



POLYMER PROCESSING

FINE GRINDING OF POLYMERIC & HEAT SENSITIVE MATERIALS



HOSOKAWA MICRON GROUP

Process Technologies For TomorrowSM

POLYMER PROCESSING TECHNOLOGIES

The manufacture of polymer products is increasingly becoming a genuine challenge since the trend is moving towards finer products to benefit many applications. In addition to limiting particle size distribution, dedusting and screening is often required. To achieve these finer results, you need specialists like us from Hosokawa.

The Hosokawa Micron Group provides the plastics industry with a wide range of size reduction process technologies and equipment for polymeric and heat sensitive materials. Typical applications include impact mills, cutting mills, and granulators, all with cryogenic options.

SUITABLE FOR PLASTICS, POLYMERS & FIBROUS MATERIALS

Common Materials Processed	Industries Served
High Density Polyesthylene (HDPE)	Medical
Low Density Polyethylene (LDPE)	Automotive
Polycarbonate (PC)	Airline & Aerospace
Polypheylene Sulfide (PES)	Marine
Polyetherketoneketone (PEKK)	Electrical & Electronics
Polyetheretherketone (PEEK)	Industrial Coatings
Polyvinylidene Fluoride (PVDF)	Sports Equipment
Liquid Crystal Polymer (LCP)	Building Materials
Polyetherimides (Nylon)	Recycling
Polypropylene (PP)	Packaging
Polystyrene (PS)	Appliances
Polyvinyl Alcohol (PVOH)	Textiles
Polyethylene Teraphthalate (PET)	Consumer Products
Acrylonitrile Butadiene Styrene (ABS)	Food
Polyvinyl Chloride (PVC)	3D Printing
Ethylene Vinyl Acetate (EVA)	Rotational Molding
Nitrile Rubber (NBR)	Chemical Recycling
Ethylene Propylene Diene Monomer Rubber (EPDM)	Pyrolysis Recycling
Thermoplastic Polyurethane (TPU)	
Polyurethane (PU)	
And Many Others	



DESIGNED, MANUFACTURED & ASSEMBLED IN THE USA

Hosokawa equipment comes with our pledge of performance and guaranteed dependability. All components are inspected and tested to ensure they meet our strict standards before being shipped to our customers. A majority of Mikro® brand milling and processing equipment sold by Hosokawa Micron Group is engineered and built in the USA.

THE NEXT STEP IN MILLING EVOLUTION

THE MIKRO® V-UMP MILL

is a vertical shaft, high speed cutting mill designed for the fine size reduction of plastics, polymers and fibrous materials that do not respond well to other forms of impact milling. This unique mill design allows for interchangeable rotor configurations depending on the fineness required and was developed to grind heat sensitive and soft materials without liquid nitrogen or conditioned air.

The V-UMP is the next step in the evolution of the Mikro® UMP Attrition Mill by providing the same grind as a rigid rotor setup while adding the flexibility of converting to a pin mill for fine size reduction.



Mikro V-UMP Model	V-UMP 2	V-UMP 15	V-UMP 40	V-UMP 75
HP	2	15	40	75
Scale Factor	N/A	1	2.5	5
Air Flow - SCFM	50	500	1300	2250

OPERATION:

Raw material enters the grinding zone from a feeding device through the centrally located feed inlet. Size reduction takes place between the adjustable stator plate and high-speed rotating grinding plate. The particle size is reduced as the raw feed passes through the tapered plates, which has a wider gap at the center of the plates where the material is introduced, and has the tightest gap at the periphery of the plate where material exits. The finely ground product exits the grinding zone and discharges into the evacuation system and collection. Essentially, the fineness of the product is dictated by the number of teeth on the plates, rotational speed of the rotor, as well as the gap between the plates.

