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Cleaning Test Center (CTC)
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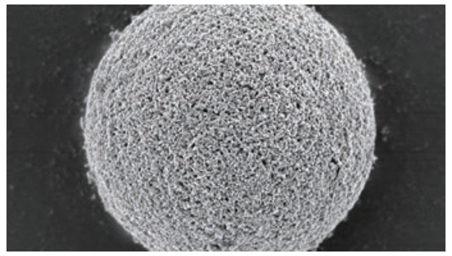
P Lab Website
https://www.preci.co.jp/en/ptc/

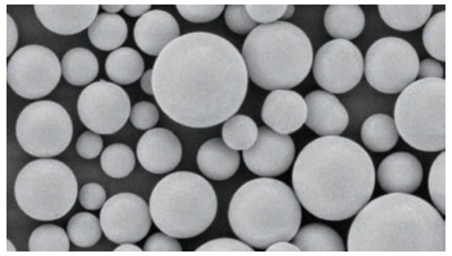
Facebook
https://www.facebook.com/preci.co.jp/

LinkedIn
https://jp.linkedin.com/company/preci-japan

PRECI

POWDER PROCESSING TECHNOLOGIES





CONTENTS

ABOUT US

LEARN MORE

PRECI is a process engineering company with multiple cutting-edge technologies. We have three technology portfolios: Powder Technology, Biotechnology, and Precision Cleaning Technology, and provide unique products and solutions based on our advanced technological background. We support sustainable development of the industries by creating superior processes that are highly efficient and considerate of energy consumption. Additionally, through strong partnerships with global users, distributors, suppliers, universities and research institutions, we are contributing to the development of new and value-added products and improved qualities in a wide variety of industries.

CORPORATE DATA

Company name
PRECI Co., Ltd.

Trademark
PRECi

Established
August 1, 2005

Capital
JPY 80,000,000

Group CEO
Hayato Kato

Products & Technologies

Powder technology
Spray dryers
Spray coolers (Spray congealers)
Freeze granulators (Spray freeze granulation dryers)

Biotechnology
Incubator shakers
Platelet shakers
High-pressure steam sterilizers

Precision cleaning technology
Aqueous cleaning systems
Solvent cleaning systems
Co-solvent cleaning systems

Testing, Contract processing & Analytical measurement services
Powder technology related processes
Precision cleaning technology related processes

Rental services
Powder technology related products
Biotechnology related products
Precision cleaning technology related products

Engineering services
Maintenance, repair, modification & renewal of existing processes
Productivity & quality improvement

Corporate creed
“以和為貴 (Wa wo motte totoshi to nasu)”
The quote by seventh-century Japanese statesman Prince Shotoku means “Harmony is to be valued”.

Corporate philosophy
“We are committed to contribute to the development of our society by designing and creating true values.”

Affiliated organizations
The Society of Chemical Engineers, Japan (SCEJ)
The Society of Powder Technology, Japan (SPTJ)
The Association of Powder Process Industry and Engineering, Japan (APPIE)
The Society for Biotechnology, Japan (SBJ)
Japan Industrial Cleaning Council (JICC)
The Ceramic Society of Japan (CerSJ)
The Society for Actinomycetes Japan (SAJ)
The Academy of Pharmaceutical Science and Technology, Japan (APSTJ)
The Society for Japanese Blood Programme (SJBP)
Tokyo Scientific Instrument Association (SIA TOKYO)

Joint R&D & Technical exchanges

National Institute of Advanced Industrial Science and Technology (AIST), Multi-Material Research Institute (Naoki KONDO, Chief Senior Researcher)

University of Tsukuba, Institute of Life and Environmental Sciences (Prof. Toshiaki NAKAJIMA)

Tokyo University of Science, Department of Mechanical and Aerospace Engineering, Faculty of Science and Technology (Prof. Takahiro TSUKAHARA)

Yokohama National University, Faculty of Environment and Information Sciences, Division of Artificial Environment and Information (Prof. Junichi TATAMI)

Tokushima University, Department of Applied Chemistry, Graduate School of Technology, Industrial and Social Sciences (Prof. Naohiro SHIMODA)

Niigata Institute of Technology, Department of Engineering, Food and Environmental Chemistry (Prof. Satoshi TAKESONO)

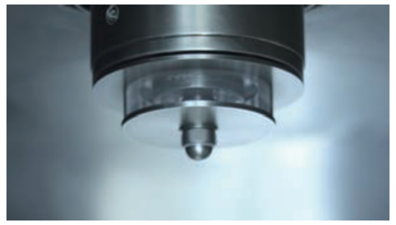
Niigata Institute of Technology, Department of Engineering, Food and Environmental Chemistry (Prof. Masayuki ONODERA)

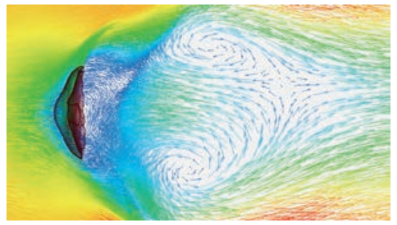
Japanese Red Cross Society

In addition, we have a track record of joint R&D with various private companies both domestically and internationally.

Group company
Aysir Corporation

Liquid atomization is the most important element in particle design for spray dryers, spray coolers and freeze granulators. Liquid materials such as solutions, gels, suspensions, slurries and emulsions are sprayed or atomized into powder manufacturing processes using atomization systems such as rotary atomizers and spray nozzles. A liquid material is atomized and droplets are formed by an atomization system. As droplets become smaller, their specific surface area rapidly increases. Therefore, with a spray dryer, the moisture in the droplets evaporates and dries in a short period of time, ranging from a few seconds to several tens of seconds. Similarly, droplets are solidified within a short period of time in spray cooling and freeze granulation. The particle size and shape of powders are strongly influenced by the shape of droplets during atomization. Therefore, the first step for designing a powder manufacturing process is to determine the right atomization system and operating conditions that can produce the desired granule quality.





ROTARY ATOMIZATION

Rotary atomization is an atomization system in which liquid material is supplied to a disc that rotates at high speed and atomized from the periphery of the disc by centrifugal force. It is also called centrifugal atomization because it uses centrifugal force from high-speed rotation to atomize liquid material. The continuously supplied liquid material becomes liquid thin film that reaches the periphery of the disc and create droplets by destabilization of the liquid. The state of liquid atomization is designed and controlled by the centrifugal force determined by the diameter and rotational speed of the disc, disc shape, liquid feed rate, and physical properties of the liquid material such as density, viscosity and surface tension. The droplet size range for rotary atomizers in general is from 20 micrometers to several millimeters. The particle size range as a powder is 10 to 200 µm in spray drying, 20 µm to several mm in spray cooling, and 20 to several hundred µm in freeze granulation. The shape of the droplets becomes spherical thanks to surface tension, resulting in granules with sharp particle size distribution and excellent flowability.

Rotary atomizers

Our rotary atomizers have a maximum capacity of 25 t/h and a rotational speed up to 35,000 rpm, allowing to select the model that best suits your purpose.

Motor drive modes

Two drive modes are available: direct drive and belt drive. We select the most suitable model according to the liquid feed rate, disc size and shape, and rotational speed.

Safety monitoring systems

Rotation sensors, bearing temperature sensors and safety interlock systems are included as our standard system. Vibration monitoring sensors and liquid leakage detection sensors can be added as options.

Control systems

Rotational speed control or Auto-PSD-Conttrol System (patented) can be selected.

Atomizer cooling systems

Air cooling system or oil cooling system can be selected depending on the model.

Discs

A variety of disc models designed in-house including our unique patented disc models can be selected.

Materials

A wide variety of materials including stainless steel, Super Duplex (SAF 2507), titanium, Inconel, Hastelloy C276, or ceramics such as alumina, zirconia, silicon nitride, and silicon carbide are available.

Surface treatments

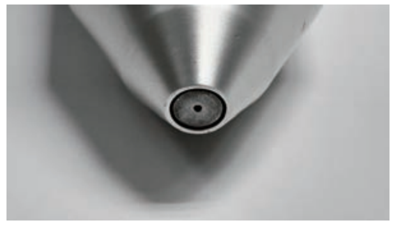
Tungsten thermal spraying treatment or stainless steel special hardening are available for preventing wear and tear. A special coating treatment to improve the slipperiness of liquid can also be selected.

Shapes

Discs with various shapes can be selected depending on the application and material properties. We have developed a variety of original discs, including the Coanda disc (patented), which utilizes the Coanda effect (the effect that fluid is attracted to nearby walls).

NOZZLE ATOMIZATION

Nozzle atomization is an atomization system that atomizes liquid using external energy such as liquid pressure, compressed gas, or ultrasonic waves. Our lineup includes single-fluid nozzle (pressure nozzle) atomization by pump pressure, two-fluid nozzle atomization by mixing and colliding of compressed gas, and ultrasonic nozzle atomization by liquid film vibration using ultrasonic waves. Our state-of-the-art two-fluid nozzle has excellent atomization performance and is capable of atomizing particles in single micron order.



Pressure nozzles

Pressure nozzles, also called single-fluid nozzles, are an atomization system in which liquid is atomized by the pressure of a pump. The liquid flow pressurized by the pump creates a swirling flow within the nozzle chamber and is atomized by being discharged from the nozzle orifice at high speed. The droplet size range for pressure nozzles is typically from 30 µm to a few millimeters. The particle size range as a powder is 15 to 500 µm in spray drying, 30 µm to several millimeters in spray cooling, and 30 to several hundred µm in freeze granulation. The liquid pressure can be set within a wide. Materials are selected based on wear, corrosion and heat resistance, etc. Our original universal nozzle system is one of our unique technologies that allows to freely adjust the nozzle angles. The system can improve production efficiency and yield by calculating the optimal number of nozzles and feed rate per unit, and designing an appropriate layout according to the chamber size.

Two-fluid nozzles

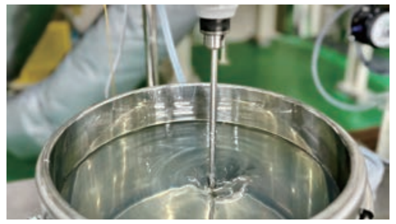
Two-fluid nozzles are an atomization system in which compressed gas impinges and mixes with a liquid stream. The liquid flow fed by the pump collides and mixes with the compressed gas flow inside the nozzle. Our state-of-the-art two-fluid nozzle has the same level of performance as multi-fluid nozzles such as four-fluid nozzles, and can atomize to single microns while significantly reducing compressed gas consumption. The droplet size range is typically from a single micrometer to around 70 µm. The particle size range as a powder is from sub-micron to 30 µm in spray drying, from 10 to several hundred µm in spray cooling, and from 10 to several hundred µm in freeze granulation. Spray patterns can be adjusted by the mixture ratio of compressed gas and liquid (gas-liquid ratio). The higher the compressed gas pressure, the finer the atomized droplets are. Our two-fluid nozzles are designed to prevent clogging even for highly viscous materials. The most suitable material is selected by considering wear, corrosion and heat resistance, etc.

Ultrasonic nozzles

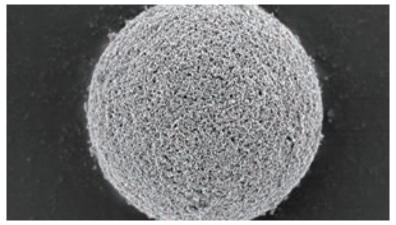
Ultrasonic nozzles are an atomization system that utilizes ultrasonic waves to vibrate the liquid film in order to destabilize and atomize a liquid material. The mechanical vibrations amplified by the ultrasonic oscillator create standing waves in the liquid flow and ripple the liquid film. The liquid film is atomized when the energy of ultrasonic waves exceeds the surface tension. Since a liquid is atomized without pressure, there is almost no kinetic energy, resulting in a slow and soft atomization. Droplets atomized without pressure are uniform regardless of the flow rate, resulting in a sharp particle size distribution. The droplet size range varies depending on the nozzle type and output, but is generally on the order of tens to hundreds of micrometers.

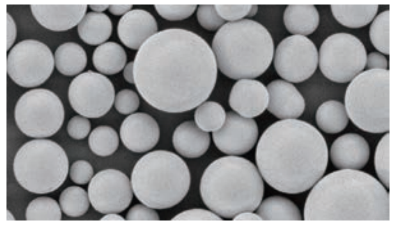
WHAT IS SPRAY DRYING?

Spray drying is a continuous drying process that produces a dry powder from a liquid material by rapidly evaporating moisture with a hot gas stream. A liquid such as a solution, gel, suspension, slurry, and emulsion is sprayed by an atomization system into a drying process where a continuous high-temperature gas stream flows. The droplets sprayed by an atomization system have an increased specific surface area, and the moisture in the liquid evaporates in seconds. The heat of the hot gas stream supplied to the process is immediately consumed as latent heat of vaporization as moisture evaporates on the surface of the droplets. Hence, spray drying is the preferred process for heat-sensitive materials such as foods and pharmaceuticals. In addition, since powder can be obtained directly and continuously from liquid, spray drying is a process that can potentially eliminate multiple steps such as concentration, filtration, pulverization, mixing, classification and granulation, and integrate those processes into one step.



Spray dried granules are spherical in shape, have excellent fluidity and a sharp and stable particle size distribution. Atmospheric air is generally used as the process gas. A closed-cycle system with the use of inert gas (e.g. nitrogen) as a process gas is selected if the liquid material contains flammable organic solvents or is sensitive to oxidation. An open-cycle system for a flammable organic solvent such as ethanol can be selected for some special cases. As a safety measure, the spray drying process is precisely controlled at below 25% of the lower explosion limit (LEL) of the organic solvent gas concentration in the process. The evaporated organic solvent gas is exhausted after the passing through a catalyst and the heat decomposition process.





