Dry bead mill

Ashizawa

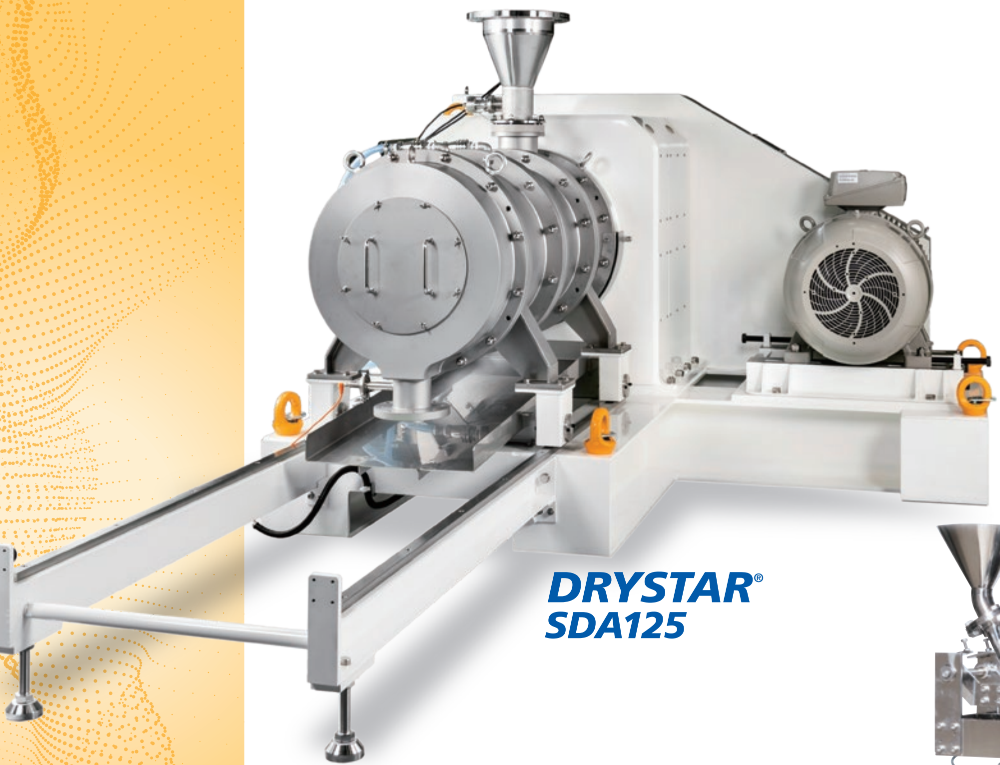
Continuous

DRYSTAR® SDA

With built-in classifier

SIGMA DRY® SGD

Unique dry bead mill from the specialist, in fine-particle technologies, Ashizawa



DRYSTAR®
SDA125

SIGMA DRY®
SGD12.5

Particle technology for co-creation of new possibilities

Ashizawa Ashizawa Finetech Ltd.

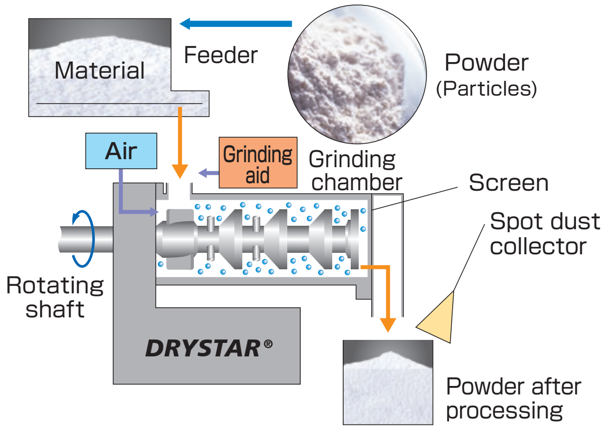
Grinding of high-hardness materials down to single-micron level!

