



Solutions in Milling & Sieving

Sample preparation for rheology, thermal and composition analysis

Sample Preparation of Polymers and Plastics

Manufacturers of polymers and plastics all over the world use products from RETSCH when it comes to sample preparation tasks. From the inspection of raw materials, quality control of finished and semi-finished products such as preforms or polystyrene beads to the recycling of production waste, RETSCH's mills and crushers as well as the sample dividers are the products of choice. The name RETSCH stands for high quality products with superior technical features – and dedicated, individual application consultation for our customers. Put us to the test!



Cutting Mill SM 300



Ultra Centrifugal Mill ZM 200



CryoMill



Mixer Mill MM 400 with CryoKit



Sample Dividers



Sieve Shakers / Particle Sizers



Retsch®

Solutions in Milling & Sieving

For optimum quality control

Within the RETSCH range of mills and grinders there is a specialist for every application. But what they have in common is that they produce a perfectly homogeneous, unaltered and uncontaminated sample so that the subsequent analysis is always trustworthy and meaningful. If you require professional solutions that combine high performance, ease of use, a maximum of operational safety and a long lifetime, then RETSCH's equipment is your only choice!

Powerful preliminary and fine size reduction of plastics

CUTTING MILL SM 300

- Powerful size reduction thanks to 3 kW drive with high torque and RES technology
- Thermal load can be reduced thanks to variable speed from 700 to 3,000 rpm
- Sample can be pre-cooled with dry ice or LN₂
- Optimum cutting effects thanks to double acting cutting bars
- Quick and easy cleaning due to fold-back hopper, smooth surfaces and push-fit rotor
- Defined final fineness due to bottom sieves with aperture sizes from 0.25 - 20 mm
- Wide range of accessories including various hoppers, collection systems, rotors and sieves

www.retsch.com/sm300



Cutting Mill SM 300 with Cyclone-Suction-Combination



SM 100
the budget-priced basic model for routine applications



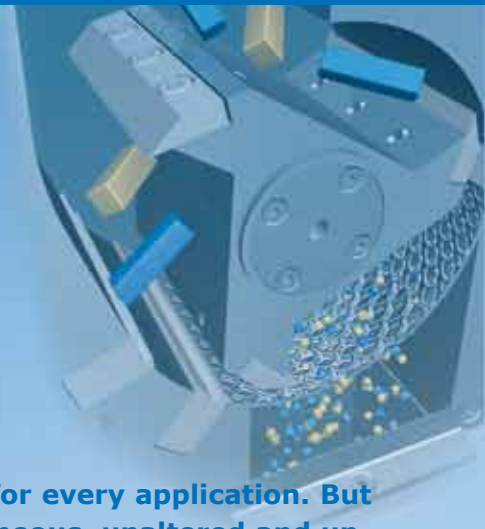
SM 200
the versatile standard model which covers a wide range of applications



SM 300
the high performance model with variable speed which processes even the most difficult materials



Parallel section rotor or 6-disc rotor selectable



APPLICATION EXAMPLES

Plastic preforms

Task



Feed size: 0 – 150 mm
Feed quantity: 240 g (40 g fine grinding)
Material specification: hard brittle
Customer requirement: < 500 µm
Subsequent analysis: Microwave digestion

Solution



Pre-grinding with Cutting Mill SM 300
(6-disc rotor, stainless steel; bottom sieve, square holes 6 mm, stainless steel; universal hopper; speed: 2,400 rpm)

Fine grinding with Ultra Centrifugal Mill ZM 200
(Push-fit rotor, 12 teeth, stainless steel; ring sieve, trapezoid holes 1 mm, stainless steel; speed: 18,000 rpm)

Remark: The material can be fed into the mills after embrittlement with liquid nitrogen

Achieved result: < 500 µm



Plastic bricks

Task



Feed size: 40 mm
Feed quantity: 30 g
Material specification(s): elastic, temperature sensitive
Customer requirement: < 500 µm
Subsequent analysis: Microwave digestion + AAS

Solution



Pre-grinding with Cutting Mill SM 300
(6-disc rotor, stainless steel; bottom sieve, square holes 8 mm, stainless steel; universal hopper; speed: 2,000 rpm)

Fine grinding with CryoMill
(Grinding jar, 50 ml, stainless steel; grinding ball, 25 mm Ø, stainless steel; frequency 25 Hz, auto-cooling, grinding time: 2 x 2 min. with 1 min. intermediate cooling)