Characteristics of spray drying

- A production process can be simplified because powder can be obtained directly from liquid.
- Heat sensitive applications are available as droplets are dried in seconds.
- Spray dried granules are spherical in shape, have excellent fluidity and a sharp PSD.
- Precise particle control is possible with a variety of atomization systems.
- Continuous process: easy to scale up and suitable for mass production.

Our spray dryers have a track record of numerous deliveries around the world and are used in a wide variety of industries. With our accumulated experience, know-how and technologies, we provide highly efficient spray drying processes that can exceed the required quality. Using a number of unique technologies, including our patented technologies, we support our customers to achieve high yields, reduce material loss, and save energy with small footprint.

APPLICATIONS

Foods

Milk, Infant formula, Creamer, Whey, Lactobacillus, Lactobacillus bifidus, Lactoferrin, Coffee, Tea, Green tea catechin, Alginic acid, Collagen peptides, Keratin, Chitosan, Glucosamine, Chondroitin, Agaricus, Propolis, Yeast, Ascorbic acid, Vitamins, Citric acid, Flavonoids, Isoflavonoids, Fumaric acid, Malic acid, Succinic acid, Tartaric acid, Phytic acid, Stevia, Inulin, Tongkat ali, Moringa, Maca, Arnica, Turmeric, Coptis rhizome, Gentian, Salacia, Microcapsules such as EPA/DHA, etc., Oil emulsion microcapsules, Hydrophilic powdered oils, Coconut oil, Starch, Dextrin, Trehalose, D-mannitol, Fructose, Glucose, Oligosaccharides, Food flavorings, Spices, Seasonings (Marine products, Livestock products, Agricultural products, etc.), Powdered alcohol, Natural pigments, Synthetic colorants, Viscous agent, Bio-gum, Locust bean gum, Xanthan gum, Antioxidant, Preservatives, Quality improvers, Plant extracts, Minerals, Algae, Green juice, Fruit juice, Egg white, Processed seafood products, Plant proteins, Animal proteins, Enzyme, Animal feeds

Pharmaceuticals

Medicines, Biopharmaceuticals, Active pharmaceutical ingredients (APIs), Poorly-soluble pharmaceutical microcapsules, Colloid carriers (Liposomes, Polymeric microspheres, Polymeric nanoparticles, Microemulsions), Antibiotics, Solid dispersion formulations, Amorphous formulations, Excipients, Polyethylene glycol (PEG), Polylactic acid (PLA), Polycaprolactone (PCL), Lactic acid-glycolic acid copolymer (PLGA), Pectin, Water-soluble polymer, Carboxyvinyl polymer, Quaternary ammonium compound, Enzyme, Yeast, Herbal medicines, Brown algae extracts, Supplements

Chemicals

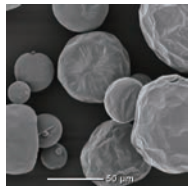
Silica, Sodium silicate, Calcium carbonate, Catalyst, Polymer, Polyvinyl alcohol (PVA), Polyethyleneimine (PEI), Polyvinylpyrrolidone (PVP), Pigment, Dye, Soap, Detergent, Surfactant, Zeolite, Cosmetics, Lignin, Ammonium sulfate, Phosphorous solution, Urea, Fertilizer, Herbicides, Pesticides, Insecticides, Ammonium carbonate, Paints, Melamine resins, Acrylic resins, Phenolic resins, Epoxy resins, Urea resins, Amino plastics, Eesin emulsions, Functional plastics, Bioplastics, Biodegradable plastics, Elastomers, Latex , Vinyl chloride, Vinyl acetate, Battery materials, Titanium oxide, Phosphoric acid compounds, Calcium phosphate, Natural apatite, Methylcellulose (MC), Hydroxypropyl methylcellulose (HPMC)

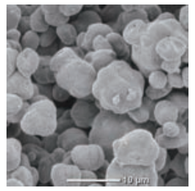
Ceramics, Alloys & Powder metallurgy

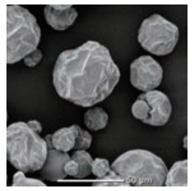
Alumina (Al_2O_3), Zirconia (ZrO_2), Silica (SiO_2), Silicon nitride (Si_3N_4), Sialon (SiAlON), Silicon carbide (SiC), Aluminum nitride (AlN), Boron nitride (BN), Titanium oxide (TiO_2), Magnesium oxide (MgO), Barium titanate ($BaTiO_3$), Steatite ($MgO \cdot SiO_2$), Mullite ($3Al_2O_3 \cdot 2SiO_2$), Ferrite (Fe_2O_3), Zircon ($ZrSiO_4$), Yttria (Y_2O_3), Ceria (CeO_2), Cermet (TiC, TiN), Tungsten carbide (WC), Nickel alloy, Aluminum alloy, Magnesium alloy, Titanium alloy, Cobalt alloy, Rare metal, Rare earth, Bioceramics

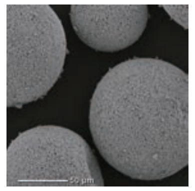
Materials & Parts

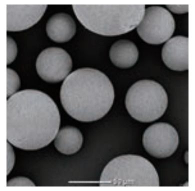
Electronic materials, Multilayer ceramic capacitors (MLCC), Semiconductors, Insulators, Magnetic materials, Dielectrics, Glass materials, Sensors, Catalysts, Refractory materials, Pulp materials, Dental materials, Hydroxyapatite, Cellulose, Cellulose nanofibers (CNF), Synthesis rubbers, Synthetic fibers, Carbon, Graphene, Carbon nanotubes (CNT), Superconducting materials, Toners, Abrasives, Carbide tools, Optical fibers, Battery materials, Lithium ion secondary battery cathode materials, Sodium ion batteries materials, All solid state battery materials

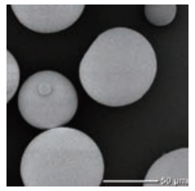

Lactose

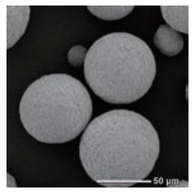

Yeast

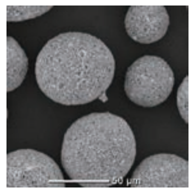

Citric acid

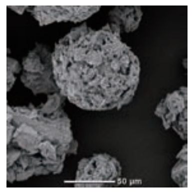

Zeolite

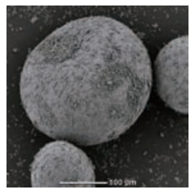

Alumina

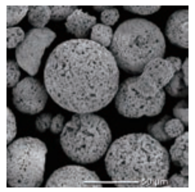

Silica

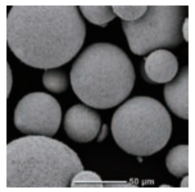

Zirconia


WC-(Fe-Ni) alloy


Cobalt


Molybdenum


Yttrium oxide

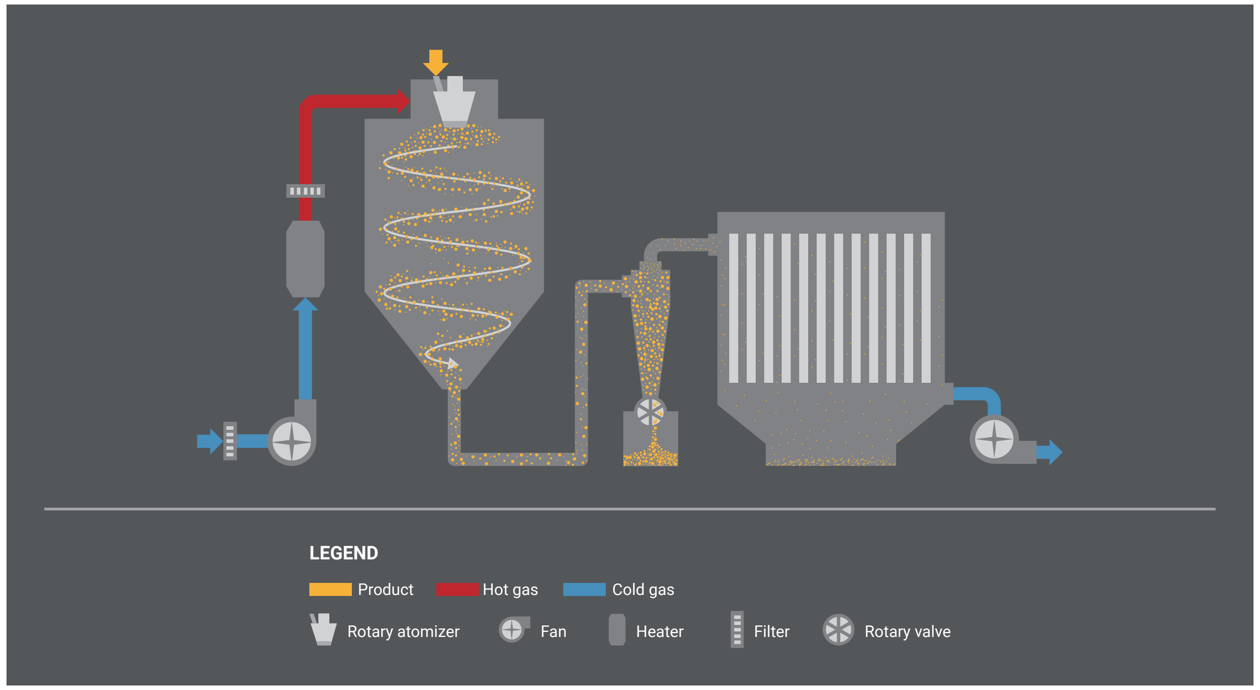

Indium oxide

SPRAY DRYING

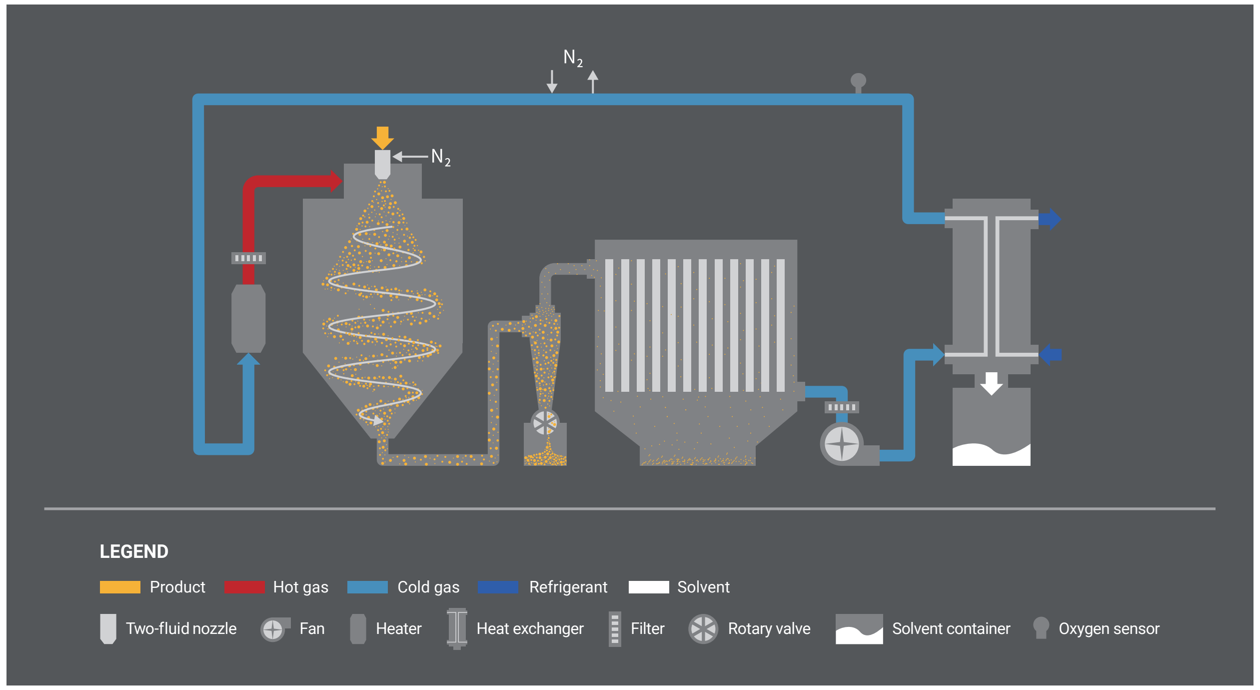
LEARN MORE

PROCESS FLOWS

Open-cycle system



Closed-cycle system



For water solvents, Open-cycle systems using atmospheric air are generally selected. Closed-cycle systems where an inert gas, e.g., nitrogen, is used in the process is selected for flammable solvents as well as oxygen-sensitive or CO2 reaction-sensitive materials. We are also capable of designing dual-cycle systems, which are both open-cycle and closed-cycle systems. There are also open-cycle systems for flammable organic solvents. As a safety measure, the concentration of solvent gas in the process is controlled below 25% of the lower explosion limit (LEL), and the evaporated solvent is discharged from the system through a catalyst and/or a thermal decomposition process.

SPRAY BOY

Fit for Your Lab.

More than just a “Lab spray dryer”.

More than lab

SPRAY BOY is an ideal all-in-one spray dryer for R&D: Easy to disassemble and clean and capable of high-level condition settings. Everything needed for operation including bag filters comes standard.

Integrated system

The integrated system is movable and components such as touch screen, pump and workbench are all equipped as standard and it allows an operator to control everything at one place.

