



## 高能纳米球磨仪 MM 500 NANO

纳米范围内的颗粒研磨

不仅仅是行星球磨机的替代品

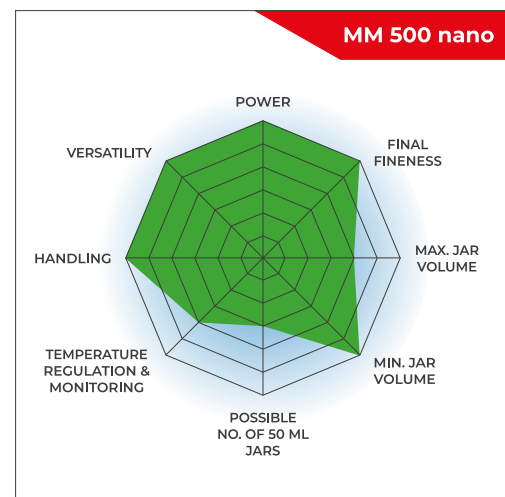
MM500 nano????????????????????????????????????2 x 45ml?????????????  
????????????????????35Hz????????????????????MM500nano?????????????  
99???????????????????????????????????????MM500 nano????????????????  
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高速球磨仪,操作方便,实验结果极佳

- | 最大频率35赫兹
- | 水平振荡对样品处理效果有很大的影响
- | 最大进料尺寸10毫米,最终出料粒度可达0.1微米（受样品材料性质和仪器配置/设定的影响而定）
- | 2个研磨工作位，可容纳2毫升至125毫升的研磨罐，适配器可容纳18 x 2毫升一次性样品瓶
- | 不锈钢研磨罐可以在液氮浴中手动预冷，将升温效果降至最低
- | GrindControl套装可测量研磨罐内温度和压力
- | RETSCH可提供通气顶盖，用于球磨罐中保持特殊气氛的应用
- | ??????????????????????????????????????????????????????????????????
- | ??????????????????????????????????????????????????????????????????



## 设计优势

- | 夹紧和操作研磨罐非常简单、舒适，压力密封可达 5 巴
- | 罐子可以保持夹紧，同时采取子样本或细度目视检查
- | 符合人体工学的触摸屏设计，便于参数设置
- | 12个SOP程序和4个程序序列，最多可重复99次，以便于日常应用

## 灵活性

- | 同样适用于小于2min的快速粉碎，以及长达99h的长期研磨。
- | 在高冲击模式下使用一个大研磨球，在高摩擦模式下使用一些更小研磨球
- | 将MM 500 nano用于常规样品制备应用、纳米研磨或机械化学和机械合金化等研究应用

MECHANOCHEMISTRY IN THE PHARMACEUTICAL INDUSTRY

## SUSTAINABLE PRODUCTION OF ACTIVE PHARMACEUTICAL INGREDIENTS WITH MAXIMUM EFFICIENCY

Discover how mechanochemical methods can contribute to the production of active pharmaceutical ingredients—with higher atomic efficiency, fewer byproducts, and a significantly reduced environmental footprint.

Mechanochemistry opens up new avenues for more sustainable chemical synthesis: By utilizing mechanical energy, reactions can be carried out in the solid state—often with no solvents at all or only minimal use of solvents. This reduces waste, lowers energy consumption, and simultaneously improves process efficiency.

Vibrating mills such as the MM 500 nano enable precise control of grinding parameters and are particularly suitable for fast, efficient syntheses on a laboratory scale. For more demanding applications requiring higher energies, the planetary ball mill PM 100 offers optimal conditions for carrying out even complex reactions in a targeted manner.

Take a look!



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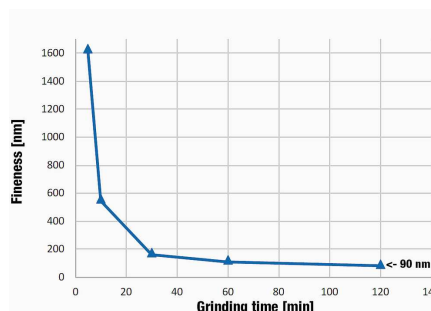
Courtesy of Clara B. Gomez, LAQV  
REQUIMTE

### 高能纳米球磨仪 MM 500 NANO 研磨尺寸在纳米范围内

- | 新的研磨罐设计可优化研磨罐容积的使用，也可用于湿磨
- | 由于在35 Hz下最大化的能量输入，最终细度<100 nm是可能的
- | 升温效应较小，因此研磨通常可以在不需要研磨间歇的情况下进行冷却