Superb energy efficiency and support for mass production

Feature

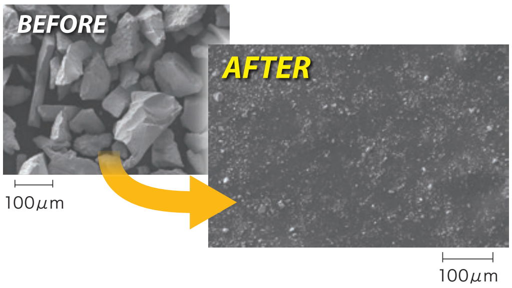
- Dry and continuous-operation horizontal mill
- Grinding of several hundred-micron materials down to single-micron with single pass
- Minimizing of energy costs
  (one-tenth of jet mill *according to in-house research)
- Minimal air consumption due to only using air for shaft seal protecting
- Effective surface modification processing

Structure



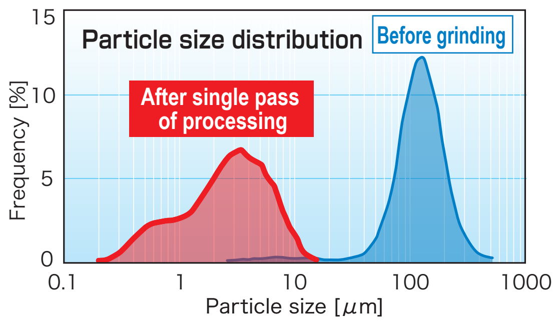
Grinding data from DRYSTAR®

Processing example 1 Material: silica (Mohs hardness of 7)

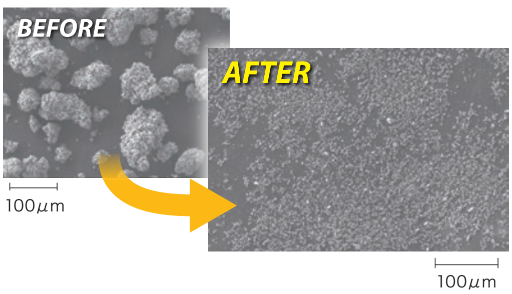


(Unit: µm)

	After single pass of processing	Before grinding
dMAX	15	520
d50	2.5	140

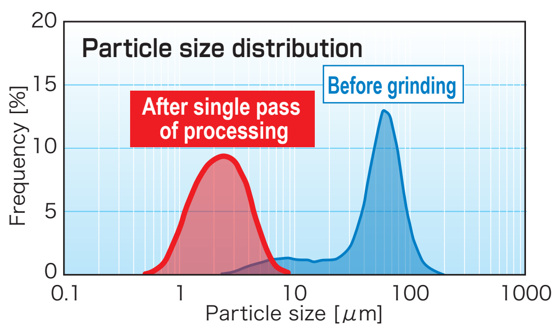


Processing example 2 Material: alumina (Mohs hardness of 9)



(Unit: µm)

	After single pass of processing	Before grinding
dMAX	9	200
d50	2.1	52



Proven materials used with DRYSTAR®

Mohs hardness	Materials
7 to 9	Quartz, Silica, Soft ferrites, Hard ferrites, Alumina, Silicon nitride, Iron oxide, Tungsten oxide, Sodium silicate
4 to 6	Glass, Carbon, Black silica, Blast furnace ash, Fly ash, Incineration ash, Organic germanium, Zinc oxide, Cerium oxide, Chromium oxide
Less than 4	Gypsum, Magnesium hydroxide, Aluminum hydroxide, Barium titanate, PZT, Powdered green tea, Rice flour, Activated carbon, Calcium carbonate