A variety of options

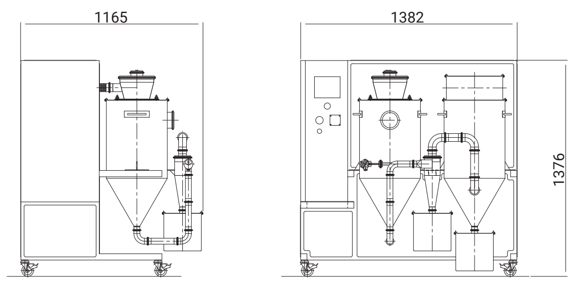
A variety of options are available to meet your needs including closed-cycle system, HEPA filters, heat insulation units, and coating treatment for powder contacting part.

Specifications

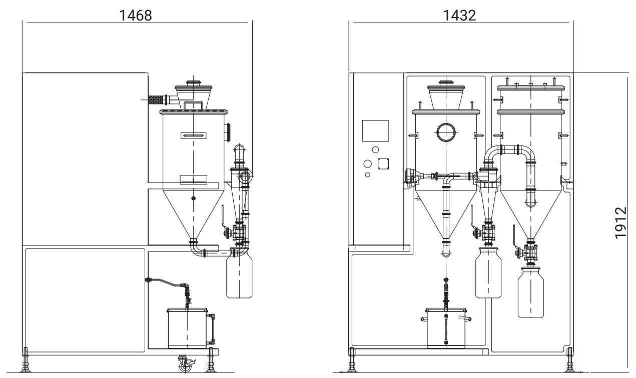
Model	SB39
Chamber diameter (mm)	φ387
Atomization system	Two-fluid nozzles, S-type two-fluid nozzles
Inlet temp. (℃)	Up to 250
Water evaporation capacity (kg/h)	Up to 3
Heater capacity (kW)	5
Electricity	3-phase 200V 50/60Hz
Powder collection	Cyclone
Dust collection	Bag filter
Control	Touch screen

* Water evaporation capacity is subject to change depending on inlet temp., outlet temp., process gas volume, and installation site conditions.
* The specifications may change without any prior notice.

External dimensions

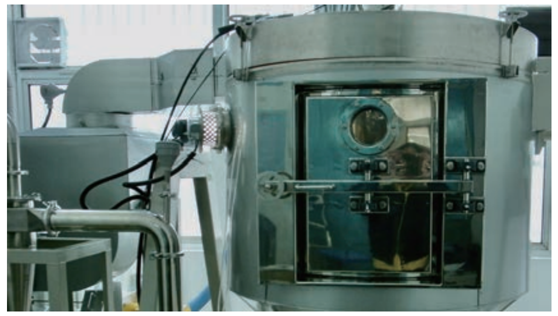


Open-cycle system



Closed-cycle system

SPRAY DRYER - R



Ideal for HMLV Production

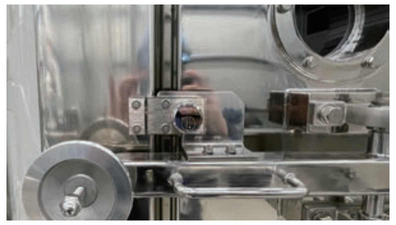
Scalable and forward-looking process design

Atomization system

Rotary atomizers, Two-fluid nozzles, S-type two-fluid nozzles, Pressure nozzles, and Ultrasonic nozzles are available.

System selection

Open-cycle systems, Closed-cycle systems and Dual systems are available.



Operability & Visibility

Detailed design for safety and operability. Manholes and inspection windows are equipped to improve visibility and work efficiency.

Custom made

A wide variety of options are available including product and dust collection systems, heat sources, cleaning systems, and control systems.

Small footprint

A variety of our original technologies are available to save your footprint without compromising the capacity.

Global network

We carry out projects globally by collaborating with our official engineering partners in each region under our quality management system.

Specifications

Model	R80	R100	R120	R140	R160	R190
Chamber diameter (mm)	φ800	φ1000	φ1200	φ1400	φ1600	φ1900
External dimensions W (mm)	1900	2100	2200	2400	2700	3400
External dimensions D (mm)	2200	2300	2500	2900	3100	3500
External dimensions H (mm)	1500	1600	1800	2200	2400	3400
Water evaporation capacity (kg/h)	4	5	8	14	22	28
Heater capacity (kW)	6	8	10	18	28	35

* The approximate external dimensions include a heater, a cyclone and a bag filter unit.
* Heater capacity is calculated value based on inlet temperature at 230℃ and outlet temperature at 80℃.
* Water evaporation capacity is subject to change depending on inlet temp., outlet temp., process gas volume, and installation site conditions.

TR SERIES

SPRAY DRYER - TR

Rotate & Clean Up.

Cleaning innovation you have never seen.

Easy cleaning

The chamber can be rotated 90 degrees to open the ceiling for easy cleaning. Manual or automatic rotation mechanism can be selected.

Atomization system

Rotary atomizers, Two-fluid nozzles, S-type two-fluid nozzles, Pressure nozzles, and Ultrasonic nozzles are available.

System selection

Open-cycle systems, Closed-cycle systems and Dual systems are available.

Operability & Visibility

Detailed design for safety and operability. Manholes and inspection windows are equipped to improve visibility and work efficiency.

Custom made

A wide variety of options are available including product and dust collection systems, heat sources, cleaning systems, and control systems.

Global network

We carry out projects globally by collaborating with our official engineering partners in each region under our quality management system.

Specifications

Model	TR80	TR100	TR120	TR140	TR160	TR190
Chamber diameter (mm)	φ800	φ1000	φ1200	φ1400	φ1600	φ1900
External dimensions W (mm)	1900	2100	2200	2400	2700	3400
External dimensions D (mm)	2200	2300	2500	2900	3100	3500
External dimensions H (mm)	1500	1600	1800	2200	2400	3400
Water evaporation capacity (kg/h)	4	5	8	14	22	28
Heater capacity (kW)	6	8	10	18	28	35

* The approximate external dimensions include a heater, a cyclone and a bag filter unit.
* Heater capacity is calculated value based on inlet temperature at 230℃ and outlet temperature at 80℃.
* Water evaporation capacity is subject to change depending on inlet temp., outlet temp., process gas volume, and installation site conditions.

SPRAY DRYERS

LEARN MORE

P SERIES

SPRAY DRYER - P

Small Footprint yet Big Capacity

Smart production with high efficiency & small footprint

High efficiency & Energy saving process

Detailed design for high yield and low material loss. Energy can also be saved by exhaust heat circulation system.

Small footprint

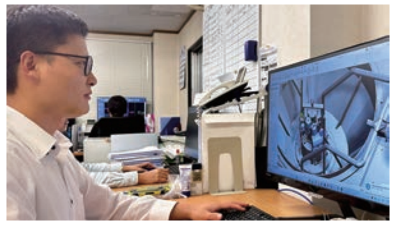
A variety of our original technologies are available to save your footprint without compromising the capacity.

Atomization system

Rotary atomizers, Two-fluid nozzles, S-type two-fluid nozzles, Pressure nozzles, and Ultrasonic nozzles are available.

System selection

Open-cycle systems, Closed-cycle systems and Dual systems are available.



Flexible design

A wide variety of options are available including powder collection, heat sources, cleaning systems, and controls.

Global network

We carry out projects globally by collaborating with our official engineering partners in each region under our quality management system.

Specifications

Model	P220	P240	P260	P290	P300
Chamber diameter (mm)	φ2200	φ2400	φ2600	φ2900	φ3000
External dimensions W (mm)	3700	3900	4200	4500	4600
External dimensions D (mm)	3900	4400	4900	6300	6500
External dimensions H (mm)	3900	4400	4900	5500	5700
Water evaporation capacity (kg/h)	32	40	48	53	60
Heater capacity (kW)	40	50	60	68	80

* The approximate external dimensions include a heater, a cyclone and a bag filter unit.
* Heater capacity is calculated value based on inlet temperature at 230℃ and outlet temperature at 80℃.
* Water evaporation capacity is subject to change depending on inlet temp., outlet temp., process gas volume, and installation site conditions.

D SERIES

SPRAY DRYER - D

Extensive Track Record

Maximize your profit with high yield & energy savings

Accumulated experience

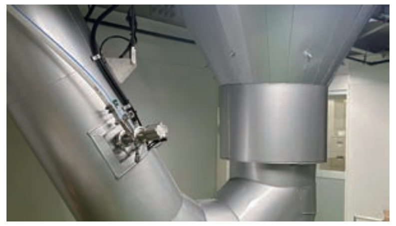
With our extensive track record and experience in installing large-scale plants with a maximum capacity of 18t/h, we are capable of realizing processes with high yields and low material loss.

Energy saving & Small footprint

Energy can be saved by exhaust heat circulation system. A variety of our original technologies are available to save your footprint without compromising the capacity.

Atomization system

Rotary atomizers, Two-fluid nozzles, S-type two-fluid nozzles, Pressure nozzles, and Ultrasonic nozzles are available.



System selection

Open-cycle systems, Closed-cycle systems and Dual systems are available.

Flexible design

A wide variety of options are available including powder collection, heat sources, cleaning systems, and controls.

Global network

We carry out projects globally by collaborating with our official engineering partners in each region under our quality management system.

References

WHAT IS SPRAY COOLING?

Spray cooling is a continuous congealing process that produces granules by atomizing a molten liquid material into a cold gas stream and rapidly cooling and solidifying the atomized droplets. The process is generally called spray cooling, but since granulation is performed by cooling and solidifying a heated and molten liquid, it is also called spray cooling granulation, spray cooling solidification, and spray congealing. Spray cooling utilizes technologies derived from spray drying. A liquid material is atomized into a process where a continuous cold gas stream flows. The atomized droplets have an increased specific surface area and are solidified in seconds. The solidified granules are spherical in shape, has excellent fluidity with a sharp particle size distribution. Unlike spray drying, there is no droplet shrinkage due to evaporation, resulting in larger granules. Spray cooled powder is also called beads, prills, etc., and can generally be granulated in the range of several tens of micrometers to several millimeters. By using the molten liquid as a membrane material and mixing the core material, microencapsulation can easily be performed. Encapsulation efficiency is high (90–100%) when compared to other microencapsulation processes, including spray drying. The cooling gas used in the process is mainly atmospheric air. A closed-cycle system with the use of inert gas (e.g. nitrogen) as a process gas is selected if the liquid material contains flammable ingredients or is sensitive to oxidation. A spray cooling process is a simple process that can produce granules with spherical in shape and high fluidity. Spray cooling is a process that can potentially eliminate downstream processes such as grinding, classification, and granulation.

Characteristics of spray cooling

- A production process can be simplified because powder can be obtained directly from liquid.
- Spray cooled granules are spherical in shape, have excellent fluidity and a sharp PSD.
- Precise particle control is possible with a variety of atomization systems.
- Continuous process: easy to scale up and suitable for mass production.
- High-level microencapsulation is achievable.

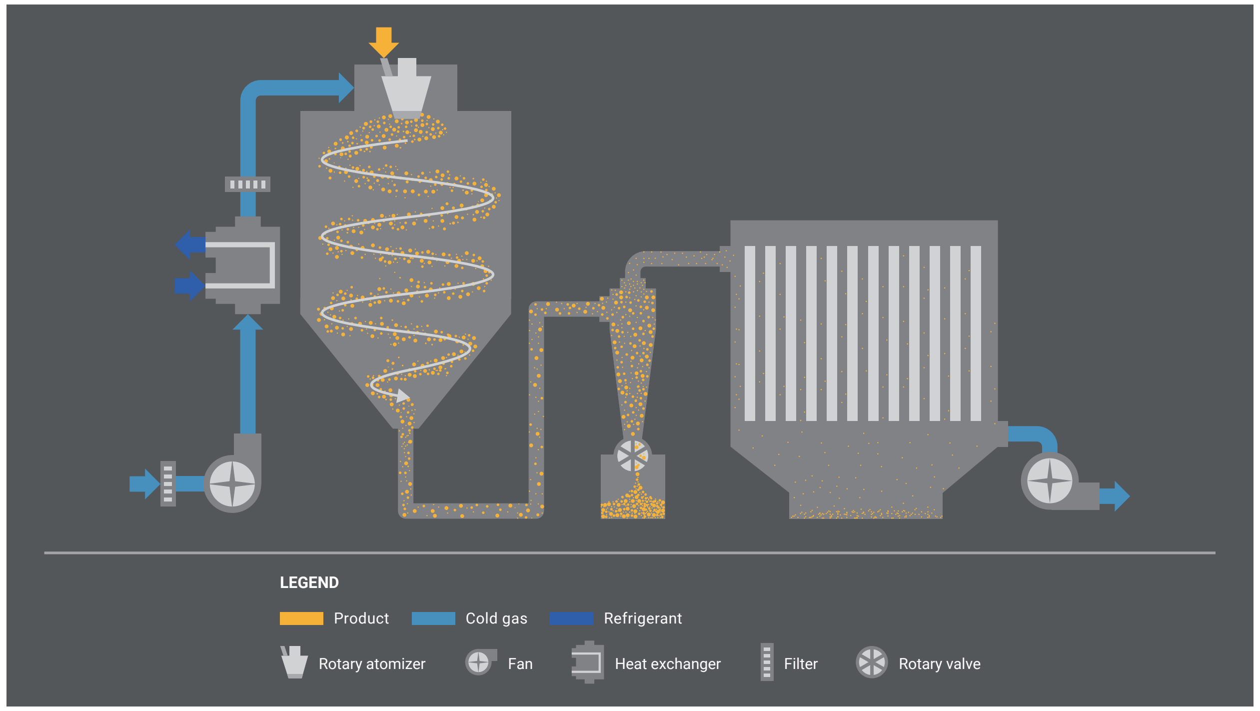
Our spray coolers have a track record of numerous deliveries around the world. With our accumulated experience and know-how, we provide highly efficient spray cooling processes that meet quality requirements. Using a number of our unique technologies, we support our customers to achieve high yields, reduce material loss, and save energy with small footprint.