结果：你可以在最短的时间内得到你的纳米样品。

#### 二氧化钛的无冷却间歇的纳米研磨



在125 ml氧化锆研磨罐中用275 g 0.1 mm氧化锆研磨球，30 ml 1%NaPO<sub>4</sub>溶液对25 g二氧化钛进行纳米研磨。研磨120分钟后，颗粒尺寸达到90纳米。

高能纳米球磨仪 MM 500 NANO  
各种配件以提供最大的灵活性



**研磨罐有三种材质**

可用的研磨罐尺寸有 50 毫升、80 毫升和 125 毫升，材料包括不锈钢、碳化钨和氧化锆，可确保无污染地制备样品。



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**通气盖 (视频)**

RETSCH为研磨罐提供了一种特殊的通气盖，设计用于在球磨罐中保持特殊气氛的应用。



**GRINDCONTROL**

GrindControl 可测量罐内的温度和压力。该系统包括一个传感器和传输装置以及一个分析软件。

## 多腔罐和适配器

使用多腔罐和反应瓶适配器可以同时处理多个小样品。例如，这是制药、化学和生物化学应用的典型要求。小腔罐为涉及少量化学品的机械化学研究活动提供了新的机会。罐中的空腔呈椭圆形，可确保有效混合。倾倒辅助装置可以安全地处理样品。该适配器最多可容纳 18 个 1.5 或 2.0 毫升的一次性反应瓶（如 Eppendorf 反应瓶）或 9 个 2.0 毫升的钢管。通过两个研磨站，MM 500 纳米混合研磨机现在可以在一次工作运行中处理多达 36 个样品。如果样品需要冷冻或加热，则应使用 2.0 ml 钢管，因为聚合物反应容器在极端温度下无法承受机械负荷；



4 x 10 毫升和 2 x 25 毫升的多腔罐，不锈钢制成，包括聚四氟乙烯助倒器。



适配器，用于 18 x 2 毫升安全锁反应瓶或 9 x 2 毫升钢管，铝制



高能纳米球磨仪 MM 500 NANO

## 作用原理

MM500 nano????????????????????????????????????  
????????????????????????????????????????????????  
????????????



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## 技术参数

|                              |                                                                                                               |
|------------------------------|---------------------------------------------------------------------------------------------------------------|
| 应用                           | 机械化学、机械合金、细粉碎、混合、均质化、低温研磨                                                                                     |
| 应用领域                         | 农业, 化学 / 合成材料, 医药品, 地质 / 冶金, 工程/电子, 建筑原料, 环境 / 资源回收利用, 玻璃/ 陶瓷, 生物, 食物                                         |
| 样品特征                         | 硬的, 中硬性, 软性的, 脆性的, 弹性的, 含纤维的                                                                                  |
| 粉碎原理:                        | 撞击力, 摩擦力                                                                                                      |
| 最大进样尺寸                       | <= 10 mm                                                                                                      |
| 最终出料粒度 *                     | ~ 0.1 µm                                                                                                      |
| 批次加料量*                       | 最大2 x 45 ml                                                                                                   |
| 研磨平台数 (可接纳研磨罐数)              | 2                                                                                                             |
| <b>Vibrational frequency</b> | 3 - 35 Hz (180 - 2100 min <sup>-1</sup> )                                                                     |
| 典型粉碎时间                       | 30 s - 2 min                                                                                                  |
| 干磨                           | 是                                                                                                             |
| 湿磨                           | 是                                                                                                             |
| 低温研磨                         | 是                                                                                                             |
| 细胞破碎适配器                      | 无                                                                                                             |
| 研磨罐种类                        | screw-lock jar with integrated safety closure devices, multi cavity jar, adapter for safe-lock reaction vials |
| 研磨套件材料:                      | 硬质刚, 不锈钢, 碳化钨, 氧化锆                                                                                            |
| 研磨罐尺寸                        | 10 ml / 25 ml / 50 ml / 80 ml / 125 ml                                                                        |
| 粉碎时间设定                       | digital, 10 s - 8 h                                                                                           |
| 总研磨时间:                       | 99 h                                                                                                          |
| 可存储运行模式                      | 12                                                                                                            |
| 可存储循环程序数量:                   | 4 (最大重复次数99)                                                                                                  |
| 电源数据:                        | 100-120 V, 50/60 Hz; 200-230 V, 50/60Hz                                                                       |
| 电源接头:                        | 单相                                                                                                            |
| 防护类型                         | IP 30                                                                                                         |
| 接受功率                         | 750瓦                                                                                                          |
| 机体尺寸 (宽x高x纵深)                | 690 x 375 x 585 mm                                                                                            |
| 净重                           | ~ 60 kg                                                                                                       |
| 标准                           | CE                                                                                                            |

