these 50 ml tubes using steel or zirconium oxide balls. To keep the mechanical stress on the vials as low as possible, a reduced frequency and a high filling level, e. g. with buffer and sample, are recommended.



비디오 시청 클릭

믹서 밀 MM 400 - 이스트 세포 파괴*



비디오 시청 클릭

믹서 밀 MM 400 - Homogenization of cannabis*

*The video shows the previous model with identical functional principle.

믹서 밀 MM 400

SOLUTIONS FOR CRYOGENIC GRINDING

The CryoKit is a cost-effective solution for cryogenic sample processing with the Mixer Mill MM 400. The set consists of two insulated containers, two tongs and safety glasses.

The sample to be embrittled and the grinding ball are filled into the stainless-steel grinding jar which is tightly screwed. Indirect embrittlement is effected by pre-cooling the jar in a liquid nitrogen bath. After approximately 2 minutes, the sample is sufficiently cooled for cryogenic processing.

If direct contact with liquid nitrogen is to be avoided, the CryoMill or Mixer Mill MM 500 control are suitable options. Both mills can be operated with jars made of other materials than steel for cryogenic grinding.

비디오 시청 클릭

믹서 밀 MM 400 - 냉동 분쇄*

믹서 밀 MM 400

APPLICATIONS IN MECHANOCHEMISTRY

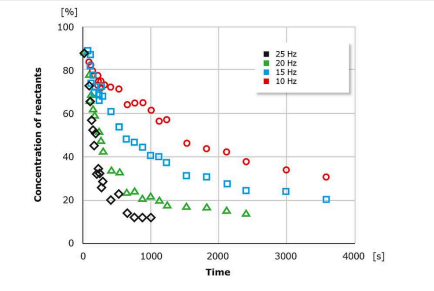
Mechanochemistry enables fast reactions of substances in a solvent-free environment. Some chemical reactions require the frictional forces of a planetary ball mill, while other reaction types need energy input through impact – that is where the Mixer Mill MM 400 comes into play.

The sample volumes available for research applications are often very low. This makes small grinding jar sizes of up to 50 ml, like they are available for the MM 400, beneficial. Due to the frequently long reaction times, the possibility to program process times of several hours is another important aspect.

Mixer mills offer a unique advantage over planetary ball mills in mechanochemical applications: the use of transparent jars in combination with the typical horizontal jar movement enables in-situ RAMAN spectroscopy. This permits real-time monitoring of the reaction process to identify the optimal time for maximum yield and avoid prolonged processing.

The MM 400 offers many advantages for mechanochemical applications:

- Process times of up to 99 h
- Various grinding jar sizes and materials
- Transparent PMMA grinding jars enable in-situ RAMAN spectroscopy
- Programmable frequency and break times
- Adapter for 4 x 5 ml stainless-steel grinding jars permits up to 8 simultaneous reactions



Time course of the Knoevenagel reaction between vanillin and barbituric acid under mechanochemical conditions using 2x10mm zirconium oxide grinding balls in 19 ml PMMA grinding jar at 30 Hz. Reaction running over 30 minutes with visible progress indicated by color change.

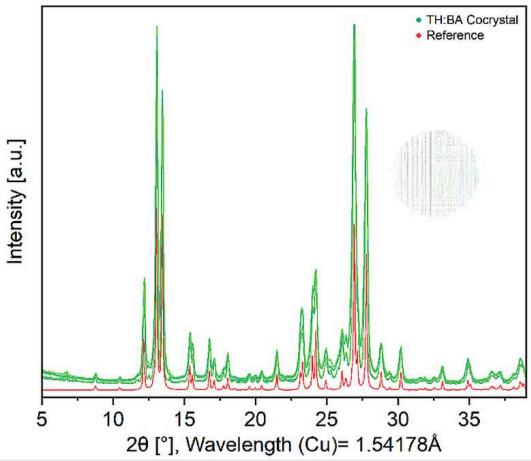
Courtesy of Dr. Sven Grätz, Ruhr-University Bochum, Faculty of Chemistry and Biochemistry, AG Prof. Borchardt.