APPLICATIONS

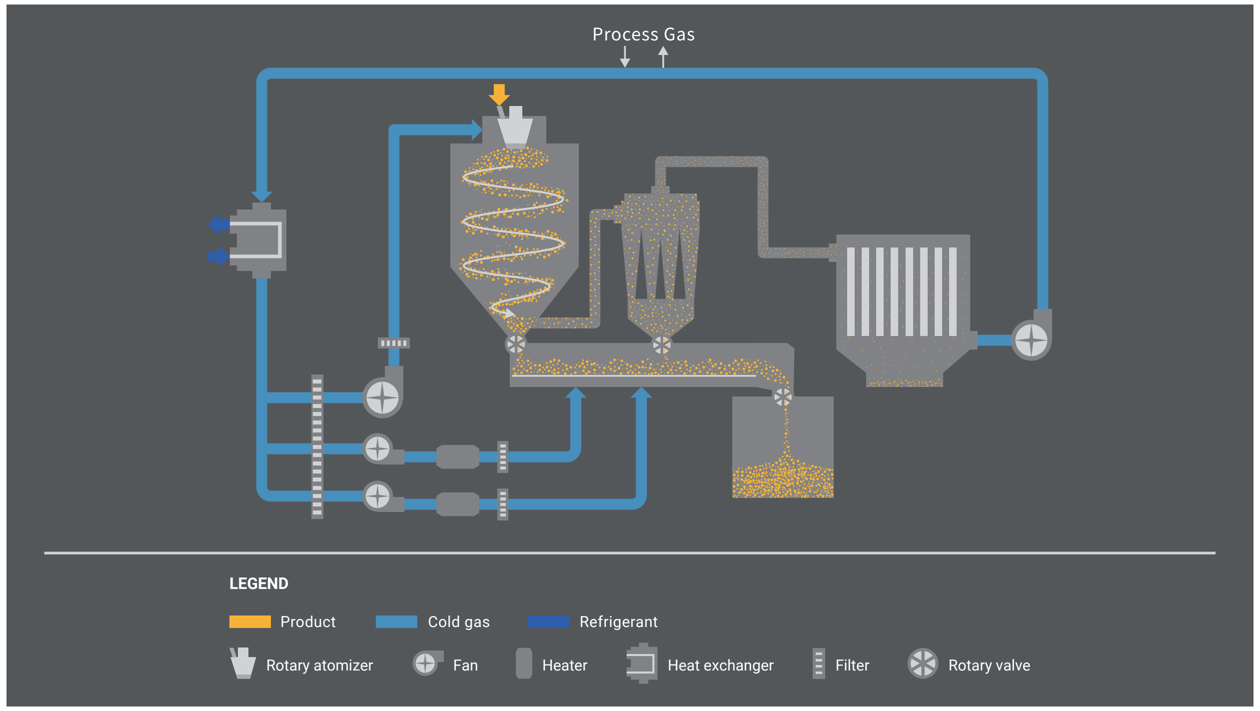
Waxes, Saturated fatty acids, Stearic acid, Palmitic acid, Lauric acid, Myristic acid, Fatty acid amide, Sebacic acid, Phospholipids, Palm oil emulsifying wax, Sodium stearoyl lactate, Essential oils, Paraffins, Terpenes, Steroids, Carotenoids, Fish oil, Omega 3 fatty acids, Omega 6 fatty acids, Glycerin, Monoglycerides, Diglycerides, Triglycerides, Polyoxylglycerides, Poloxamers, Polyethylene glycol (PEG), Higher alcohols, Phthalic anhydride, Maleic anhydride, Dimethyl terephthalate, Microcapsules, Polymers, Petroleum resins, Phenolic resins, PVC stabilizers, Latex, Elastomers, Synthetic rubber, Urea, Inorganic melts, Organic melts

PROCESS FLOWS

Open-cycle system



Closed-cycle system



SPRAY COOLER - SC

Extensive Track Record

Maximize your profit with high yield & energy savings

Accumulated experience

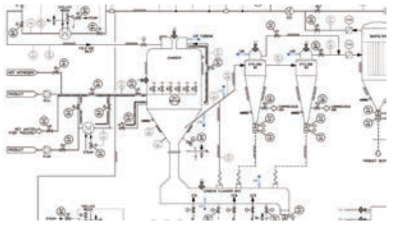
With our extensive track record and experience in installing large-scale plants with a maximum capacity of 12t/h, we are capable of realizing processes with high yields and low material loss.

Energy saving & Small footprint

Energy can be saved by optimizing utilities. A variety of our original technologies are available to save your footprint without compromising the capacity.

Atomization system

Rotary atomizers, Two-fluid nozzles, S-type two-fluid nozzles, Pressure nozzles, and Ultrasonic nozzles are available.



System selection

Open-cycle systems, Closed-cycle systems and Dual systems are available.

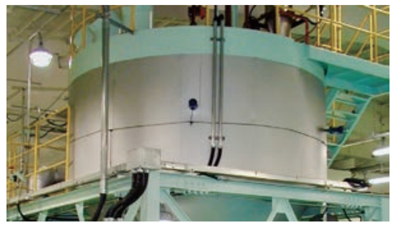
Flexible design

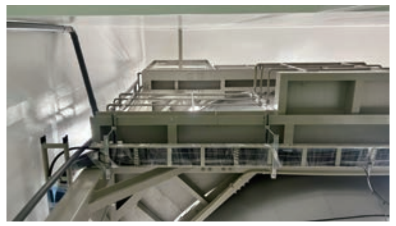
A wide variety of options are available including powder collection, cooling sources, cleaning systems, and controls.

Global network

We carry out projects globally by collaborating with our official engineering partners in each region under our quality management system.

References



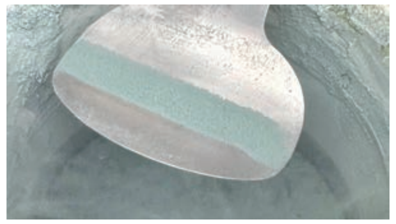



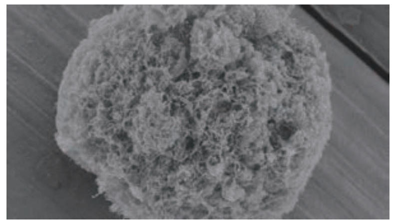
WHAT IS FREEZE GRANULATION?

Freeze granulation is a process that produces frozen granules by atomizing a liquid mateial into an ultra-low temperature environment. The atomized droplets instantaneously get frozen and dried granules are obtained after sublimation process (freeze drying). We have developed the world's first production scale dry cooling freeze granulation process. The process is called freeze granulation or spray freeze drying, also known as spray freeze granulation drying. The freeze granulation process is a two-step powder manufacturing process consisting of a freezing process in which a liquid material is atomized and rapidly cooled to obtain frozen granules, and a drying process in which the frozen granules are freeze-dried to obtain dried granules. There are three types of freeze granulation processes: a wet cooling in which the liquid material is directly atomized into liquid nitrogen, a dry cooling that uses evaporated gas from liquid nitrogen, and a dry cooling using our original high-efficiency cooling system. Our latest generation “liquid nitrogen-free” dry cooling freeze granulation process using our original high-efficiency cooling system is now in mainstream. As the process does not use liquid nitrogen, it has advantages in safety, environment, installation costs, and operating costs.



Liquid materials such as solutions, gels, suspensions, slurries, and emulsions are sprayed into the freeze granulation process by atomization systems such as a rotary atomizers and spray nozzles to produce frozen granules. The freezing process is continuous, while the freeze-drying process is batch-based. In order to eliminate the drawbacks of the batch-type freeze-drying process that is the latter stage, it is possible to process as semi-continuous production by connecting multiple freeze dryers to the freeze granulator and automatically switching connections between them. The dried granules obtained by freeze granulation are spherical in shape, have excellent fluidity, and can maintain low density and high homogeneity. The particle size range of the granules is relatively wide, ranging from 10 to 500 μm, and the tap density equivalent to or higher than spray drying can be obtained. Additionally, unlike high-temperature hot gas drying processes, there is no heat effect on the material, and oxidation can be minimized.





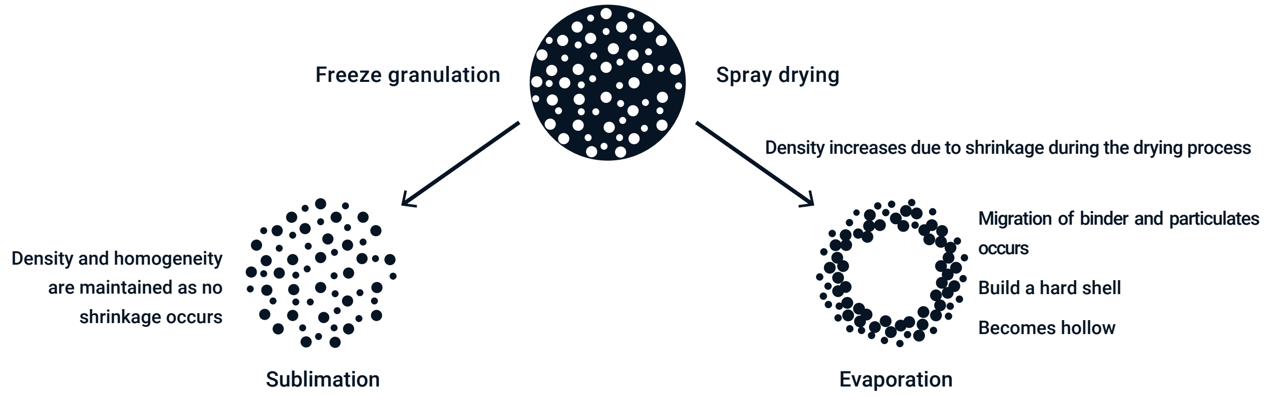
Characteristics of freeze granulation

- Granules are spherical in shape and have excellent fluidity.
- Particle size is ranging from 10 to 500 μm with a sharp distribution.
- Precise particle control is possible with a variety of atomization systems.
- No thermal effect on the material and oxidation can be minimized.
- Granules can maintain low density and high homogeneity.
- Excellent dispersibility for nano fibers.

We have developed the world's first production scale dry cooling freeze granulation process. With our accumulated experience, know-how and technologies, we provide a highly efficient freeze granulation processes that exceed the required quality. With a number of patented technologies and “liquid nitrogen-free” dry cooling process, we support our customers to achieve high yields, reduce material loss, and save energy with small footprint.

FG VS SPRAY DRYING

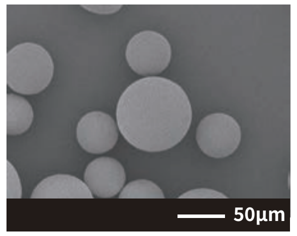
Freeze granulation has advantages over the spray drying in terms of the density and homogeneity of the granules, as well as the degree of thermal effect and oxidation.



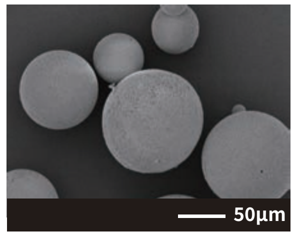
Structured granules with low density

In spray drying, the moisture evaporates from the surface of the droplet, and at the same time, the internal moisture moves to the surface, causing the droplet to shrink, and the solid content inside the droplet to move outward. Therefore, the density of granules is higher on the outside surface than inside, so that the shape of the granules may become hollow. Freeze granulation immobilizes the internal structure of droplets containing the moisture by rapidly freezing the droplets. In freeze-drying as the post-process, the frozen moisture (ice) is dried by sublimation, resulting in extremely low material movement and shrinkage. Therefore, the granules are porous but structured, low density with no difference between the inside and outside. Low-density structured granules contribute to improved solubility in pharmaceuticals and foods, as well as properties in fine ceramics and powder metallurgy.

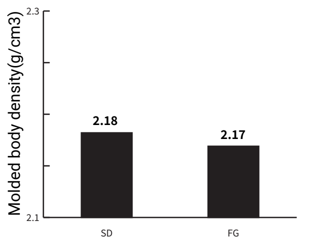
Case 1. Alumina（Al_2O_3）

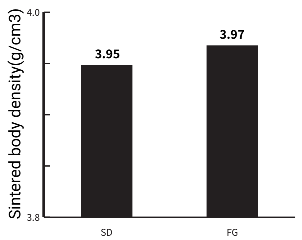


Spray dry



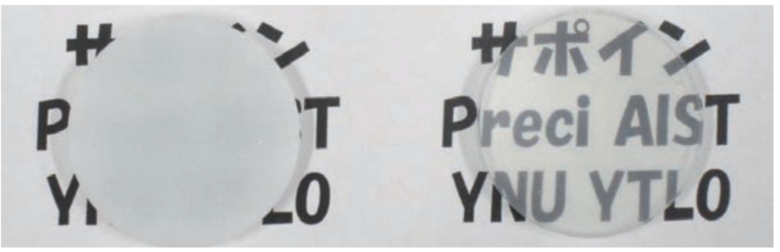
Freeze granulation



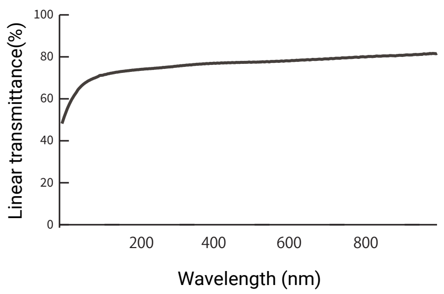


φ20mm mold, uniaxial molding at 30MPa, sintering at 1600℃ for 2 hours

Case 2. Silica（SiO_2）



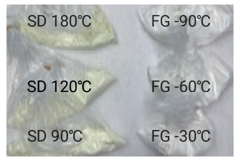
Spray dry　　Freeze granulation



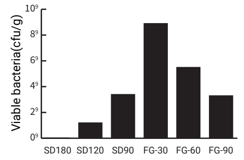
Low temperature drying

Spray drying is a drying process that produces a dry powder from a liquid material by rapidly evaporating moisture with a hot gas stream. The heat of the hot gas supplied to the process is immediately consumed as latent heat of vaporization as moisture evaporates on the surface of the droplets. Hence, spray drying is the preferred process for heat-sensitive materials such as foods and pharmaceuticals. However, since hot gas is used as the drying medium, exposure to heat above room temperature is unavoidable, making it unsuitable for materials that are extremely sensitive to heat. Freeze granulation makes it possible to obtain dry powder without applying heat above room temperature.