Suction System

Patent pending

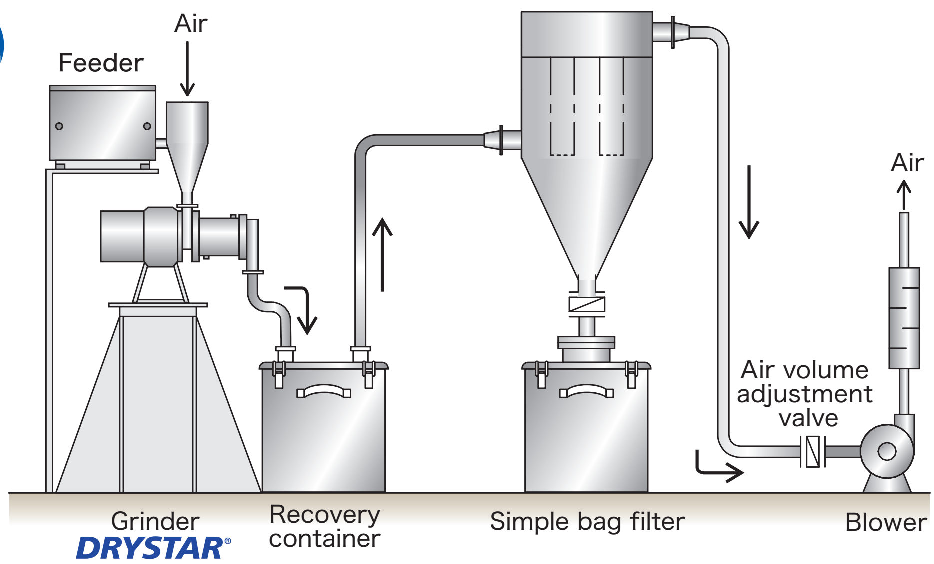
A new system that enables the processing of adherent powders!

Stabilizes powder fluidity by controlling air flow in the system channels

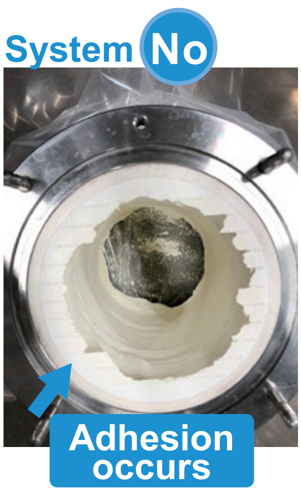
Feature

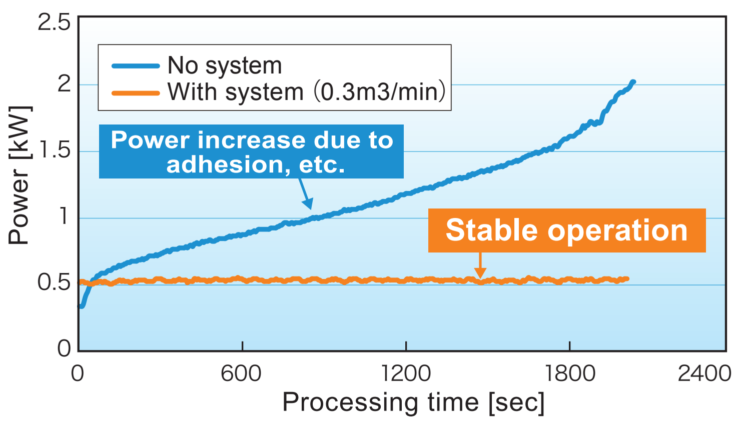
- Achieves stable operation without the need for dispersing agents, even for adherent materials
- Capable of retention time control (power adjustment) by adjusting the air volume
- Suppresses contamination due to dispersing agents and wearing of parts

Flow diagram



Processing example Material ground: Titanium oxide





Materials ground for which the suction system is effective

Titanium oxide, Quicklime, Indium oxide, Niobium oxide, Lithium carbonate, Yttrium oxide, Lithium titanate, Nickel, Manganese, Cobalt, Cuprous oxide, Organic pigments, Zeolite, Crystalline cellulose, Bentonite, etc.

Achievement of high-level particle-size control!