CO-CRYSTAL SCREENING WITH THE MM 400

Co-crystal screening can be effectively performed in Mixer Mills. In a study [9] using the MM 400, 2 ml steel tubes and the corresponding PTFE adapter were employed to co-crystallize theophylline and benzamide in a 1:1 ratio under the following conditions:

- 60 min milling time
- 30 Hz frequency
- One 6 mm steel ball per tube
- Four experiments without solvent and four with 20 µL ethanol

X-ray powder diffraction patterns of the eight resulting samples (shown in green) align closely with the simulated reference pattern of the target co-crystal. All observed signals correspond to the desired product, with no significant additional signals, indicating successful and reproducible co-crystal formation. The MM 400 with 2 ml steel tubes delivers consistent results, and this compatibility extends to the MM 500 series, which can also accommodate 2 ml steel tubes.



XRD patterns after the co-crystal formation of theophylline and benzamide after 60 min milling time in the MM 400 against a simulated reference. Results presented by experiments of Dominik Al-Sabbagh. [2]

CHEMISTRY IN THE MILL: TEFLON RECYCLING (PTFE) USING MECHANICAL ENERGY

MECHANOCHEMICAL RECYCLING OF PTFE (TEFLON)

Mechanochemical reactions can also be carried out particularly efficiently using the MM 400. Recent research shows how PTFE (Teflon) can be broken down in the MM 400 through a reaction with sodium, using mechanical energy. The intense movement of the grinding balls provides the energy needed to break the stable carbon-fluorine bonds – without any additional heat or pressure. In this way, large portions of the material can be converted into sodium fluoride and carbon – a promising approach for future recycling processes.

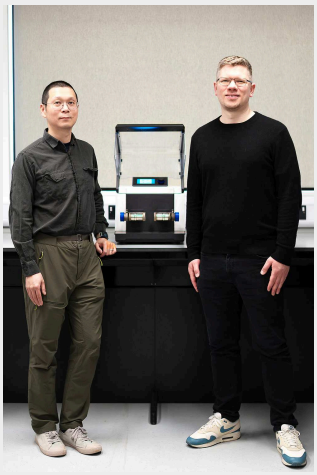


Image on the right: Dr. Erli Lu and Dr. Dominik Kubicki with the Mixer Mill MM 400, which was used to decompose PFAs. [4]

The process using MM 400 was part of the renowned science program “Forschung aktuell” on Deutschlandfunk. Give it a listen!

The radio segment is available only in German.

FUNCTIONALIZING BIOMASS FOR PHARMA APPLICATIONS VIA MECHANOCHEMISTRY

Mechanochemistry is transforming how functional biomaterials are made, and cationic cellulose is a prime example. Using a solvent-free process, cotton fibers are combined with a catalytic base and a minimal additive, then milled together with the cationic reagent to activate the reaction using the Mixer Mill MM 400. This solid-state approach eliminates water and bulk solvents, dramatically reducing chemical use and waste compared to conventional methods. After milling, a short aging step completes the reaction, delivering highly charged cellulose fibers with exceptional performance. [3]

Optimal reaction conditions: Cotton fibers were milled in a 50 ml stainless steel jar with 3 x 10 mm balls for 5 min at 25 Hz, then EPTMAC was added, and the mixture was milled for additional 30 min. The subsequent aging of the reaction mixture at 50 °C for 24 h, followed by Soxhlet extraction (48 h) and freeze drying, resulted in the isolation of pure cCF material.

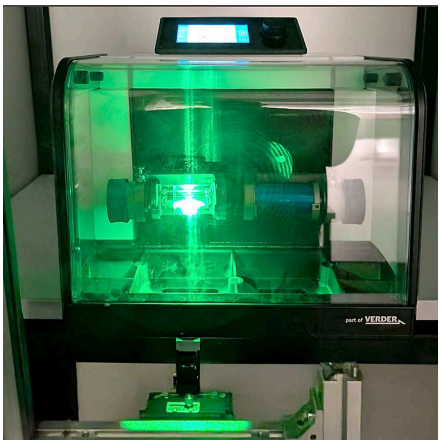
Why is this exciting for pharma?
These cationic fibers show strong electrostatic binding to viruses, enabling efficient removal of pathogens from water and process streams—critical for sterile manufacturing and clean water applications. Beyond filtration, the material offers potential in drug delivery, antimicrobial surfaces, and bioprocessing aids. The process achieves outstanding sustainability metrics aligning with green chemistry principles and industry goals. It also allows precise control over charge density for tailored performance.