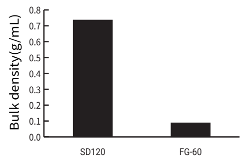
Case 3. Lactic acid bacteria



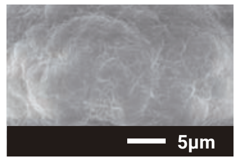
Color comparison



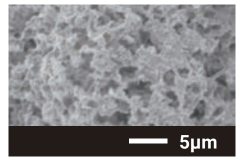
Viable bacteria count



Bulk density



SD 120℃



FG −60℃

FG VS GRINDED FD PRODUCTS

A process similar to freeze granulation is a grinding process of freeze-dried products. A frozen material is freeze-dried and grinded after the drying process. In general, raw materials are pre-frozen in a freezer for a certain period of time. One of the examples is instant coffee production process. Freeze granulation has advantages in terms of homogeneity and fluidity of the dried granules when compared to the grinding process of freeze-dried products.

Homogeneous with no segregation

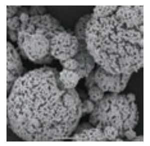
The major difference between freeze granulation and the grinding process of freeze-dried products is the freezing speed. When pre-freezing in a freezer, the freezing process takes several hours, so segregation of ingredients occurs during the freezing process. In addition, if the material is a suspension, segregation due to sedimentation may be a problem. On the other hand, in freeze granulation, specific surface area of atomized droplets increases, resulting in instant freezing and the granular structure is immobilized without segregation. Even in the subsequent freeze-drying process, the moisture sublimes with almost zero material movement and shrinkage so that the dried powder can maintain a homogeneous and structured state.

Spherical with excellent flowability

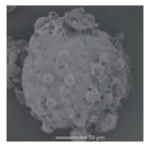
Freeze granulation produces spherical frozen granules because surface tension acts on the droplets during the atomization process. Frozen granules maintain their shape even during the subsequent freeze-drying process and become dry powders with excellent flowability. On the other hand, the grinding process of freeze-dried products involves physical mechanical grinding, resulting in powders that are irregularly shaped, non-uniform, and have poor flowability.

APPLICATIONS

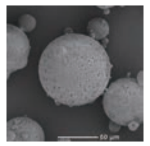
- Fine ceramics, metals, alloys, and composite materials (MMC)
- Thermal spray materials such as ceramics, metals, cermets, etc.
- Precursor preparation in material synthesis
- Re-dispersion treatment of nano-powders and carbon nanotubes (CNT)
- Carriers in catalysts
- Viable bacteria in foods and pharmaceuticals
- Filler powder for MIM and extrusion molding
- Ceramic fluorescent plate materials for white LED
- Graphene sheets and graphene oxide
- Fine nanofibers such as cellulose nanofibers (CNF)
- Pharmaceutical and biopharmaceutical products
- Porous proteins



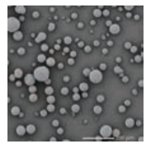
Yeast



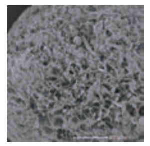
Lactose



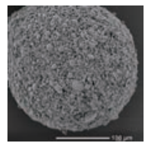
Ascorbic acid



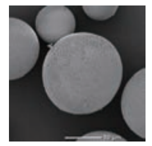
Dextrin



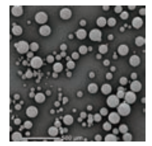
Cellulose nanofiber



SUS316



Alumina

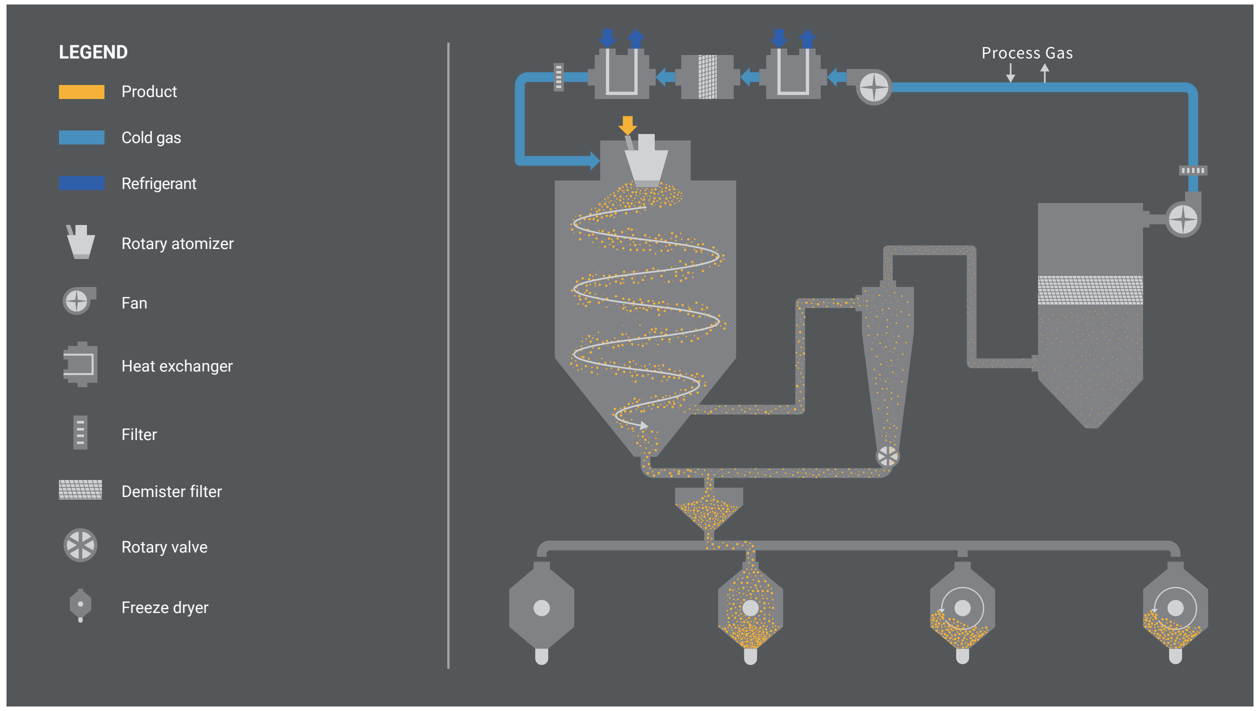


Silica

FREEZE GRANULATOR - CS220

CS220 is our latest generation “liquid nitrogen-free” dry cooling freeze granulator that uses patented technology with our original high-efficiency cooling system. As the process does not use liquid nitrogen, it has advantages in safety and environment, and can reduce the installation and operating cost. Our latest generation CS220 is the world's first closed-cycle system that can be scaled up for mass production. Since liquid nitrogen is not used in the process, operating costs can be significantly reduced. The atomized droplets come into contact with the ultra-low temperature gas flow that is continuously supplied into the process, and instantaneously get frozen. Frozen granules are collected at the bottom of the freezing chamber and the cyclone. The collected frozen granules are freeze-dried using a freeze dryer RHEOFREED. By connecting multiple freeze dryers to CS220 and automatically switching connections, it is possible to process as semi-continuous production.

PROCESS FLOW

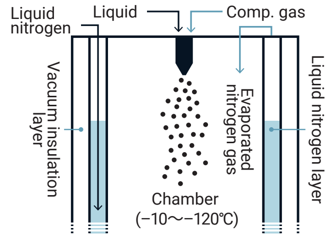


Specifications

Model	CS220
Chamber diameter	φ2200mm
Atomization system	Two-fluid nozzles, S-type two-fluid nozzles, Pressure nozzles, and Ultrasonic nozzles are available.
Material feed capacity	Up to 320kg/h
Cooling temperature	−10 ～ −50℃
Cooling system	Original high-efficiency dry cooling system

FREEZE GRANULATOR - CS30

CS30 is the world's first production scale freeze granulator that uses patented technology to enable continuous production. Liquid nitrogen is supplied to the outer layer of the jacketed chamber to control the process. The evaporated nitrogen gas in the outer layer is supplied to the inner layer of the chamber. A liquid mateial is atomized into the inner layer by two-fluid nozzle and droplets are frozen by contacting with the nitrogen gas. Process temperature can be controlled by adjusting the supply amount of liquid nitrogen. Frozen granules are collected in the container installed at the bottom of the chamber. The collected frozen granules are freeze-dried using freeze dryer TFD-10 or RHEOFREED. By connecting multiple freeze dryers to CS30 and automatically switching connections, it is possible to process as semi-continuous production.

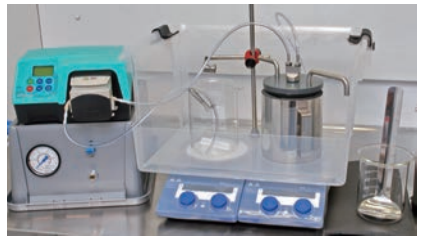


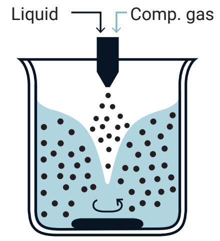
Specifications

Model	CS30
Chamber diameter	φ300mm
Atomization system	Two-fluid nozzles, S-type two-fluid nozzles
Material feed capacity	Up to 15kg/h
Cooling temperature	−10 ～ −120℃
Cooling system	Dry cooling system by evaporated nitrogen gas

LAB FREEZE GRANULATOR - LS-6

LS-6 is a lab-scale freeze granulator unit manufactured by PowderPro. A liquid mateial is atomized by two-fluid nozzle into a container filled with liquid nitrogen. The frozen granules are deposited in the container and collected using a scoop, and manually placed to trays for freeze-drying. Freeze-drying is processed by storing trays in a multi-stage freeze dryer.





Specifications

Model	LS-6
Chamber diameter	φ120mm
Atomization system	Two-fluid nozzles
Material feed capacity	Up to 6kg/h
Cooling temperature	−196℃
Cooling system	Wet cooling system by liquid nitrogen

FREEZE DRYER - RHEOFREED®

RHEOFREED is a rotary freeze dryer manufactured by Kobelco Eco-Solutions. The rotating drying chamber dries frozen granules uniformly with high efficiency. Drying time can be reduced by over 50% when compared to standard freeze dryers. Powder collection and cleaning are easy thanks to the simple structure. Capacity can be scaled up from 160L to 1,000L. By connecting multiple freeze dryers to CS220 or CS30 and automatically switching connections, it is possible to process as semi-continuous production.



Specifications

Chamber volume	160L
Cold trap capacity	30kg
Cold trap temperature	−45℃

FREEZE DRYER - TFD-10

TFD-10 is a swing freeze dryer. The swinging movement of the chamber allows the frozen granules to dry uniformly. By connecting multiple TFD-10 units to CS30 and automatically switching connections, it is possible to process as semi-continuous production.



Specifications

Chamber volume	85L
Cold trap capacity	10kg
Cold trap temperature	−40℃

FREEZE DRYER - FD-551

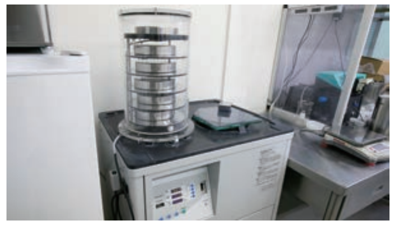
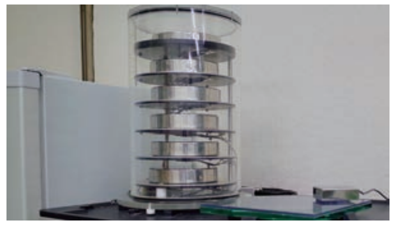
FD-551 is a multi-stage freeze dryer manufactured by EYELA. The unit is suitable for experimental applications that handle a wide variety of products in small quantities. In addition, by introducing and operating multiple units, it is also possible to perform small-scale production of dry granules. The capacity fits for the use with lab-scale freeze granulator LS-6 or freeze granulator CS30.


Specifications

Chamber volume	8000ml × 3段
Cold trap capacity	10kg
Cold trap temperature	−45℃

LAB FREEZE DRYER - FDU-2110

FDU-2110 is a multi-stage lab-scale freeze dryer manufactured by EYELA. The 6-stage multi-stage design allows for processing multiple samples at one time, making it suitable for a variety of samples in small quantities. The capacity fits for the use with lab-scale freeze granulator LS-6.