Support for combination of grinding, dispersing, and classifying

Feature

- **Strong with grinding special pin shape**
- **Efficient collection of fine particles based on loosening of particles agglomerated in dispersing zone**
- **Elimination of coarse particles based on adoption of high-precision classifier**
- **Achievement of sharp particle-size distribution**
- **Minimization of installation space**

Process flow of *SIGMA DRY*® (model: SGD)

❶ The raw materials are supplied into ***SIGMA DRY***® through the constant feeder.

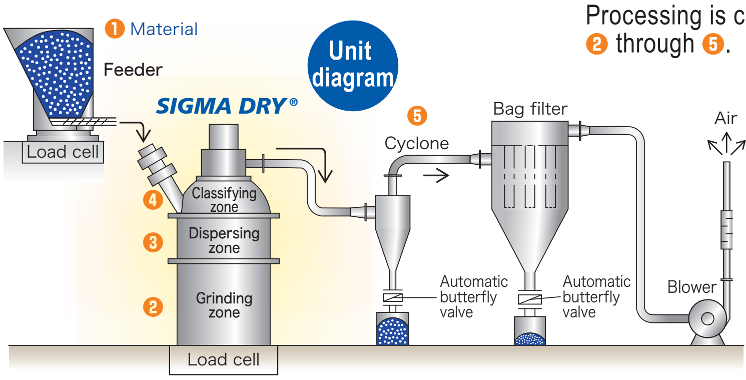
❷ The coarse particles are sent to the grinding zone, and undergo grinding with beads.

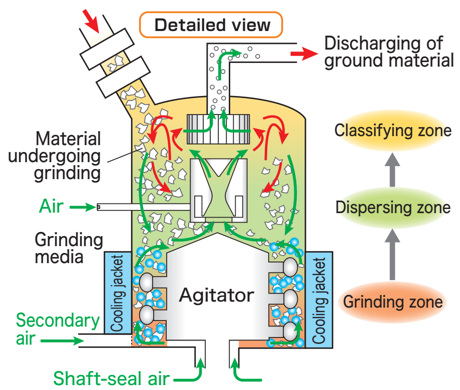
❸ The powder that has undergone grinding is loosened with air flow in the dispersing zone, and then is sent to the classifying zone.

❹ In the classifying zone, the fine and coarse particles undergo classifying with the centrifuge rotor.

❺ The fine particles are dispensed from ***SIGMA DRY***® and are collected with the cyclone and bag filter.

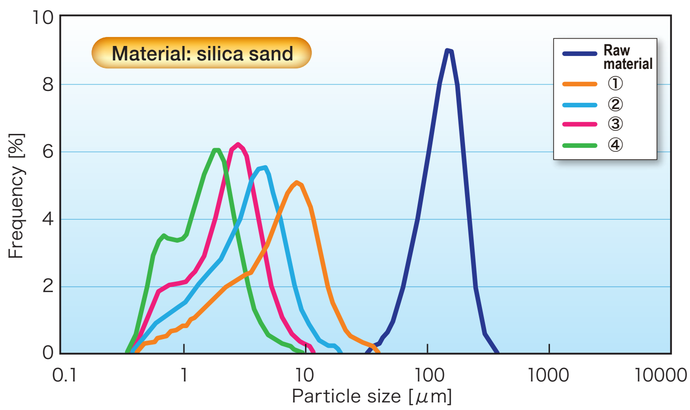
Processing is continuously carried out by repeating steps ❶, and ❷ through ❺.