This innovation demonstrates how mechanochemistry can deliver high-value, eco-friendly solutions for pharmaceutical production—combining safety, efficiency, and sustainability in one breakthrough approach.

믹서 밀 **MM 400**

IN-SITU RAMAN SPECTROSCOPY

In-situ Raman spectroscopy is a powerful analytical technique that allows for the monitoring and analysis of materials in their natural or process environment. This method utilizes Raman scattering, a phenomenon where light interacts with molecular vibrations, leading to shifts in the wavelength of the scattered light. These shifts provide a unique spectral fingerprint for the material being analyzed, offering insights into its chemical composition or molecular structure.



The "*in-situ*" aspect refers to the ability to observe and measure these characteristics directly during an ongoing process. This can include observing changes in the presence of various chemical reactions, also the so called mechanochemistry. Mechanochemistry involves the use of impact, shearing, or friction actions to induce chemical changes in solids. This approach is increasingly popular for its ability to bypass the need for solvents, potentially offering a more environmentally friendly and energy-efficient pathway for chemical synthesis. The Raman spectroscopy can provide invaluable insights into the reaction mechanism, phase transformations, reaction kinetics or for optimization of reaction conditions.

The MM 400 is “Raman-ready”, allowing easy removal of the bottom plate inlay. The bottom plate has openings for the Raman probe to consistently measure at the bottom of the jars by placing the Raman probe underneath the mill and thus underneath the jars, where particle interaction is most intense, ensuring accurate data. The Retsch PMMA grinding jars, with their transparency and chemical resistance, enhance spectral data without contamination. The plane outer shapes of the jars further enhance the spectroscopic data. These design adjustments streamline the experimental workflow. Researchers can now perform *in-situ* Raman spectroscopy with greater ease and precision, opening new possibilities for in-depth material analysis.

안전하고 효과적인 분쇄 작업을 위해

믹서 밀 **MM 400**의 액세서리

GRINDING JARS IN 7 DIFFERENT MATERIALS

The nominal volume of the screw-top grinding jars ranges from 1.5 ml to 50 ml; available materials include hardened steel, stainless steel, agate, tungsten carbide, zirconium oxide and PTFE, ensuring contamination-free sample preparation.

Transparent PMMA grinding jars are used for in-situ RAMAN spectroscopy but also enable applications with photochemical reactions. Moreover, these are resistant to a variety of chemicals. The jars can be used with the predecessor of the MM 400 just like older jar models are compatible with the latest mixer mill model.

2 ML TUBES FOR CRYOGENIC GRINDING

Small 2 ml steel tubes are used for cryogenic applications. Up to 20 of these tubes can be clamped into the MM 400 using an adapter. The advantage: they can withstand low temperatures and mechanical stress and do not break like disposable vessels. Ideal for the smallest sample quantities in the cryogenic range.

일회용 바이알을 위한 어댑터

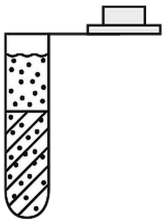
0.5 / 1.5 / 2 / 5 ml 일회용 바이알을 위한 어댑터가 MM 400에 사용 가능합니다. 단백질 추출과 같은 대량의 시료를 위해 50 ml 코니컬 원심분리 튜브 또는 30 ml 광구병 용 어댑터도 사용될 수 있습니다.

ADAPTERS FOR INCREASED SAMPLE THROUGHPUT

The MM 400 can be equipped with adapters that accommodate four 5 ml stainless-steel grinding jars, allowing for simultaneous pulverization of a maximum of 8 samples. This increased throughput is particularly beneficial for mechanochemical applications.

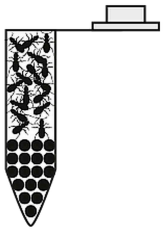
VIALS, BOTTLES AND TUBES AVAILABLE FOR MM 400

1.5 or 2 ml
Safe-lock
single-use vials
2 x 10 vials max.



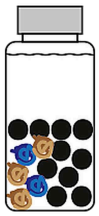
- Cell disruption for DNA/RNA proteins/ metabolites
- Cryogenic grinding of soft sample (tissue, plants, cell pellets, insects)
- Dry or wet homogenization of soft samples (tissue, insects)

5 ml
Safe-lock
single-use vials
2 x 5 vials max.