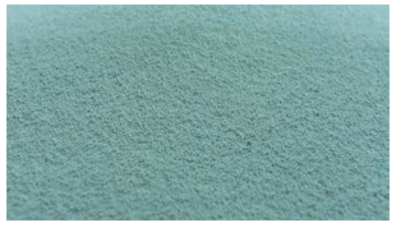
Specifications

Chamber volume	700ml × 6段
Cold trap capacity	3kg
Cold trap temperature	−80℃

We not only provide powder processing trials for spray drying, spray cooling, and freeze granulation, but also services that include pre- and post-powder processing, such as wet pulverizing, mixing, molding, sintering and freeze-drying. We operate a total of three locations: two Powder Technical Centers in Japan and ASEAN Powder Technical Center in Thailand under the partnership with T.S.K. Engineering Co., Ltd.. Our brand new Powder Technical Center 2 (PTC2), which was newly established in 2023, has one of the largest collections of analytical measurement equipment in Japan. We provide one-stop support for powder processing and analytical measurements.







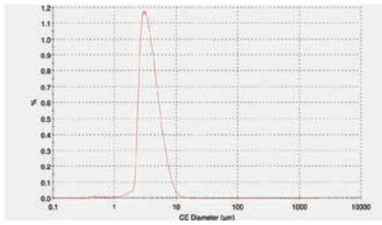
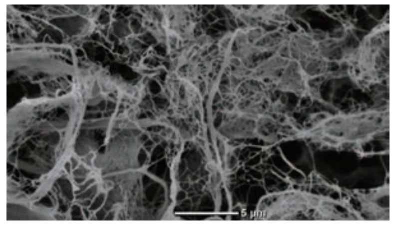

Characteristics of powder processing trial & analytical measurement services

- Consistent support from R&D to mass production.
- One-stop service from powder processing to analytical measurements.
- The latest facilities are available without initial investment and maintenance costs.
- Time saving by outsourcing operations and analysis.
- Obtain new awareness and insights through collaboration with specialized engineers.

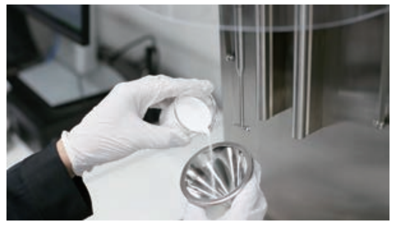
SERVICES

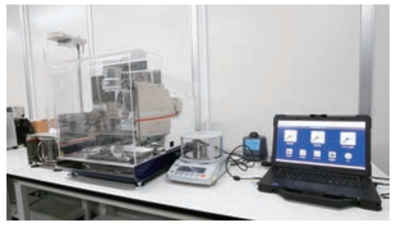
Wet Pulverization | Nano Pulverization | Spray Drying | Spray Cooling | Freeze Granulation | Freeze Drying | Particle Design | Classification | Molding | Sintering | Analytical Measurement

USAGE EXAMPLES OF ANALYTICAL MEASUREMENTS

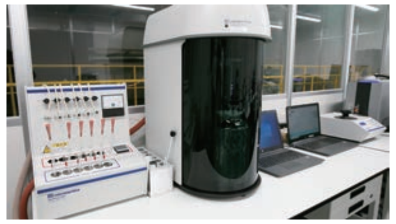




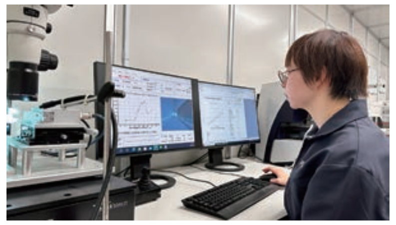
The particle size and shape of granules are analyzed using multiple image analyzers and a laser diffraction analyzer. The image analyzers can perform shape analysis such as particle size distribution and circularity, as well as brightness analysis of each individual particle. An online real-time laser diffraction PSD analyzer is also available to perform continuous particle size distribution analysis. SEM analysis is also conducted to observe the surface of particles.





Powder characteristics analyzer and powder rheometer are used to analyze powder fluidity and flowability. In addition to the traditional methods of evaluating fluidity, such as angle of repose, bulk density, and Carr's fluidity index, dynamic analysis is also available to measure the actual behavior of powders in a dynamic environment. Dynamic rheometer can also analyze the disintegration properties due to friction between flowing particles, making it possible to evaluate the filling properties and handling properties of powders.





Analyzing the specific surface area and density of particles is also important. We measure a specific surface area and pore distribution using a constant volume method using gas adsorption. We also analyze a true density and particle density using the gas displacement method. A microparticle crushing force measurement is also available to evaluate a particle strength by physically crushing a single particle.



The physical properties of the liquid are also evaluated for parameters that affect the latter process: powder processing. In the case of slurries or suspensions, the particle size distribution is measured using laser diffraction analysis. By circulating a liquid material and continuously measuring the particle size distribution, it is also possible to evaluate changes in cohesion, disintegration, and re-dispersibility. We also perform rheology analysis using a wet rheometer for dynamic flow behavior such as viscoelasticity, shear stress, cohesive/dispersion stability, thixotropy and dilatancy properties, and yield point.

HOW TO APPLY

1. Contact

Please contact us via the contact form or by phone.

2. Initial Q&A session

We will discuss the outline of your plan by phone, email, face-to-face, online, etc. We will also provide information about our Powder Technical Center and inform you possible facilities to be selected and time slots available. Depending on the facility selected, reservations may be booked for several months, so we ask that you schedule your appointment early.

3. Submission of Trial/Contract Processing/Analytical Measurement Confirmation Sheet

Please fill out and submit the Trial/Contract Processing/Analytical Measurement Confirmation Sheet. You can skip items that are unclear or non-disclosure information.
*We ask for detailed disclosure regarding the safety and environmental information.

4. Submit a quotation

We will submit you a quotation based on the Trial/Contract Processing/Analytical Measurement Confirmation Sheet.

5. Schedule adjustment

The trial date will be fixed after we receive your formal request.

6. Shipping your material

Ship your material by the day before the trial date. If you visit our PTC and observe your trial on the day, you may bring your material with you.

7. Conducting your trial

If you observe your trial on the day, we will conduct the trial while discussing operating conditions with you. Even if you are not present, we can adjust the conditions while reporting the progress over the phone.

8. Submission of Trial/Contract Processing/Analytical Measurement Report

A report will be submitted within one week from the trial date.

FAQ

Q. Is it possible to test a small amount?

A. By using a small facility, it is possible to test from approx. 1L at a time.

Q. What kinds of materials do you accept for trials?

A. We generally handle a wide variety of applications. However, we may not be able to accept some materials due to safety and/or environmental aspects.

Q. Is it possible to request a trial without disclosing the material information?

A. Regarding safety and environmental aspects, we must ask you to present the detail information including SDS, etc. and we will evaluate whether or not we are able to conduct the trial. We may also enter into a confidentiality agreement with you.

Q. Is it possible to witness a trial?

A. Yes, we always welcome you at our PTC.

Q. Is it possible to request only powder analysis/measurements?

A. Yes, we are pleased to support for your analytical measurements.

Q. How are costs estimated?

A. Powder processing trial costs are estimated on a daily basis, including the cleaning process of the facility. It is also possible to conduct the trial on multiple consecutive days. Analytical measurements are estimated based on a sample basis. A liquid material preparation, wet pulverizing, freeze drying, molding and sintering are estimated in working-hour basis.

Q. Can you inform about the reservation status?

A. We will notify you of the latest reservation status by phone or email. We usually take reservations 1 to 3 months in advance. You can also make a reservation on the waiting list.

We provide contract processing services for spray drying, spray cooling, freeze granulation, freeze drying, wet pulverizing, nano powder wet pulverizing, classification, molding, and sintering. We support your journey from initial R&D phase to small-scale production and full-scale production. Utilize our facilities for sudden production increases and/or high-mix low-volume production. We also support you during the O&M period of your facilities or during interim production until you complete your new facility installation. We provide processing services tailored to your needs at a total of three locations: two domestic Powder Technical Centers (PTC1 and PTC2) and ASEAN Powder Technical Center (PTC ASEAN) in Thailand.

Characteristics of contract powder processing services

- Consistent support from R&D to mass production.
- One-stop service from powder processing to analytical measurements.
- The latest facilities are available without initial investment and maintenance costs.
- Time saving by outsourcing your production.
- Ideal for low-volume production that does not fit your production capacity.

SERVICES

Wet Pulverization | Nano Pulverization | Spray Drying | Spray Cooling | Freeze Granulation | Freeze Drying

EXAMPLES OF CHALLENGES IN POWDER PROCESSING

- Powder processing is required, but since we do not have the facility, it has to be outsourced.
- We have newly developed a new product and need to outsource the production.
- Although our new facility is in progress, we need to start production before it becomes operational.
- Since our facility is being aged, we want to switch our production to outsourcing.
- As our facility is too large for some low-volume productions, we want to outsource them.

HOW TO APPLY

1. Contact

Please contact us via the contact form or by phone.

2. Initial Q&A session

We will discuss the outline of your plan by phone, email, face-to-face, online, etc. We will also provide information about our Powder Technical Center and inform you possible facilities to be selected and production schedule. Depending on the facility selected, reservations may be booked for several months, so we ask that you schedule your appointment early.

3. Submission of Trial/Contract Processing/Analytical Measurement Confirmation Sheet

Please fill out and submit the Trial/Contract Processing/Analytical Measurement Confirmation Sheet. You can skip items that are unclear or non-disclosure information.
*We ask for detailed disclosure regarding the safety and environmental information.

4. Submit a quotation

We will submit you a quotation based on the Trial/Contract Processing/Analytical Measurement Confirmation Sheet.

5. Schedule adjustment

Processing schedule will be fixed after we receive your formal request.

6. Shipping your material

Ship your material by the day before the processing date.

7. Conducting your processing

We will conduct the processing according to predetermined processing conditions.

8. Delivery of processed products

We deliver processed products according to a predetermined schedule.

9. Submission of Trial/Contract Processing/Analytical Measurement Report

A report will be submitted within one week from the delivery date.

FAQ

Q. Is it necessary to make a trial before contract processing?
A. An initial trial is required to determine the processing conditions.

Q. What kinds of materials do you accept for contract processing?
A. We generally handle a wide variety of applications. However, we may not be able to accept some materials due to safety and/or environmental aspects. We do not undertake contract processing of food and pharmaceutical products. For some food applications, we may be able to introduce you to our partner companies.

Q. Is it possible to request a trial without disclosing the material information?
A. Regarding safety and environmental aspects, we must ask you to present the detail information including SDS, etc. and we will evaluate whether or not we are able to conduct the processing. We may also enter into a confidentiality agreement with you.

Q. Is it possible to witness the processing?
A. Yes, we always welcome you at our PTC.

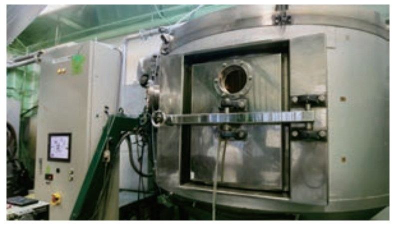
Q. How is the processing cost estimated?
A. After setting the processing conditions through a trial, we will select the facility to be used according to the amount of processing and estimate the cost.

Q. Can the production schedule be changed flexibly?
A. It depends on the availability of the facility. However, we will be as flexible as possible and propose the optimal alternative processing plan.

POWDER PROCESSING

SPRAY DRYERS

SB39	4 units
Chamber diameter	φ387mm
Atomization system	Two-fluid nozzles
Water evaporation vol.	Up to 3kg/h
Note	Closed-cycle system available

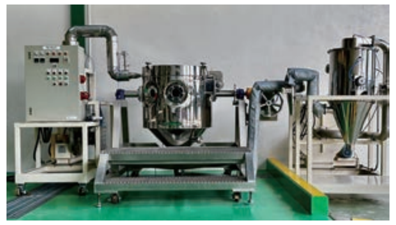


TR160	1 unit
Chamber diameter	φ1600mm
Atomization system	All systems available
Water evaporation vol.	Up to 15kg/h
Note	Closed-cycle system available

P260	2 units
Chamber diameter	φ2600mm
Atomization system	All systems available
Water evaporation vol.	Up to 30kg/h

D350	1 unit
Chamber diameter	φ3500mm
Atomization system	All systems available
Water evaporation vol.	Up to 50kg/h

SB39	1 unit
Chamber diameter	φ387mm
Atomization system	Two-fluid nozzles
Water evaporation vol.	Up to 3kg/h
Note	PTC ASEAN (Thailand)



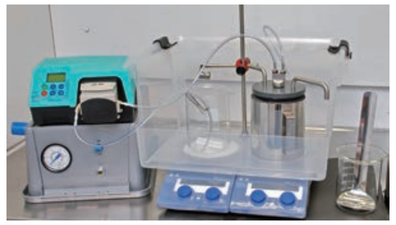
TR80	1 unit
Chamber diameter	φ800mm
Atomization system	Rotary atomizers, Two-fluid nozzles
Water evaporation vol.	Up to 3kg/h
Note	PTC ASEAN (Thailand)

P260	1 unit
Chamber diameter	φ2600mm
Atomization system	All systems available
Water evaporation vol.	Up to 30kg/h
Note	PTC ASEAN (Thailand)

SPRAY COOLERS

Spray cooling processing is available using the above spray dryers.