Grinding data from *SIGMA DRY*®

<Differences in particle-size distribution resulting from adjusting of SGD12.5 classifier rotation speed and blower air volume>



	Operating conditions		Particle size (μm)	
	Classifier rotation speed (rpm)	Air flow (m^3/min)	d50	dMAX
Raw material	–	–	130.1	352.0
①	3,000	4	6.1	37.0
②	5,000	4	3.3	18.5
③	7,000	4	2.3	11.0
④	7,000	3	1.5	10.1

Specifications

Model	SGD 12.5	SGD 25	SGD 50	SGD 125
Motor for grinding (kW)	7.5～	11～		
Motor for classifying (kW)	2.2～		5.5～	
Air flow used (m^3/min)	2～4	4～8	8～20	20～50
Dimensions: W × D × H (mm)	800×1300×1900	1000×1600×2400	1300×2000×3000	1400×2300×3500
Capability ratio	1	2	4	10
Chamber material	Ceramics and metals (only metals in case of SGD125)			

Applications

Battery materials (positive and negative electrode materials), electronic part materials, ferrites, various glasses, various ceramics (alumina, silicon nitride, etc.), carbon, cement, iron and steel slag, fly ash, abrasives, silica, inorganic substances, food, etc.

*The values are representative examples, and the specifications are subject to change without notice.

Continuous dry bead mill
for research & development

DRYSTAR® SDA1

Only table-sized model in industry!

For R&D purposes

Mechanochemical is possibe !

Feature

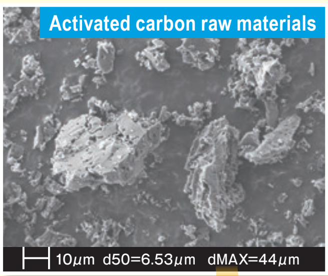
Smallest size in industry

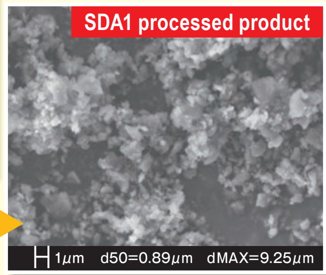
- Achievement of submicron range with dry grinding
- Maximum particle size of 10 μm without need for classifier
- The 100 times capability of grinding compared to the ball mills
- Testing with minimum sample amount of 0.5 L
- Scaling up to production size

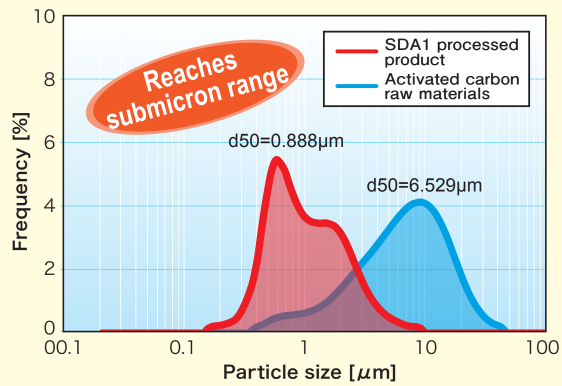
Smallest amount in industry

Grinding data from DRYSTAR® SDA1

Material: Activated carbon







Specifications

Model		SDA1	SDA5	SDA12.5	SDA25	SDA50	SDA125	SDA250	SDA500
		DRYSTAR®							
Grinding chamber volume (L)		1.0	3.8	12.2	25	50	125	250	500
Motor (kW)		3.5	5.5	15	22	45	75	132	200
Dimensions (W×D×H)	W(mm)	400	600	850	1100	1300	2000	2300	2600
	D(mm)	600	1300	2000	2500	3200	3500	4500	6000
	H(mm)	500	1400	1700	2800	3300	1100	1400	1700
Weight (kg)		50	550	800	1600	2700	5000	7500	12000
Chamber material		Ceramics and metals (only metals in case of SDA125 or larger)							
Combability with 1.5mm beads		○	○	○	—				

*The values are representative examples, and the specifications are subject to change without notice.