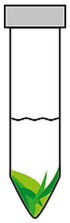
- Cell disruption for DNA/RNA proteins/ metabolites
- Cryogenic grinding of soft sample (tissue, plants, cell pellets, insects)
- Dry or wet homogenization of soft samples (tissue, insects)

30 ml
disposable wide
mouth bottles
2 x 4 bottles max.



- Cell disruption for DNA/RNA proteins/ metabolites
- Dry or wet homogenization of soft samples (tissue, insects)
- Dry milling of hard samples (quartz sand)

50 ml
disposable conical
centrifugation tubes
2 x 4 tubes max.



- Cell disruption for DNA/RNA proteins/ metabolites
- Dry or wet homogenization of soft samples (tissue, insects)
- Extraction of pesticides from food/ plants (QuEChERS)
- Mixing of powder and wax to press pellets for XRF

RECOMMENDED JAR FILLINGS

The jar size should be adapted to the sample volume to ensure optimum results. Ideally, the grinding balls are 3 times the size of the largest sample piece. The numbers and sizes of balls given in the table below follow this rule of thumb. To pulverize, for example, 20 ml of a sample consisting of 8-mm sized particles, the use of a 50 ml jar and 25 mm balls is recommended. According to the table, one grinding ball is required. 20 ml of a sample with 5-mm particles, however, can be homogenized with four 15 mm balls.

Grinding jar nominal volume	Sample amount	Max. feed size	Recommended ball charge (pieces)						
			Ø 5 mm	Ø 7 mm	Ø 10 mm	Ø 12 mm	Ø 15 mm	Ø 20 mm	Ø 25 mm
1.5 ml	0.2 – 0.5 ml	1 mm	1 – 2	-	-	-	-	-	-
5 ml	0.5 – 2 ml	2 mm	-	1 – 2	-	-	-	-	-
10 ml	2 – 4 ml	4 mm	-	5 – 7	1 – 2	1 – 2	-	-	-
25 ml	4 – 10 ml	6 mm	-	-	5 – 6	2 – 4	1 – 2	-	-
35 ml	6 – 15 ml	6 mm	-	-	6 – 9	4 – 6	2 – 3	1	-
50 ml	8 – 20 ml	8 mm	-	-	12 – 14	6 – 8	3 – 4	1	1

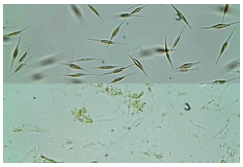
The table shows the recommended charges (in pieces) of differently sized grinding balls in relation to the grinding jar volume, sample amount and maximum feed size.

대표 시료

RETSCH 믹서 밀은 진정한 범용 제품 입니다. 제품은 합금, 동물 사료, 뼈, 세라믹, 시리얼, 화학 제품, 석탄, 코크스, 의약품, 전자 폐기물, 유리, 과립, 모발, 미네랄, 기름 종자, 광물, 제지, 식물 재료, 플라스틱, 하수 슬러지, 토양, 짚, 정제, 섬유, 조직, 담배, 폐기물, 목재, 양모 등과 같은 시료의 균질화에 사용됩니다.

FIBROUS: HAIR

30 ml sample
50 ml stainless steel jar
1 x 25 mm stainless steel ball
2 min at 30 Hz

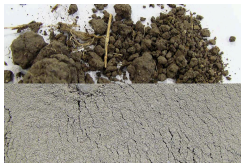


CELL DISRUPTION: MICROALGAE

30 ml cell suspension
8 x 50 ml conical centrifuge tubes (adapter)
with 25 ml glass beads each; 0,5-0,75 mm
30 s at 30 Hz

ELASTIC-LIQUID: CAPSULES WITH LIQUID

15 ml sample
50 ml stainless steel jar
1 x 25 mm stainless steel ball
embrittlement in LN_2 for 3 min
4 x 2 min at 30 Hz
with intermediate cooling



MEDIUM-HARD/ FIBROUS: SOIL

20 ml sample
50 ml stainless steel jar
1 x 25 mm stainless steel ball
1 min at 30 Hz

비디오 시청 클릭

PARSLEY

TOUGH-FIBROUS: WOOD

5 ml sample
10 ml zirconium oxide jar
2 x 12 mm zirconium oxide balls
3 min at 30 Hz

ELASTIC-TOUGH: POLYURETHANE PELLETS

20 ml sample
50 ml stainless steel jar
1 x 25 mm stainless steel ball
embrittlement in LN_2 for 3 min
4 x 2 min at 30 Hz
with intermediate cooling