FREEZE GRANULATORS



LS-6	1 unit
Container diameter	φ120mm
Atomization system	Two-fluid nozzles
Material feed capacity	Up to 6kg/h
Cooling temperature	−196℃
Cooling system	Wet cooling system

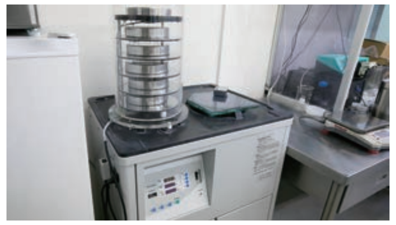
POWDER PROCESSING

FREEZE GRANULATORS

CS-30	1 unit
Chamber diameter	φ300mm
Atomization system	Two-fluid nozzles
Material feed capacity	Up to 15kg/h
Cooling temperature	-10 ~ -120℃
Cooling system	Dry cooling system

CS-220	1 unit
Chamber diameter	φ2200mm
Atomization system	All systems available
Material feed capacity	Up to 320kg/h
Cooling temperature	-10 ~ -50℃
Cooling system	Dry cooling system

FREEZE DRYERS



FDU-2110	1 unit
Tray volume	700ml × 6 stages
Cold trap capacity	3kg
Cold trap temperature	-80℃

FD-551	1 unit
Tray volume	8000ml × 3 stages
Cold trap capacity	10kg
Cold trap temperature	-45℃

TFD-10	1 unit
Chamber volume	85L
Cold trap capacity	10kg
Cold trap temperature	-40℃

RHEOFREED	1 unit
Chamber volume	160L
Cold trap capacity	30kg
Cold trap temperature	-45℃

LIQUID PROCESSING & WET GRINDING

POT MILL	4 units
Note	Various capacities available

BALL MILL (50L)	2 units
Container capacity	50L
Material contact part	Nylon
Ball	Zirconia φ10mm

BALL MILL (100L)	2 units
Container capacity	100L
Material contact part	Nylon
Ball	Zirconia φ10mm

BEAD MILL	1 unit
Model	RMH-08
Vessel capacity	0.95L
Material contact part	Zirconia
Beads	Zirconia φ0.5mm or 1.0mm

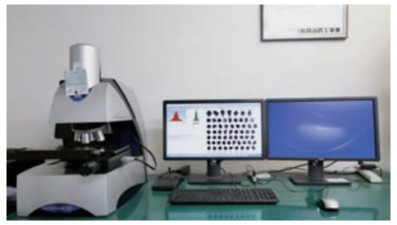
MOLDING & SINTERING

UNIAXIAL MOLDING MACHINE	1 unit
Model	SMT-200AF
Pressure capacity	max. 200kN
Note	CIP container available

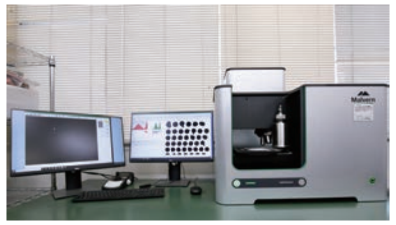
MUFFLE FURNACE	1 unit
Model	FP103
Temperature range	100 - 1150℃
Inner dimensions	100 x 150 x 100mm
Note	Nitrogen available

HORIZONTAL TUBULAR FURNACE	1 unit
Model	HF1800
Temperature range	300 to 1800℃ (normal use 1700℃)
Chamber	Al2O3 tube φ60mm
Note	Vacuum and nitrogen available

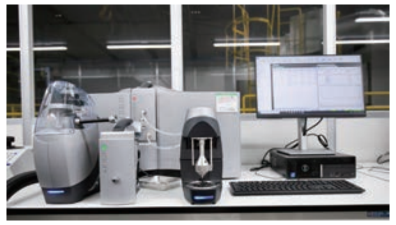
ANALYTICAL MEASUREMENTS



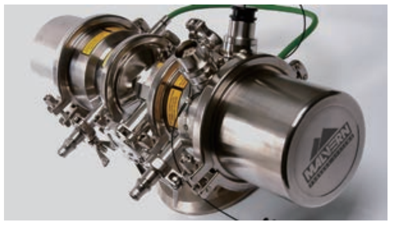
PSD ANALYZER	1 unit
Model	Morphologi G3
Measurement items	Particle size, shape, PSD, etc.
Note	Image-based analysis



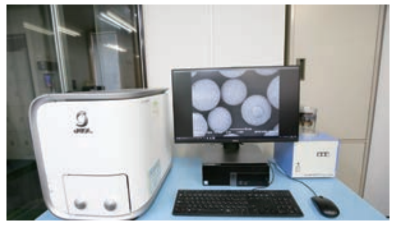
PSD ANALYZER	1 unit
Model	Morphologi 4
Measurement items	Particle size, shape, PSD, etc.
Note	Image-based analysis



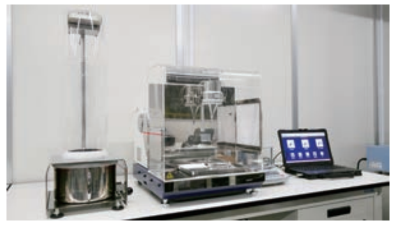
PSD ANALYZER	1 unit
Model	Mastersizer 3000
Measurement items	Particle size, PSD
Note	Laser diffraction



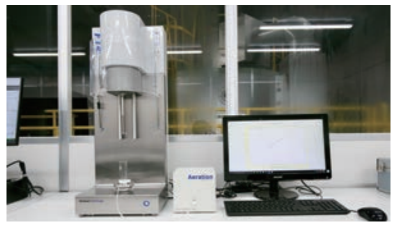
REAL-TIME PSD ANALYZER	1 unit
Model	Insitec
Measurement items	Particle size, PSD
Note	Laser diffraction



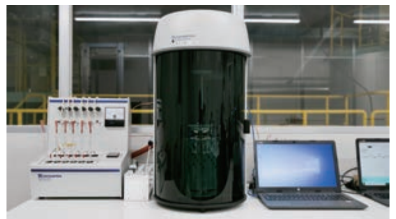
SEM	1 unit
Model	JCM-6000Plus
Measurement items	Shape, structure, surface, etc.



CHARACTERISTICS TESTER	1 unit
Model	PT-X
Measurement items	Angle, compaction, bulk density, etc.



POWDER RHEOMETER	1 unit
Model	FT4
Measurement items	Stability, compressibility, bulk density, etc.



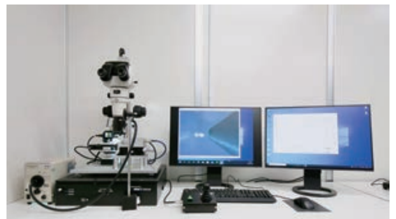
SURFACE AREA ANALYZER	1 unit
Model	TriStar II Plus3030
Measurement items	Specific surface area, pore distribution

DENSITY ANALYZER	1 unit
Model	Accupic II
Measurement item	Density
Note	Gas replacement method

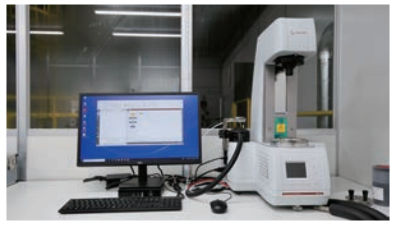
FACILITIES

LEARN MORE

ANALYTICAL MEASUREMENTS



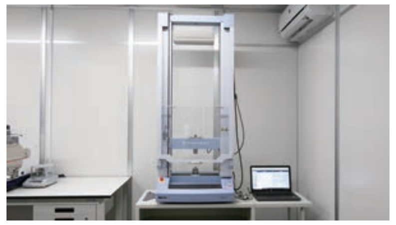
CRUSHING FORCE ANALYZER 1 unit
Model NS-A200
Measurement item Particle crushing force



WET RHEOMETER 1 unit
Model MCR302e
Measurement items Dynamic flow properties

VISCOMETER 1 unit
Model DVE
Measurement item Viscosity

MOISTURE ANALYZER 1 unit
Model MKV-710S
Measurement item Moisture content



UNIVERSAL TESTER 1 unit
Model AGS-10kN
Measurement items Tension, compression

RENTAL SERVICES

LEARN MORE

We provide rental services for powder process products. In cases where it is difficult to record fixed assets in your organization, when you want to use the process only for a certain period of time, or when the development goal is set for a certain period, it may be more cost-effective to rent our products than to purchase them. Even if the desired product is being rented and is not in stock, if you are considering a long-term rental period, we may manufacture a new product and rent it to you.

Characteristics

- Ideal for limited-term R&D projects
- Available to use the product in-house even if you cannot manage to purchase it.
- Can be considered as an alternative production in case of O&M period or relocation.
- Available in case of sudden troubles such as breakdowns in your existing facility.

HOW TO APPLY

1. Contact
Please contact us via the contact form or by phone.

2. Initial Q&A session
We will discuss the outline of your plan by phone, email, face-to-face, online, etc. and inform you of the latest stock status.

3. Submission of a rental quotation
If we are able to provide our proposal, we will submit you a formal proposal and quotation.

4. Rental date adjustment
The rental date will be fixed after we receive your formal request.

5. Product delivery
We will deliver the product to your specified location. Based on your request, we will carry out an installation, test run, and operation training.

6. Return of product
The product must be returned at the end of the contract period. It is also possible to extend the period through negotiation.

FAQ

Q. I have never used the product, is it possible to rent it?
A. Yes, it is possible. We can provide you an operational training as required. It is also possible to conduct a trial and provide an operation training in advance at our PTC.

Q. How are costs estimated?
A. Costs are estimated based on specifications of the facility selected and rental period.

Q. Are there any restrictions on the rental period?
A. The product rental period is 6 months or more. After 6 months, it can be set arbitrarily.

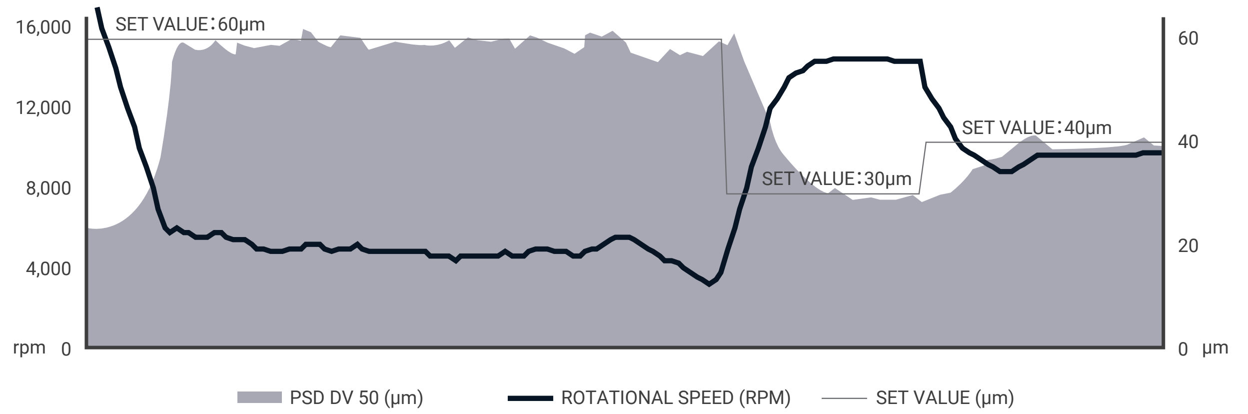
Q. What happens if the product breaks down during the rental period?
A. Except for failures caused by customer side, we will carry out repairs at our expense.

Q. How should I consider restoring the product when returning the product?
A. We will restore the product at our expense, excluding damage caused by the customer's unique circumstances. For example, if there is significant wear within the product due to the characteristics of the materials used by the customer, the customer will be responsible for the cost of restoring the worn area, such as repolishing, etc.

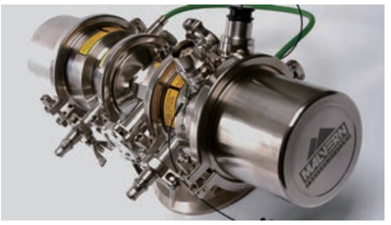
Q. Is it possible to rent it overseas?
A. Rental service is only available in Japan.

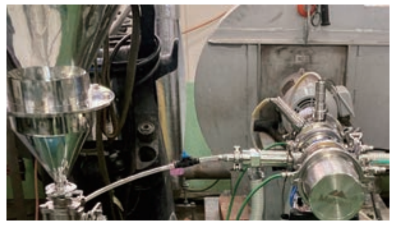
AUTO PSD CONTROL ATOMIZER SYSTEM

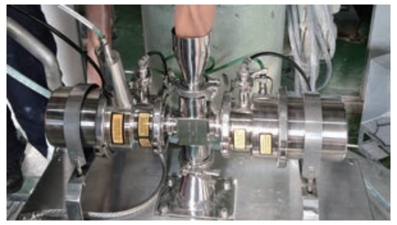
Our patented technology, the automatic PSD control atomizer system, measures the particle size of the powder flowing through the process in real time, and the rotational speed of the rotary atomizer is automatically adjusted by our original algorithm. Since the particle size is automatically controlled as a set value without fixing the rotational speed, the system can precisely keep the set PSD during the operation.



Currently, the mainstream for rotary atomizer controls in operation around the world is to fix the rotational speed at an arbitrary set value. Fixed speed operations run the risk of the product deviating from the targeted particle size range if other environmental conditions change. Most of the manufacturers control powder quality by periodically measuring particle size ex-situ. In-situ real-time monitoring is an effective way to improve quality stability. Product loss can be avoided by automatically controlling PSD in real time. There are quality control parameters in powder processing using rotary atomizers. In terms of raw materials, concentration, viscosity, pH, etc. of liquid materials are to be monitored. Additionally, if the raw material is a suspension or slurry, the physical properties and dispersibility of the primary particles are also to be considered. If there is a difference in quality between batches during the liquid material manufacturing process, it will affect the PSD of the powder processed. Process conditions also change depending on the weather and environment of the installation location.