受样品材料性质和仪器配置/设定的影响

[www.retsch.cn/mm500-nano](http://www.retsch.cn/mm500-nano)

## ORDER DATA

### 冷冻混合型球磨仪MM 500 NANO

**Mixer Mill MM 500 nano with quick release clamp**  
(please order grinding jars and balls separately)

20.765.0003  MM 500 nano 200–230 V, 50/60 Hz

20.765.0004  MM 500 nano 100–120 V, 50/60 Hz

### SCREW-LOCK GRINDING JARS MM 500 CONTROL/NANO

#### 淬火钢

01.462.0463  50毫升

01.462.0468  80毫升

01.462.0470  125毫升

#### 不锈钢

01.462.0447  50毫升

01.462.0467  80毫升

01.462.0420  125毫升

#### 碳化钨

01.462.0466  50毫升

01.462.0479 80毫升



#### 氧化锆

01.462.0464 50毫升



01.462.0417 80毫升



01.462.0471 125毫升



## MULTI CAVITY GRINDING JARS MM 500 CONTROL/NANO

01.462.0537 4 x 10 ml, 1.4112 stainless steel, incl. 3 pouring aids



22.462.0014 Pouring aid for 10 ml Multi cavity jar



01.462.0536 2 x 25 ml, 1.4112 stainless steel, incl. 1 pouring aid



22.462.0015 Pouring aid for 25 ml Multi cavity jar



## ACCESSORIES FOR GRINDING IN 1.5 OR 2 ML VIALS

22.008.0012 Adapter made of aluminum for 18 x 2.0 ml / 1.5 ml Safe-lock reaction vials or 9 x 2.0 ml reaction vials made of stainless steel 316L



22.749.0001 2.0毫升安全试管，1000件



22.749.0002 1.5毫升安全试管，1000件



22.749.0008 Reaction vials made of stainless steel 316L, 2.0 ml, 10 pcs.



## ACCESSORIES FOR GRINDING UNDER INERT ATMOSPHERE

## AERATION LID FOR SCREW-LOCK GRINDING JARS

**incl. o-rings and sintered filter (please order lid insert and grinding jar separately)**

|             |                                                 |
|-------------|-------------------------------------------------|
| 22.107.0638 | Aeration lid for screw-lock grinding jars 50ml  |
| 22.107.0639 | Aeration lid for screw-lock grinding jars 80ml  |
| 22.107.0640 | Aeration lid for screw-lock grinding jars 125ml |

## LID INSERT FOR SCREW-LOCK GRINDING JARS

|             |                                                                         |
|-------------|-------------------------------------------------------------------------|
| 03.474.0258 | Aeration lid insert for screw-lock grinding jars 50ml, stainless steel  |
| 03.107.0570 | Aeration lid insert for screw-lock grinding jars 50ml, zirconium oxide  |
| 03.474.0131 | Aeration lid insert for screw-lock grinding jars 50ml, tungsten carbide |
| 03.474.0259 | Aeration lid insert for screw-lock grinding jars 80ml, stainless steel  |
| 03.474.0166 | Aeration lid insert for screw-lock grinding jars 80ml, zirconium oxide  |
| 03.474.0167 | Aeration lid insert for screw-lock grinding jars 80ml, tungsten carbide |
| 03.474.0260 | Aeration lid insert for screw-lock grinding jars 125ml, stainless steel |
| 03.107.0565 | Aeration lid insert for screw-lock grinding jars 125ml, zirconium oxide |

## ACCESSORIES FOR AERATION LIDS FOR SCREW-LOCK GRINDING JARS

|             |                                                                                     |                                                     |
|-------------|-------------------------------------------------------------------------------------|-----------------------------------------------------|
| 05.114.0057 |  | O-ring for screw-lock grinding jars 50 ml, 1 piece  |
| 05.114.0158 |                                                                                     | O-ring for screw-lock grinding jars 80 ml, 1 piece  |
| 05.114.0122 |  | O-ring for screw-lock grinding jars 125 ml, 1 piece |
| 22.186.0007 |                                                                                     | Sintered filter with O-ring, set of 10 pieces       |
| 22.864.0001 |  | Valve set M8x1 for GrindControl and aeration lids   |