Achieved result: < 500 µm



Fine grinding of larger quantities of plastics

ULTRA CENTRIFUGAL MILL ZM 200

- High-throughput processing of samples
- Temperature-sensitive samples can be ground with dry ice or pre-cooled with LN₂
- Large ring sieve allows for quick sample processing
- Option for load-controlled automatic feeder
- Cyclone separator for 230 ml to 4.5 l sample material.
- Optional dust extraction for optimum material discharge
- Heavy-duty "Powerdrive"
- Speed range 6,000 rpm to 18,000 rpm

www.retsch.com/zm200

Fine grinding at -196 °C to preserve volatile components

MIXER MILL MM 400 WITH CRYOKIT

- Cost-efficient cryogenic grinding
- Low consumption of LN₂
- Two grinding stations for jars up to 50 ml
- Safe and convenient handling

www.retsch.com/mm400



CRYOMILL

- Automatic, efficient cryogenic grinding at -196 °C
- Closed LN₂-system (Autofill) for enhanced safety, avoids any contact of the user with LN₂
- Outstanding efficiency with high frequency impact ball milling at 30 Hz
- Programmable cooling and grinding cycles
- Highly reproducible grinding results
- One grinding station for screw-top grinding jars up to 50 ml for leak-proof operation

www.retsch.com/cryomill



Ultra Centrifugal Mill
ZM 200

CryoMill



Plastic – one material with many variations

Thanks to the almost unlimited variety of plastics, their fields of application are huge. Abbreviations such as PE, PET, PC, PP, PBT or ABS not only describe a simple material but a whole class of products with many different characteristics. Depending on the intended use, plastic needs to be, for example, impact-resistant, break-proof, heat-resistant or solvent-resistant.

The material is submitted to various tests in order to ascertain its suitability for a particular process. Tested properties of plastics include, among others, extrusion behavior (melt index: MFR, MVR), or melting point and glass transition via Differential Scanning Calorimetry (DSC) or Thermo-Mechanical Analysis (TMA). Another common test is analyzing additional components in plastics - such as antimony and acetaldehyde in PET bottles or plasticizers in PVC films.

To ensure reproducible analysis results, it is necessary to obtain an adequately pulverized sample. With a homogeneous original material such as plastic, the purpose of sample preparation is to achieve the grind size required for the subsequent analysis.

The **Ultra Centrifugal Mill ZM 200** is particularly suitable for grinding plastic granules and achieves grind sizes typically between 500 microns and 100 microns in a very short time. Cryogenic processing of plastic is recommended due to its usually low glass transition point and elasticity. The sample is first embrittled with liquid nitrogen and then fed directly into the mill. Using a 0.5 mm ring sieve typically yields particle sizes of less than 300 microns which is sufficient for most analyses. Accessories such as a distance sieve or a cyclone further reduce the heat generated by the grinding process and improve material discharge. In this configuration, sample quantities of up to 4.5 liters are feasible. If the plastic material is rather brittle and insensitive to heat, it is also possible to use a 0.25 mm sieve, thus achieving grind sizes of 100 microns and below. Now a sample can be extracted and submitted to the tests described before.



before



after

Plastic figures before and after grinding in an Ultra Centrifugal Mill ZM 200.



RETSCH offers the widest range of particle sizing equipment worldwide covering a size range from 1 µm to 125 mm

- Maintenance-free, low-noise, precise electromagnetic sieve shakers in various sizes, for sieves 100 – 450 mm diameter
- Tap Sieve Shaker for standard applications
- Air Jet Sieving Machine for sieve cuts of powdered substances
- High quality analytical test sieves according to ISO standards
- Evaluation software EasySieve®
- Particle size and particle shape analysis with Dynamic Image Analysis

www.retsch.com/sieving

To increase the efficiency in the laboratory RETSCH offers a complete product range for perfect results

- Representative Sample Dividers for precise particle size analysis
- Equipment for professional maintenance of the test sieves

www.retsch.com/assisting

FREE TEST GRINDING

As part of RETSCH's professional customer support we offer our customers the individual advice required to find the optimum solution for their sample preparation task. To achieve this our application laboratories process and measure samples free-of-charge and provide a recommendation for the most suitable method and instrument.

For more information please visit our website www.retsch.com/testgrinding

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