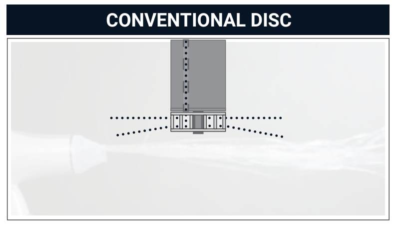


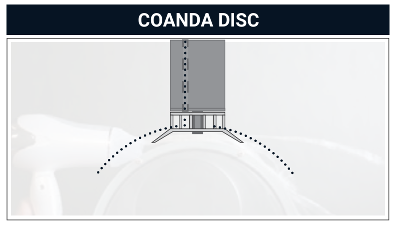


We use Malvern Panalytical's Insitec for our system. The Mie theory laser diffraction method adopted by ISO is used to measure particles in real time in the particle size range of 0.1 to 2,500 μm. The angularly scattered light intensity data from the laser is analyzed and the particle size distribution is calculated as the diameter of a volume-equivalent sphere. A sampling point is installed on the powder collection line to measure the particle size of the flowing powder. The obtained value is fed back to the control of the rotary atomizer, and the rotational speed is automatically adjusted by our patented algorithm. PSD can be precisely controlled with our continuous feedback control system all the time in operation. Powder is a collection of particles of various sizes. Therefore, those sizes are expressed by a "distribution". The rotary atomizer is an atomization system that can obtain a sharp PSD. However, the environmental conditions during production are not constant. In order to precisely monitor the process and stabilize the powder quality, we automatically control the PSD instead of the conventional fixed rotational speed.

COANDA DISC

Our patented Coanda Disc is a rotary atomizer disc that applies the Coanda effect, in which a fluid jet is attracted and followed to a nearby curved surface. Compared to conventional rotary atomizer discs, the production efficiency in spray drying, spray cooling, and freeze granulation can be increased.



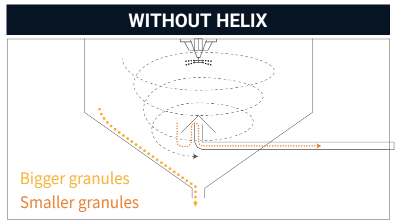


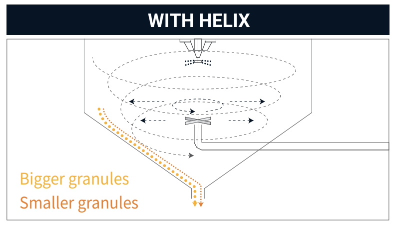
The atomization pattern of droplets from a rotary atomizer using a conventional disc is horizontal due to the action of centrifugal force. Therefore, the diameter of the process chamber must be of a size that allows the droplets to solidify before adhering to the chamber inner wall (E.g. Spray drying is evaporation, spray cooling is solidification, freeze granulation is freezing and solidification). For processes that produce larger particle sizes, the rotational speed should be set lower in order to create a larger droplet size. In that case, the time required for droplet solidification becomes longer and the chamber diameter need to be designed wider in size. The Coanda effect, discovered by Romanian engineer Henri Coanda, is being applied for creating high lift force by flowing jets over the wings of an aircraft. The Coanda disc has a dome-shaped design extending downward in a curved shape, so that the atomization pattern, which is normally horizontal, is directed downward. This effect can increases the droplet fall distance and allows efficient use of chamber space. In other words, assuming a production process with the same liquid material, particle size, and feed capacity is introduced, by using the Coanda disc, the chamber size can be smaller, leading to a reduction in process installation costs. Alternatively, by adopting Coanda discs in existing production processes, it is possible to increase the feed capacity or produce products with larger particle sizes. Through joint research with Tokyo University of Science, we have conducted repeated experiments using CFD simulations and high-speed cameras, and have developed a shape that maximizes the Coanda effect. In demonstrations conducted in-house and jointly with our customers, we succeeded in increasing the yield rate of fine ceramic materials such as alumina and silicon carbide, as well as food applications such as dextrin and saccharides. Our Coanda disc can reduce product adhesion inside the process and improve your production yield.

SWIRL FLOW CLASSIFIER

LEARN MORE

Our patented swirl flow classifier HELIX is a classification module that can improve the powder recovery rate at the bottom of the process chamber in spray dryers, spray coolers, and freeze granulators. Powered by process gas and no electrical work is required. Even in existing production processes, HELIX can be installed simply by hand.



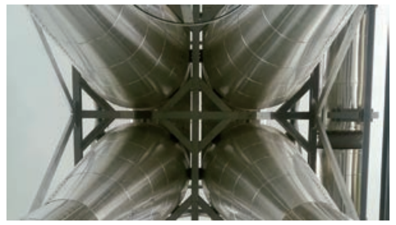


In fine ceramics industry, the granules collected at the bottom of the chamber are generally treated as first grade products. The fine powder that has passed through the chamber is collected by a cyclone. The fine particles collected by the cyclone may collapse due to the swirling flow inside the cyclone, so they may be discarded without being treated as a first grade product, or they may be returned to raw materials and reused. Therefore, improving the recovery efficiency at the bottom of the chamber will lead to higher process production efficiency. HELIX uses rotating blades powered by process gas to create a swirling flow within the chamber, thereby reducing the powder passing through the chamber toward the cyclone. By simply installing the unit at the top of the cyclone duct, the product yield at the bottom of the chamber can be improved.

ACS HIGH EFFICIENCY CYCLONES

Advanced Cyclone Systems (ACS) is a company exclusively dedicated to the development and commercialization of high-efficiency cyclone systems that incorporates the PACyc (Particle Agglomeration in Cyclones) model into design optimization simulations. In 2023, we concluded an exclusive distributorship agreement in Japan territory. In addition to our range of spray dryers, spray coolers and freeze granulators, we also offer high-efficiency cyclones for powder recovery and emission control fields.

Advanced Cyclone Systems



INDUSTRIES

Product recovery

Products are manufactured in powder form in a variety of industries, from pharmaceuticals to food, chemicals, fertilizers, and nanoparticles. It is inevitable that these products will be separated from the air after processes such as drying and grinding. Several industrial filtration systems can be employed for this purpose. Cyclones have the advantage of easily handling a wide range of operating temperatures, pressures and moisture conditions, unlike other dust collectors such as bag filters. By its simple and aseptic design, without any moving parts, cyclones have very low maintenance costs and can be easily and effectively cleaned, minimizing bacteria contamination or product cross contamination. ACS cyclones can be designed both to increase product yield and to comply with strict particle emission limits, frequently exempting the use of other filters downstream.

Emission control

Particulate matter (PM) emission control is a common problem in industries that operate boilers or incinerators for energy production, or furnaces, kilns and dryers for the manufacturing of products, such as ceramics, cement or pellets. Complying with stack emission limits, avoiding the carry through of particles to downstream processes or purifying ambient air, are the main motivations for clients to reduce PM emissions.

ABOUT ACS

ACS was founded in 2008 by Romualdo Salcedo (CTO), Professor at Faculdade de Engenharia da Univerdade do Porto (FEUP) and by Pedro Araújo (CEO), Industrial Engineer from FEUP and MBA from the Lisbon MBA, with the support of the CoHitec program by Cotec: A Portuguese institutional innovation association. With unique scientific knowledge in cyclone design optimization and particle agglomeration modeling (PACyc) in partnership with FEUP for R&D, ACS is the only company worldwide exclusively dedicated to cyclone systems and uses this technologic platform to solve particle separation problems. ACS has fulfilled over 400 successful installations in 37 countries.

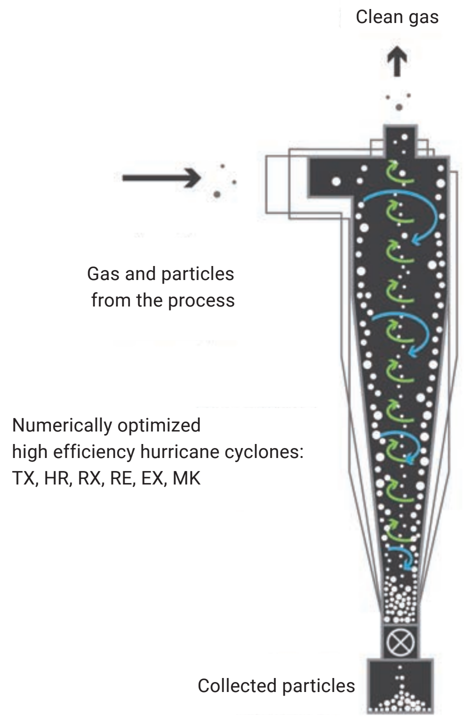
HURRICANE CYCLONES

Hurricane cyclone families respond to a particular need from the client and considering how inter-particle agglomeration/clustering affects collection efficiency. From coarse particle pre-separation proportioned by compact and low pressure drop cyclones, such as the SD and DX, to fine particulate capture with high-end geometries such as the EX and MK, ACS provides solutions for a wide range of industrial cases, being able to reach emissions comparable to ESPs (down to less than 30mg/Nm3).

hurricane

Particle agglomeration & Numerical optimization

ACS holds accurate efficiency prediction models, capable of explaining why sub-micrometer particles are often captured with much higher efficiency than expected. Particles with bigger agglomerates (clusters) are easier to be collected than the original particles. Agglomeration increases in the presence of wide particle size distributions and it causes long residence times in the cyclone and high inlet particle concentrations. This mechanism are incorporated in ACS numerical simulation, combining a sophisticated stochastic algorithm with a classical numerical model to predict cyclone performance: the PACyc (Particle Agglomeration in Cyclones) model.



Multiple cyclones for multiple needs

Together with economic and operation constraints such as size and pressure loss, PACyc Model allows to simulate millions of virtual prototypes with numerical optimization within an affordable period. The numerical optimization have resulted in several families of cyclones, some of those patented. The following cyclone families, always subject to further customization, are the result of very different client demands ACS has come across until now.

Depending on the requirements of the client, ACS designs solutions that go from compact pre-separators to a final stage dust collector. The more efficient the solution is, the larger the number of cyclones needed to increase residence time and promote particle agglomeration. ACS offers the most cost-efficient solutions by considering the impact of space and cost.

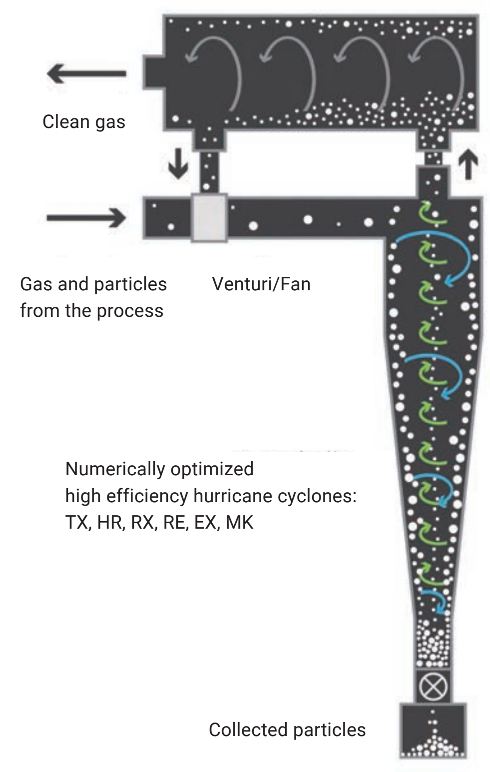
RECYCLONE MH

ACS holds a patent of a recirculation system to increase the efficiency of cyclones. ReCyclone is made up of a high efficiency Hurricane and a particle separator, placed downstream, called the “mechanical recirculator”. The main purpose of the recirculators is to reintroduce the uncaptured particles into the cyclones after those fine particles are driven to the outer walls of the recirculators by centrifugal force. While the process gas is enriched in particles, the axial exhaust gas stream is clean with less particles. Recirculation is achieved through an additional fan. Since the recirculation system only serves as dust separation (and not collection), the particles are exclusively collected in the cyclones. The system is a combination of a cyclone and a recirculator. Efficiency increases due to recirculation and agglomeration of fine particles with larger ones coming directly from the process. ReCyclone® MH decreases emissions of Hurricane cyclones by 30 to 60%. Recirculation control has the benefit of handling variable process gas flow rates.

ReCyclone® MH System

Characteristics

- High efficiency: Cyclone emissions can be reduced by 30-60%
- Low emissions: Emissions around 15-45mg/Nm3 can be achieved
- Pressure drop: 150~200mm w.g.
- No temperature limitations with appropriate metals or refractories
- Recirculation maintains proper cyclone inlet flow rate
- Robust material and structure with no moving parts
- Less maintenance and downtime
- Can be introduced with low investment cost



RECYCLONE EH

An adoption of electrostatic recirculation in the cyclone system has successfully proven to further reduction of particle emissions, even in the 1-5μm particle size range, assuring future regulation compliance, particularly where legal limits are very strict. DC high voltage is applied to the recirculator, allowing the recirculation of very fine nanometric particles, more resistant to centrifugal forces, to the cyclones. After separation in the recirculator and concentration in the recirculation flow, electrically charged fine particles are attracted by the cyclone walls, while agglomerating with larger particles entering the system – both promoting their easier capture. Unlike ESPs, particles are not captured on the walls of the recirculator so that ReCyclone® systems can avoid dust accumulation and condensation. Additionally, ReCyclone® EH systems have low sensitivity to either low or high electrical resistivity while required power is only 10 to 15% of that used in ESPs.

ReCyclone® EH System

Characteristics

- High efficiency: Cyclone emissions can be reduced by 40-70%
- Low emissions: Emissions around 5-25mg/Nm3 can be achieved
- Pressure drop: 120~170mm w.g.
- Operation temperature can be up to 400℃
- Less susceptible to fluctuating flow rates
- Robust material and structure with no moving parts
- Less maintenance and downtime
- Can be introduced at a reasonable level of investment cost