DESIGN & FEATURES:

- › Pin or Attrition rotor options
- › Can process heat sensitive materials
- › Compact design, low profile design with Vertical Drive
- › Sizes available from 2 HP to 75 HP
- › Process 5 lb/h up to 3,000 lb/h
- › Capable of ultra-fine milling down to $d_{97} < 75 \mu\text{m}$
- › More energy efficient than other polymer milling systems
- › Variable speed rotor drive with tip speeds up to 150 m/s
- › Three (3) access ports to facilitate rotor gap adjustment
- › Adjustable rotor plate gap
- › Fabricated stainless-steel construction
- › Dust-free operation
- › Cryogenic option for more difficult to grind materials
- › Variety of system configurations

DESIGN & COMPONENTS

GRINDING CHAMBER:

The standard mill is constructed in 304 stainless steel with a highly cleanable finish. Higher quality finishes are available for specialty applications. The top cover is easily removed and allows for quick access and inspection to the mill interior. The high-speed bearing housing includes maintenance free, sealed for life bearings.



ATTRITION PLATE ROTOR:

Hosokawa's attrition plates are uniquely engineered to finely grind heat sensitive materials, and in many cases, without cooling gas or liquid nitrogen. The serrated teeth of the rotating and stator plates create shear forces that cut materials into fine powders with a narrow particle size distribution. The plates are highly durable and can be easily resharpened to maintain high performance.



PIN DISC ROTOR:

The pin disc assembly includes a stationary pin disc mounted to the inside door cover. The door and stationary pin disc can be provided as one single piece, if required for a specific application. A rotating pin disc rotor is mounted to the main drive shaft of the mill. During rotation the interlacing pins create a labyrinth the product has to pass through — providing ultra fine size reduction through a high number of impacts the feed has with the pins. At high speed, the Mikro® V-UMP Pin Mill can process materials to a top size of 35 microns or even finer in certain applications.

SYSTEM DESIGN OPTIONS

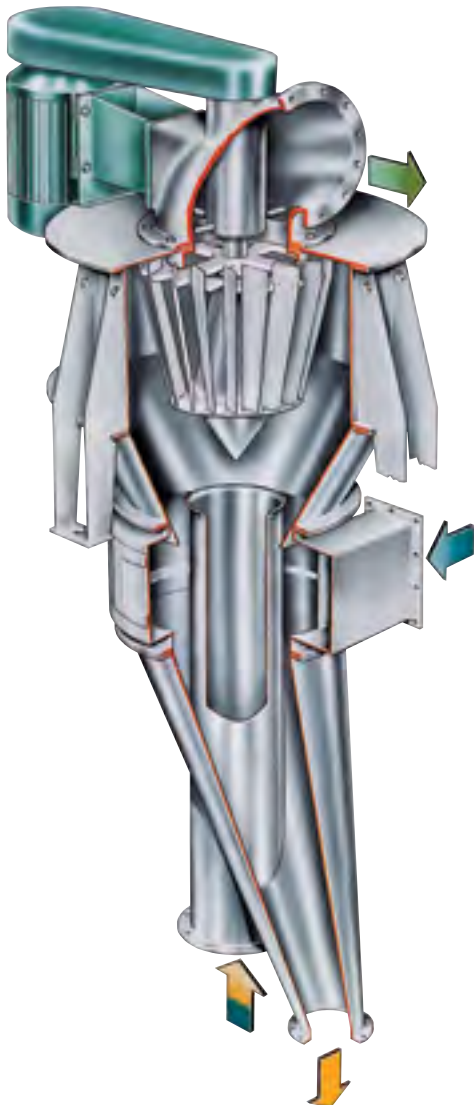
CRYOGENIC COOLING SCREW CONVEYORS:

The Cryogenic Cooling Screw Conveyors compliment our wide selection of pulverizers. Our conveyors are available in 304SS and 316SS construction with a quick and easily removable screw design for complete screw driving cleaning. The conveyors offer continuous feeding to accommodate many heat sensitive applications and are fully insulated, resulting in the highest efficiencies.



GRANULATOR:

We offer many sizes and models of granulators (cutting mills) for tough applications requiring shear and low heat. HDPE, PVC, PP, Rubbers, Films, Bottles, Recycling are where our granulators offer superior size reduction performance. Hosokawa designed three types of cutting geometry for our granulators; Double Angle Cut, Chevron Cut and patented Cross Scissor Cut. These have specific advantages that result in tight knife gaps, low heat generation and a high efficiency of size reduction. We also offer different cutting chamber geometries which can be utilized for films, large voluminous parts or other post-consumer applications. Hosokawa's granulators are designed to be easy to use, protect against wear, and operate 24/7.