FIBROUS: CANNABIS

3 g sample
50 ml stainless steel jar
1 x 25 mm stainless steel ball
embrittlement with LN_2 for 2 min
90 s at 30 Hz

HARD-BRITTLE: CONCRETE

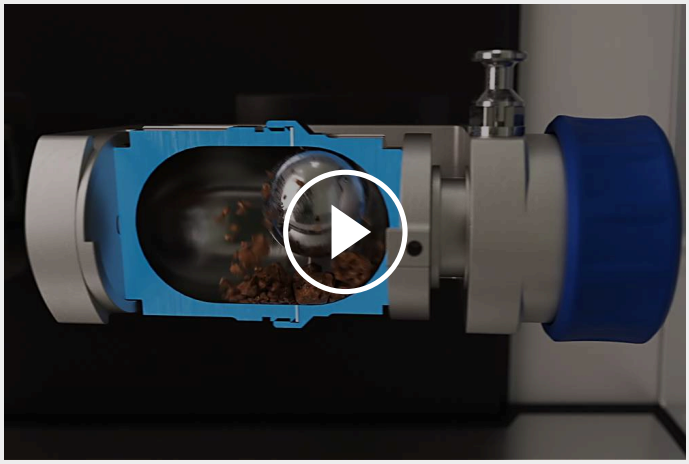
10 ml sample
25 ml zirconium oxide jar
2 x 15 mm zirconium oxide balls
2 min at 30 Hz

믹서 밀 MM 400

작동 원리

믹서 밀 MM 400의 분쇄 용기는 수평 위치에서 방사형 진동을 수행합니다. 분쇄용 볼의 관성은 용기의 둥근 끝 부분에서 높은 충격 에너지를 발생시켜 시료를 분쇄합니다. 또한 분쇄 용기의 운동 운동은 볼의 운동과 조합되어 시료의 집중 혼합을 발생시킵니다.

혼합 정도는 여러개의 작은 볼들을 사용하여 더욱 증가될 수 있습니다. 여러 개의 작은 볼들이 사용되는 경우 (예. 유리 재질 볼) 생물학적 세포가 파괴될 수 있습니다. 볼 사이의 큰 마찰 충격 효과가 효과적인 세포 파괴를 보장합니다.



비디오 시청 클릭

믹서 밀 MM 400

기술 데이터

응용 분야	size reduction, mixing, homogenization, cell disruption, cryogenic grinding, mechanochemistry
응용분야	건축자재, 기술적/전기적, 농산물, 생물학, 식품, 유리 제품/ 세라믹, 의학/제약, 지질학 / 금속 공학, 화학/플라스틱 공학, 환경 / 재활용
투입 시료	경질, 중-경질, 연질, 취성, 탄성, 섬유질
크기 축소 원리	충격, 마찰
최대 투입 크기*	<= 8 mm
최종 분말 입도*	~ 5 µm
시료 일괄 처리량*	max. 2 x 20 ml
분쇄조 수	2
Vibrational frequency	3 - 30 Hz (180 - 1800 min-1)
평균 분쇄 시간	30 초 - 2 분
Max. grindig time	99 h
건식 분쇄	가능
습식 분쇄	가능
냉동 분쇄	가능
바이알을 이용한 세포파쇄	가능, 20 x 2.0 ml 까지
자가 중심 결착기	가능
분쇄 용기 종류	스크류형 디자인
분쇄 도구 재질	경화 강철, 스테인레스 스틸, 텅스텐 카바이드, 마노, 지르코늄 산화물, PTFE, PMMA
분쇄 용기 크기	1.5 ml / 5 ml / 10 ml / 25 ml / 35 ml / 50ml
분쇄 시간 설정	digital, 10 s - 8 h
표준 운영 절차 저장 가능 수	12
저장 주기 프로그램	6
전원 공급 데이터	100-240 V, 50/60 Hz
전원 연결	단상
안전 보호 코드	IP 30
소비 전력	165W
폭 x 높이 x 깊이 닫혔을 때	385 x 350 x 470 mm
중량	~ 27,5 kg
표준	CE

*투입 재료와 장비 환경, 설정에 따라

REFERENCES

[1] Reaction scheme and performance of the experiments: Prof. Dr. Claudia Weidenthaler, Research Group Leader Heterogeneous Catalysis Powder Diffraction and Surface Spectroscopy, Max-Planck Institut für Kohlenforschung, Mülheim an der Ruhr.