Comparison data 1 Differences between dry bead mill *DRYSTAR*® and various grinding machines

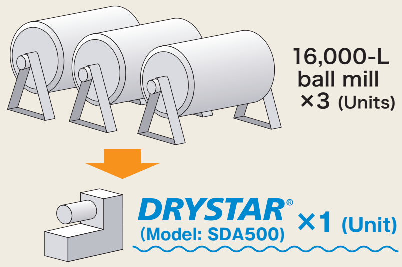
Production efficiency comparison between dry bead mill *DRYSTAR*® and dry ball mills

Performance comparison between *DRYSTAR*® and ball mills

Model	DRYSTAR®	Vibrating ball mill	Rotating ball mill
Grinding performance	80	20	1
Particle size distribution	Sharp	Slightly broad	Broad
Achieved particle size	1 to several μm	Several μm	Several μm
Ball size	ϕ1.5 to 8 mm	ϕ10 to 20 mm, or Rods	ϕ20 to 50 mm
Scaling up	Easy	Difficult	Somewhat difficult
Noise	75 to 85 dB (A)	85 to 100 dB (A)	85 to 100 dB (A)
Vibration	Same as general machinery	Pollution problems at low frequencies	Somewhat large
Installation area	Small	Somewhat small	Large
Temperature control	Easy	Easy	Difficult
Product collection	Easy	Easy	Difficult
Wear	Agitator	Chamber	Chamber
Maintenance	Easy	Difficult	Major undertaking
Grinding method	Continuous pass	Continuous pass	Batch method

Example of facility comparison between *DRYSTAR*® and ball mill

In cases in which machines are geared for production, it is extremely difficult to manufacture the same product as the testing sample by using ball mills. In addition, even if it is viable to manufacture a product that is equivalent to the testing sample, compared to dry bead mill *DRYSTAR*®, the facility costs amount to roughly twice as much, three times more machines are required, the installation area expands by roughly seven times, and the number of beads needed increases by roughly 60-fold. Hence, the use of ball mills is inefficient and does not seem to be realistic.



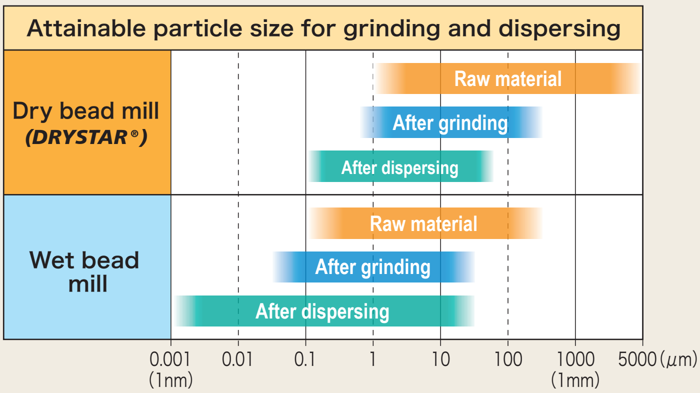
Comparison between dry bead mill and jet mill

Compared item	Grinding media	Grinding principle	Grinding configuration	Grinding force	Particle-size control	Energy costs	Additional equipment
DRYSTAR®	Beads (ϕ1.5 to 8 mm)	Shear force and impact force of beads	Surface grinding	Strong	Easy... Bead diameter, rotating tip speed, and processing flow rate	One-tenth or less relative to jet mill	Small quantity needed
Jet mill	Air (Humidity control)	Impact of product itself	Bulk grinding	Weak	Difficult... Classifier and air pressure adjustment	Extremely large	Large quantity needed

Comparison data 2 Difference between dry bead mill and wet bead mill

Dry bead mills can minimize contamination from beads compared to wet grinding. Therefore, dry grinding is effective as a pre-grinder for materials that require fine wet-process grinding to a submicron level or nano-scale level.

	Dry bead mill (*DRYSTAR*®)	Wet bead mill
Bead size	ϕ1.5 to 8 mm	ϕ0.015 to 2 mm
Shaft sealing	Easy (Oil seal)	Precise (Mechanical seal)
Material wear	Low (one-tenth of wet grinding)	High
Re-agglomeration	Strong	Weak
Particle compounding	Good	Possible
Mechanochemical effect	Large	Extremely small



Particle technology for co-creation of new possibilities

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