MICRON SEPARATOR AIR CLASSIFIER

The Micron Separator Air Classifier is a mechanical centrifugal air classifier, using "flow through" technology, providing precise, efficient, and reliable separations of materials. The Micron Separator is unique in the field of fine particle classification as it can be retrofitted to many popular grinders, such as the Mikro® V-UMP and UMP Mill.

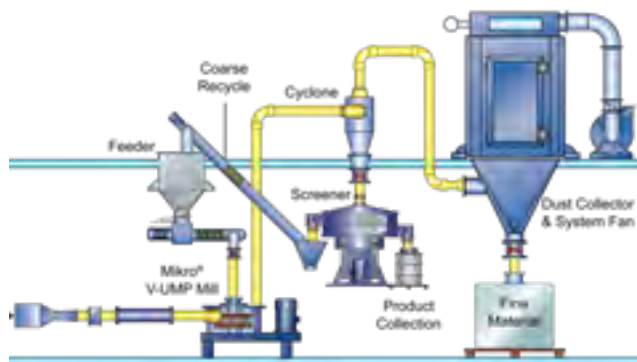
This machinery classifies particles by balancing the centrifugal force of the rotor and the centripetal force of the air. Material to be separated is conveyed into the classifier through the inlet duct and directed up to the rotor, where the two opposing forces classify it. Finer particles, more susceptible to centripetal forces, are carried on the air current through the rotor and then discharged through the upper outlet duct. Coarser particles, more susceptible to centrifugal force, flow down the inside of the wall of the machine and go out the coarse particle discharge. Since the rotor speed determines the centrifugal force, particle size can easily be adjusted by changing the rotor speed.

The Micron Separator is unsurpassed with its sharp cut points, broad applications, boosted productivity when paired with a grinding unit, and precise classifications of even the finest particles.

SYSTEM CONFIGURATIONS

MULTIPLE SYSTEM OPTIONS ARE AVAILABLE TO FURTHER ENHANCE THE PERFORMANCE AND FLEXIBILITY OF THE MIKRO® V-UMP MILL.

V-UMP Mill with Screener



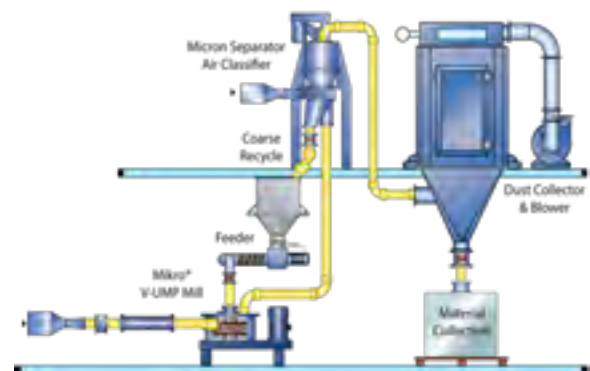
Hosokawa can install a cyclone and a screener in-line with your V-UMP Mill for material separation and collection, preventing oversized particles and ensuring the powder top size.

Coarse Grinding System



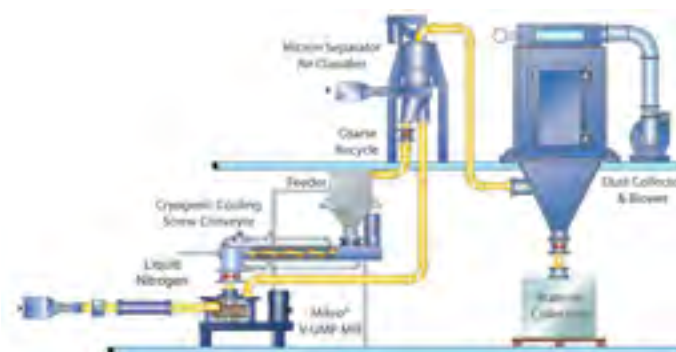
Complete size reduction and recycling from 12mm to below 1mm with Hosokawa's combined granulator and V-UMP attrition milling. This efficient technology allows recycling of PVC, HDPE, Nylon, Rubbers, and other similar materials.