[2] Reaction scheme and performance of the experiments: Dominik Al-Sabbagh, Chemistry Laboratory Technician, Division 6.3 – Structure Analysis, Federal Institute for Materials Research and Testing (BAM), Berlin.

[3] Tatsiana Nikonovich, Yao Yu, Mikko Korkiakoski, Chengji Yang, Iris Seitz, Daniel Langerreiter, Mauri A. Kostiainen, Eduardo Anaya-Plaza, and Sandra Kaabel; Solid-State Synthesis of Cationic Cellulose Fibers from Low-Processed Cotton for Efficient Virus Capture; ACS Sustainable Chemistry & Engineering 2025 13 (42), DOI: 10.1021/acssuschemeng.5c07884

[4] With permission of Dr Erli Lu, Associate Professor in Mechanochemistry & Sustainable Synthesis School of Chemistry, University of Birmingham

www.retsch.kr/mm400

주문 정보

믹서 밀 MM 400

믹서 밀 MM 400 퀵 릴리즈 클램프 포함
(분쇄 용기와 볼을 별도로 주문하시기 바랍니다.)

20.715.0001		MM 400	100–240 V, 50/60 Hz

MM 400 분쇄 용기, 스크류 탑 디자인

HARDENED STEEL

01.462.0237		25 ml

STAINLESS STEEL

01.462.0230		1.5 ml
01.462.0231		5 ml
01.462.0290		5 ml (for use with adapter 02.706.0351)
01.462.0236		10 ml
01.462.0213		25 ml
01.462.0214		35 ml
01.462.0216		50 ml

TUNGSTEN CARBIDE

01.462.0235		10 ml

01.462.0217		25 ml

아게이트 (마노)		
01.462.0232		5 ml
01.462.0233		10 ml

ZIRCONIUM OXIDE		
01.462.0234		10 ml
01.462.0201		25 ml
01.462.0215		35 ml

PTFE		
01.462.0238		25 ml
01.462.0244		35 ml
22.041.0004		Mixing beakers of polystyrene, 56 ml, 100 pcs.

PMMA, TRANSPARENT JARS FOR MECHANOSYNTHESES		
01.462.0539		10 ml, 10 pieces
02.462.0539		10 ml, 2 pieces

ACCESSORIES FOR AERATION AND INCREASED PRESSURE	
01.462.0548	Jar set incl. aeration jar 28 ml stainless steel, filter 10 µm, sealings and fittings 2 x 1/

		8“ for hose diameter 3 mm and 0.65 mm wall thickness (2x3 m hose included)
22.050.0005		Conversion kit including 2 connectors for the hoses on grinding arm, bottom plate for leading hoses out of the housing, counterweight

MM 400 분쇄 용기 용 액세서리

22.486.0005		Opening aid for grinding jars, 2 pcs.
02.706.0351		Adapter for use of 2/4 grinding jars 5 ml (01.462.0550)
22.085.0007		Gasket for grinding jar 1.5 ml, 10 pcs.
22.085.0008		Gasket for grinding jar 5 ml, 10 pcs. (for grinding jar 01.462.0231)
22.111.0001		Gasket for grinding jar 5 ml, 10 pcs. (for grinding jar 01.462.0550)
22.085.0009		Gasket for grinding jar 10 ml, 10 pcs.
22.085.0006		Gasket for grinding jar 25 ml hardened steel and stainless steel, 10 pcs.
22.085.0003		Gasket for grinding jar 25 ml zirconium oxide and tungsten carbide, 10 pcs.
22.085.0005		Gasket for grinding jar 35 ml stainless steel, 10 pcs.
22.085.0004		Gasket for grinding jar 35 ml zirconium oxide, 10 pcs.
22.085.0002		Gasket for grinding jar 50 ml stainless steel, 10 pcs.