## ACCESSORIES FOR GRINDING JARS MM 500 CONTROL/NANO

|             |                                |
|-------------|--------------------------------|
| 22.486.0006 | Grinding jar stabilization pad |
| 02.486.0050 | Jar wrench for grinding jars   |

05.114.0057



O-ring for grinding jars 50 ml, 1 piece

05.114.0158

O-ring for grinding jars 80 ml, 1 piece

05.114.0122



O-ring for grinding jars 125 ml, 1 piece

## ACCESSORIES FOR COLD GRINDING MM 500 CONTROL/NANO

22.354.0003 Cryo kit for cooling the grinding jars with liquid nitrogen (incl. insulated container 4-liter, 2 grinding jar holders, 1 pair of safety glasses)

## ACCESSORIES MM 500 CONTROL/NANO

05.114.0197 O-ring PTFE for grinding jars 50 ml, 1 piece, for cryogenic grinding

05.114.0196 O-ring PTFE for grinding jars 80 ml, 1 piece, for cryogenic grinding

05.114.0195 O-ring PTFE for grinding jars 125 ml, 1 piece, for cryogenic grinding

05.114.0207 O-ring for multi cavity jars, 4 x 10 ml, 1 piece

05.114.0208 O-ring for multi cavity jars, 2 x 25 ml, 1 piece

05.114.0212 O-ring for multi cavity jars, 4 x 10 ml, 1 piece, for cryogenic grinding

05.114.0213 O-ring for multi cavity jars, 2 x 25 ml, 1 piece, for cryogenic grinding

99.200.0034 IQ/OQ Documentation for MM 500 nano

## PRESSURE AND TEMPERATURE MEASURING SYSTEM GRINDCONTROL FOR MIXER MILLS

**incl. sensors and transmitter unit, case, opening aid and cleaning accessories for MM 500 control / nano / Emax (please order lid insert and grinding jar separately)**

22.782.0032 GrindControl for MM 500 control/nano/Emax grinding jar 125 ml

03.474.0242 GrindControl lid insert for MM 500 control/nano and Emax grinding jar 125 ml, stainless steel

03.474.0245 GrindControl lid insert for MM 500 control/nano and Emax grinding jar 125 ml, zirconium oxide

## ACCESSORIES FOR MM 500 CONTROL/NANO GRINDCONTROL

05.114.0122  O-ring for 125 ml grinding jars (MM 500 control/nano and Emax)

22.186.0007 Sintered filter with O-ring, set of 10 pieces

22.864.0001  Valve set M8x1 for GrindControl and aeration lids

## GRINDING BALLS

### 淬火钢

05.368.0029  直径5毫米

05.368.0030  直径7毫米

05.368.0059  直径10毫米

05.368.0032  直径12毫米

05.368.0108  直径15毫米

05.368.0033  直径20毫米

### 不锈钢

22.455.0010  2 mm Ø, 500 g (approx. 110 ml)

22.455.0011  3 mm Ø, 500 g (approx. 120 ml)

22.455.0002  3 mm Ø, 200 pieces (approx. 6 ml)

22.455.0003  5 mm Ø, 200 pieces (approx. 25 ml)

05.368.0034



直径5毫米

05.368.0035



直径7毫米

05.368.0063



直径10毫米

05.368.0037



直径12毫米

05.368.0109



直径15毫米

05.368.0062



直径20毫米

05.368.0105



直径25毫米

#### 碳化钨

05.368.0038



直径5毫米

05.368.0039



直径7毫米

05.368.0071



直径10毫米

05.368.0041



直径12毫米

05.368.0110



直径15毫米

05.368.0070



直径20毫米

#### 氧化锆

32.368.0005



直径0.1毫米, 0.5千克 (约135毫升)

|             |                                                                                     |                                    |
|-------------|-------------------------------------------------------------------------------------|------------------------------------|
| 32.368.0003 |    | 直径0.5毫米, 0.5公斤 (约135毫升)            |
| 32.368.0004 |    | 直径1毫米, 0.5公斤 (约135毫升)              |
| 05.368.0089 |    | 直径2毫米, 0.5公斤 (约135毫升)              |
| 05.368.0090 |    | 直径3毫米, 0.5公斤 (约140毫升)              |
| 22.455.0007 |    | 3 mm Ø, 200 pieces (approx. 6 ml)  |
| 22.455.0009 |    | 5 mm Ø, 200 pieces (approx. 25 ml) |
| 05.368.0146 |                                                                                     | 直径7毫米                              |
| 05.368.0094 |   | 直径10毫米                             |
| 05.368.0096 |  | 直径12毫米                             |
| 05.368.0113 |  | 直径15毫米                             |