V-UMP Mill with Air Classifier



Hosokawa's V-UMP Milling systems can incorporate our high-efficiency air classifiers for applications where ultra-fine grinding is required, providing extremely tight particle size distributions and the ability to make a fine and coarse end product.

Cryogenic Fine Grinding system



This system configuration allows for a Cryogenic Cooling Screw Conveyor to be used. It is designed for heat sensitive applications, which will allow liquid nitrogen to be used with the feed. This makes the feed brittle and easier to grind into a powder. Perfect for 3D printing materials.

RELIABLE PROCESS EQUIPMENT FOR A WIDE RANGE OF POLYMER APPLICATIONS



Mikro® UMP Universal Milling System – Pilot Scale Model

THE MIKRO® UMP UNIVERSAL MILLING SYSTEM

is a compact, high speed impact mill capable of coarse granulation or fine size reduction with interchangeable rotor configurations. The UMP provides the same grind as the Mikro Pulverizer® hammer & screen mill while adding the flexibility of converting to a pin mill for fine size reduction or a rigid rotor for coarse granulation.

DESIGN & FEATURES:

- › Capable of ultra-fine grinding to D97 = 35 µm
- › Lab & production models available with 1 HP to 40 HP
- › Capacity ranges from 5 g/batch up to 3,000 lb/h
- › Suitable for polymers, plastics, pharmaceutical, food & chemical applications
- › Energy efficient & economical to operate
- › Designed for milling soft to medium-hard materials with a Moh's hardness of 4 or less
- › Fabricated stainless steel construction
- › Finishes available to 0.6 micron Ra
- › Variable speed rotor drive
- › Cantilevered design for easy cleaning & rotor changes
- › Maintenance free, sealed for life bearings
- › Double lip seals & gas purging between drive & process area
- › Compact design & dust free operation

OPTIONS & ACCESSORIES:

- › Gravity or pneumatic conveying discharge available
- › Wear protection options include stellite, tungsten carbide and other wear resistant materials
- › Cryogenic operation available
- › Different rotor options available
 - High Speed Pin rotor for ultra-fine milling
 - Hammer & screen configuration for fine milling
 - Low speed knife rotor for coarse granulation
- › Variety of feeding options and system configurations
- › Isolator installations available for high containment applications



Hammer & Screen Configuration

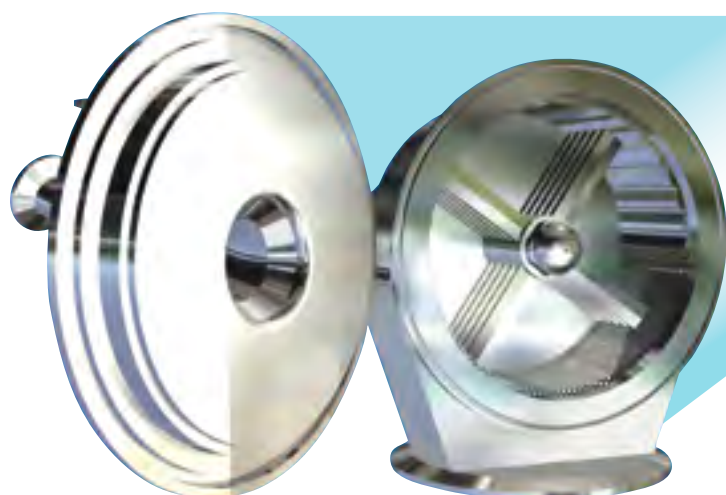
EASY OPERATION — SUPERIOR PERFORMANCE

OPERATION

The Mikro® UMP Universal Milling System utilizes the same design and operating principles perfected in the original Mikro Pulverizer® Hammer & Screen Mill.

The Mikro® UMP was developed to meet the increased market demand for high performance machines for multiple applications. An interchangeable grinding mechanism for flexible particle size distribution is a key feature to this machine's design.

Multiple feed and collection options further enhance the flexibility of the Mikro® UMP Universal Milling System across polymers, plastics, food, pharmaceutical, and chemical applications.