MM 400 혼합 및 세포 파괴 용 액세서리

22.001.0020		Adapter for 4 conical centrifuge tubes (e.g. Falcon® Tubes), 2 pieces, incl. 20 tubes
05.026.0001		코니컬 원심 튜브, 50 ml, 20 개
22.001.0021		어댑터, 광구 병 4 개 용, 2 개, 30 ml 광구 병 12 개 포함

MM 400 냉동 분쇄를 위한 악세사리

22.354.0001		냉동 키트, 액체 질소 용기 냉각 용 (절연 용기 (1 및 4 리터) 2 개, 분쇄 용기 집게 2 세트, 보안경 1 세트 포함)

MM 400 액세서리

99.200.0043		MM 400 IQ / OQ 문서

세포 및 조직 파괴 용 액세서리

22.008.0010		어댑터, 5 리액션 바이알 5.0 ml, PTFE
22.008.0014		Adapter for 10 reaction vials 1.5 and 2.0 ml, made of PTFE or stainless steel
22.008.0005		Adapter for 5 reaction vials 1.5 and 2.0 ml, made of PTFE or stainless steel
22.008.0006		어댑터, 10 리액션 바이알 0.2 ml 용, PTFE
22.749.0006		안전 잠금 리액션 바이알 5.0 ml, 200 개
22.749.0001		안전 잠금 리액션 바이알, 2.0 ml, 1000 개
22.749.0002		안전 잠금 리액션 바이알, 1.5 ml, 1000 개
22.749.0004		안전 잠금 리액션 바이알, 0.2 ml, 1000 개
22.749.0008		Reaction vials made of stainless steel 316L, 2.0 ml, 10 pcs. (for use with adapter 22.008.0014)

분쇄용 볼

HARDENED STEEL

05.368.0029		5 mm Ø

05.368.0030		7 mm Ø
05.368.0059		10 mm Ø
05.368.0032		12 mm Ø
05.368.0108		15 mm Ø

STAINLESS STEEL		
22.455.0010		2 mm Ø, 500 g (약 110 ml)
22.455.0011		3 mm Ø, 500 g (약 120 ml)
22.455.0002		3 mm Ø, 200 개 (약 6 ml)
22.455.0001		4 mm Ø, 200 개 (약 14 ml)
22.455.0003		5 mm Ø, 200 개 (약 25 ml)
05.368.0034		5 mm Ø
05.368.0035		7 mm Ø
05.368.0063		10 mm Ø
05.368.0037		12 mm Ø
05.368.0109		15 mm Ø
05.368.0062		20 mm Ø

05.368.0105		25 mm Ø

TUNGSTEN CARBIDE

22.455.0006		3 mm Ø, 200 개 (약 6 ml)
22.455.0005		4 mm Ø, 200 개 (약 14 ml)
22.455.0004		5 mm Ø, 200 개 (약 25 ml)
05.368.0038		5 mm Ø
05.368.0039		7 mm Ø
05.368.0071		10 mm Ø
05.368.0041		12 mm Ø
05.368.0110		15 mm Ø

아게이트 (마노)

05.368.0024		5 mm Ø
05.368.0025		7 mm Ø
05.368.0067		10 mm Ø
05.368.0027		12 mm Ø

ZIRCONIUM OXIDE

05.368.0089		2 mm Ø, 0.5 kg (approx. 135 ml)
05.368.0090		3 mm Ø, 0.5 kg (approx. 140 ml)
22.455.0007		3 mm Ø, 200 개 (약 6 ml)
22.455.0009		5 mm Ø, 200 개 (약 25 ml)
05.368.0146		7 mm Ø
05.368.0094		10 mm Ø
05.368.0096		12 mm Ø
05.368.0113		15 mm Ø
05.368.0093		20 mm Ø
05.368.0106		25 mm Ø

PTFE, 스틸 코어		
05.368.0045		10 mm Ø
05.368.0046		12 mm Ø
05.368.0114		15 mm Ø
05.368.0047		20 mm Ø

혼합 비커 용 폴리아미드		
05.368.0042		5 mm Ø

05.368.0043		7 mm Ø
05.368.0044		9 mm Ø
05.368.0003		12 mm Ø

유리 볼		
22.222.0001		0.10 – 0.25 mm Ø, 500 g (약 320 ml)
22.222.0002		0.25 – 0.50 mm Ø, 500 g (약 320 ml)
22.222.0003		0.50 – 0.75 mm Ø, 500 g (약 320 ml)
22.222.0004		0.75 – 1.00 mm Ø, 500 g (약 320 ml)
22.222.0005		1.00 – 1.50 mm Ø, 500 g (약 320 ml)