Model	UMP-B	UMP-1	UMP-2	UMP-3
HP	1.5	5-10	20	40
Hammer & Screen (LFS)				
Rotor RPM – Max	14,000	9,600	6,900	4,150
Scale Factor	-	1	4	8
Air Flow - SCFM Nom.	50	80	200	600
Pin Disc Rotor				
Rotor RPM – Max	27,000	18,000	12,000	9,000
Scale Factor	-	1	2	4
Air Flow - SCFM Max.	25	100	250	550

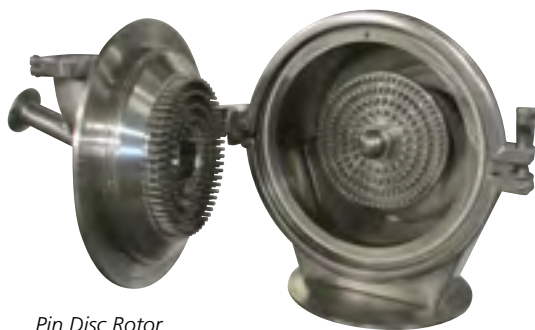
TRULY UNIVERSAL

DESIGN & COMPONENTS

Grinding Chamber – The fabricated grinding chamber is constructed in 316 stainless steel with a high quality 0.6 micron Ra finish. Higher quality finishes are available for specialty applications. The access door is hinged to the grinding chamber and is secured with a tri-clamp connection for easy and quick inspection and cleaning.

The bearing housing is a cantilevered design and includes maintenance free, sealed for life bearings. There are double lip seals and a gas purge between the drive and process areas to eliminate material contamination and premature wear to drive components.

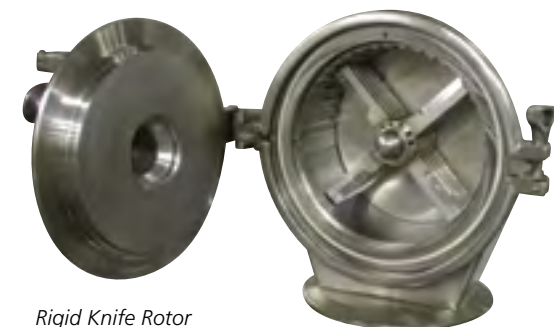
*Mikro® UMP
Universal Milling System
for pharmaceutical
applications*



Pin Disc Rotor



Hammer & Screen Configuration



Rigid Knife Rotor

ROTOR & GRINDING MEDIA OPTIONS

Pin Disc – A pin disc assembly includes a stationary pin rotor disc mounted to the inside door cover and a rotating pin disc mounted to the main drive shaft of the mill. The pins interlace creating a labyrinth for materials to pass through when rotating. The rotors have a one piece pressed pin design to provide for ease of cleaning. The high speed of the rotating pins makes this option capable of ultra-fine grinding to a D97 = 35 µm.

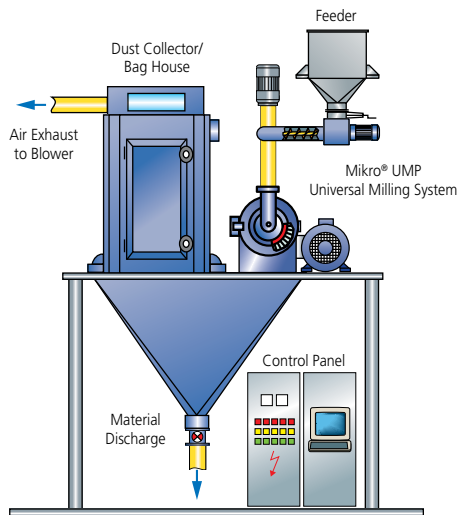
Hammer Rotor – This rotor produces the tightest particle size distribution of the Mikro® UMP grinding options. Material is pulverized by mechanical impact until the material is fine enough to discharge through the retaining screen. There are a variety of retaining screens and deflector liners available to produce the required size reduction and desired particle size distribution.

Rigid Knife – A fixed blade rigid rotor uses a cutting or impact force (depending on the orientation of the rotor) to reduce materials to coarse or granular powders. This option is well suited for large materials when a wider and coarse particle size distribution is necessary. There are a variety of retaining screens and deflector liners available to produce the required size reduction and desired particle size distribution.

SYSTEM CONFIGURATIONS

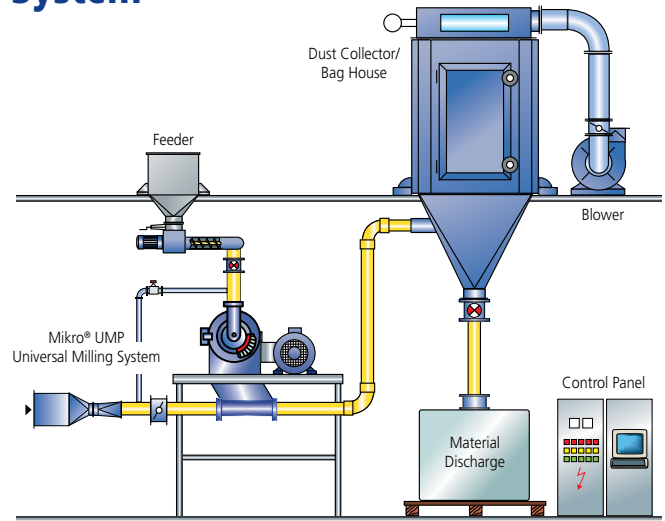
MULTIPLE SYSTEM OPTIONS ARE AVAILABLE TO FURTHER ENHANCE THE PERFORMANCE AND FLEXIBILITY OF THE MIKRO® UMP UNIVERSAL MILLING SYSTEM.

Gravity/Bunker System



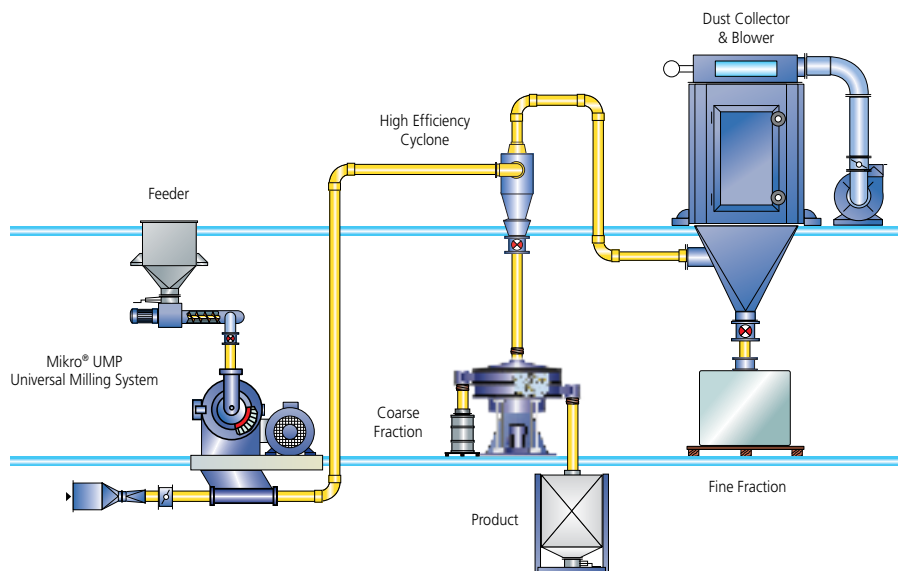
The Mikro® UMP Gravity/Bunker System is a simple and compact milling system designed for batch processing that requires minimal floor space.

Vacuum/ Pneumatic Conveying System



This system is designed for long batch or continuous processing. It requires less vertical space than the Bunker Configuration but uses more floor space.

Downstream Classification System



Hosokawa can install a cyclone or other air classifiers in-line with your Mikro® UMP Universal Milling System for materials separation and collection.

TEST CENTER & TOLL PROCESSING CAPABILITIES

LET US DO THE GRINDING FOR YOU!



Hosokawa's test and toll processing center has the ability to operate in a nitrogen inert atmosphere as well as cryogenically grind materials to very fine particle sizes. Our test center features equipment for R&D testing and larger production systems for scale-up evaluation. The center also features an adjacent analytical laboratory for material examination on a wide range of laboratory equipment.

The Hosokawa Micron group encourages our customers to participate in the testing and evaluation of their product. Hosokawa has a highly skilled team of application engineers

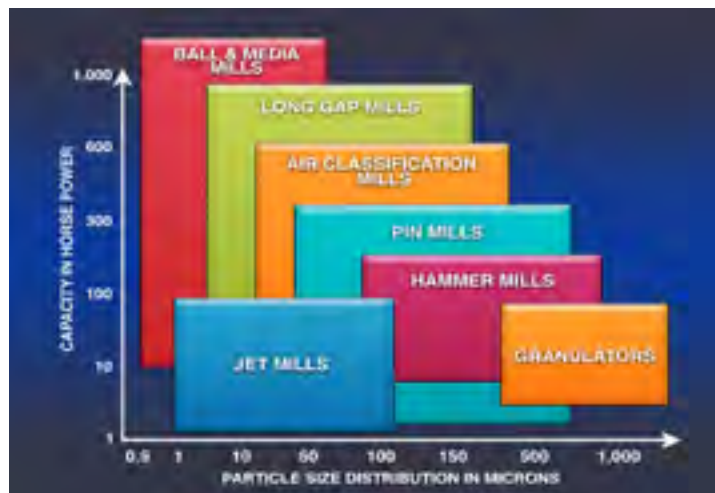
with decades of experience who can discuss your test results with you. We offer an extensive selection of process equipment for material trials and analysis.

The toll processing or Contract Manufacturing department at Hosokawa specializes in process and product development. Our team is comprised of highly experienced, professionally trained operators with extensive backgrounds in powder processing, equipment operation, and powder analysis and characterization. We can solve most processing requirements; offering equipment options designed for optimum output and performance. We can help you take your powder from the development stage into full production!

HOSOKAWA MILLING TECHNOLOGIES

HOSOKAWA MICRON POWDER SYSTEMS OFFERS A WIDE RANGE OF EQUIPMENT FOR COARSE GRANULATION TO ULTRA-FINE SIZE REDUCTION.

- Coarse Granulation to Ultra-fine Grinding
- Lab Scale to Large Production Models
- Air Classification Mills
- Jet Mills: Opposed Gun, Fluidized & Spiral
- Hammer & Screen Mills
- Pin & Universal Mills
- Pre-Crushers & Granulators
- Ball & Media Mills
- Attrition Mills
- Wet & Dry Grinding
- Dedusting Systems



PLENTY OF REASONS TO GIVE US A CALL



COMBINED ADVANTAGE

The Hosokawa Group has several technology centres, each expert in one or more specific powder processing technologies. Combining this knowledge gives you the benefit of having just one supplier and contact.



VAST EXPERIENCE

Hosokawa has decades of experience in providing solutions for polymer powder processing. We have references all over the world, including the biggest names in the industry.



R&D/TEST FACILITIES

Hosokawa has extensive research and test facilities in Summit, New Jersey, USA, perfectly outfitted to assist clients determining what the best system solution is for their specific process.



WORLDWIDE SERVICE

Hosokawa has a very responsive and smoothly operating service department. Our Service Team carries out repair and maintenance services onsite or in one of our fully-equipped workshops.

Hosokawa Micron Powder Systems and Hosokawa Polymer Systems are members of the Hosokawa Micron Group. We are a leading provider of equipment and systems for Size Reduction, Classification, Mixing/Blending, Drying, Particle Analysis, Compaction, Granulation, Containment, Filling/Weighing as well as a full line of laboratory and analytical equipment. We also provide Contract Manufacturing, Complete Aftermarket Services and OEM parts, Equipment Leasing, Refurbishing, Product Development Services and Educational Programming. We serve the Chemical, Mineral, Food, Pharmaceutical, Cosmetic and Plastic processing industries.



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HOSOKAWA MICRON POWDER SYSTEMS

Toll Free: (800) 526-4491

Fax: (908) 273-7432

Email: help@hmps.hosokawa.com

www.hmicronpowder.com

HOSOKAWA POLYMER SYSTEMS

Toll Free: (800) 233-6112

Fax: (860) 829-1313

Email: sales@hps.hosokawa.com

www.polysys.com

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