

NETZSCH

Proven Excellence.



Fine-Grinding and Fine-Classifying

for Processing Dry Products - NETZSCH Trockenmahltechnik GmbH

Business Unit
GRINDING & DISPERSING

Business Unit Grinding & Dispersing

The Business Unit Grinding & Dispersing, one of three business units within the globally engaged NETZSCH-Group, offers a comprehensive program for many applications in mechanical process technology. In this sector, the business unit is particularly active in the areas of wet- and dry-grinding, mixing, dispersing, deaerating and classifying.

Laboratory-size and production-scale machines as well as complete manufacturing lines are used in nearly all branches of industry, for example in the future-oriented nanotechnology sector for manufacturing printing inks, minerals or foodstuffs.

The bundling of process technological expertise, a comprehensive machine program, the solution of customer-specific application tasks and the global presence of NETZSCH are unique and form the strength of this business unit.



Headquarters of the Business Unit Grinding & Dispersing, Selb, Germany



NETZSCH worldwide

NETZSCH works literally close to its customers and manufactures in Germany, the USA, in Brazil, Russia, India and China. When new markets are established, NETZSCH ensures their support and provides advice for customers locally. We work with highly-qualified experts in a globally-organized, regional sales network. This means that you are advised and supported locally worldwide by NETZSCH-specialists from the sales, service, engineering and process-technology areas.

Your Specialist for Dry Fine-Grinding and Classifying:

NETZSCH Trockenmahltechnik GmbH, one of the global leading companies in the area of dry product processing, is part of the Business Unit Grinding & Dispersing of the NETZSCH Group. Customers profit from our comprehensive experience potential and our diverse machine program, ranging from laboratory- and production machines to complete production lines. **Fine impact mills, classifying- and jet mills** as well as **fine-cutting mills** and **high-efficiency fine classifiers** made by NETZSCH are mainly used in the application areas chemistry, inorganic materials/minerals, ceramics and life science for pharma- and food applications.



NETZSCH Trockenmahltechnik GmbH

NETZSCH Trockenmahltechnik GmbH's headquarters are based in Hanau am Main. Here, as well as administration, R&D, process engineering, production and sales departments, one of the most state-of-the-art application laboratories in grinding- and classifying technology is also available for customer tests. This was extended in 2015 to include a *FoodLAB* for tests under food-grade conditions.

At the production location in Stockach near Konstanz on Lake Constance, **filters** and **cyclones** are manufactured, which are either integrated in plants at Hanau or delivered directly to the final customer.



NETZSCH Jet Mills

In jet mills the size-reduction of particles is carried out in a gas jet. The grinding gas (air or argon, N₂, ...) is guided into the grinding chamber and accelerated in such a way, that product particles are carried along in the gas flow and impact against each other. Size-reduction is autogenous and contamination is therefore low. Jet mills are predestined for grinding dry- and very hard materials to obtain a particle fineness in a range of 0.1 µm to 100 µm.

With the **CGS fluidized bed jet mill** and the **CONJET® high-density bed jet mill**, which are both equipped with a dynamic air classifier for exact limiting of the upper particle size, NETZSCH has a well tried and tested premium-technology in its portfolio. The **s-JET® steam jet mill**, which is a logical further development of an air jet mill with an integrated air classifier, demonstrate NETZSCH's technology leadership. Using super-heated steam as a grinding medium instead of air, a considerably higher jet energy is available, with which higher capacities can be obtained and new fineness ranges (submicron) for dry-grinding are made possible.



Example of Application: Rare Earth Magnets

Grinding is an essential step in the production process of rare earth magnets (neodymium-iron-boron- (Nd-Fe-B)) as the particle size of the powder used in their manufacture is decisive for their quality and properties. A narrow particle size distribution is ideal and finest (< 2 µm) and coarsest (> 8 µm) particles should be kept to a minimum.

Using *M-JET* high-density bed jet mills and *M-CLASS* finest-classifiers, which were further developed especially for this application, sensitive Nd-Fe-B-compounds or other alloys can be processed under inert gas to obtain a product with a narrow particle size distribution and defined upper particle size limit.



NETZSCH Fluidized Bed Jet Mill CGS

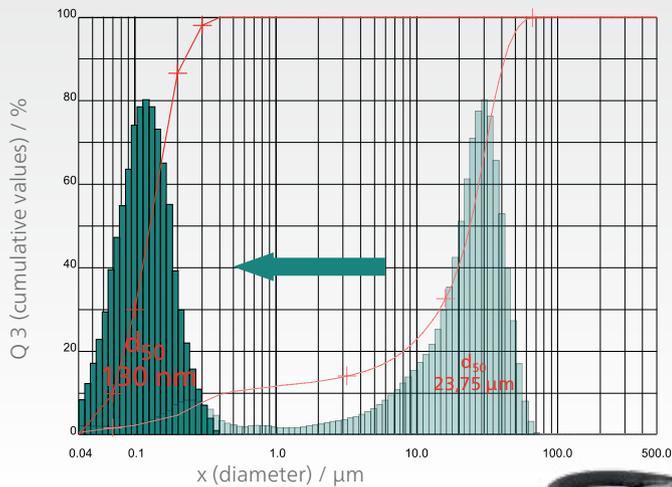


NETZSCH High-Density Bed Jet Mill CONJET®

Application Example: Superfine products in the submicron range

The *s-JET*[®] grinding process is opening new doors for the dry manufacture of products with particle sizes in the submicron range and an exact particle size distribution. The basic requirement is a grinding product which is thermally resistant.

Many different products, such as minerals, ceramics, pigments and raw materials for batteries are already processed on the *s-JET*[®] steam jet mill. This unique process has provided access to completely new application possibilities.



Particles size measuring method CILAS 1064 wet
Measuring range: 0.04 μm – 500.00 μm



NETZSCH Steam Jet Mill *s-JET*[®]

NETZSCH Impact Mills

In general, rotary impact mills are used for the grinding of soft products to products with medium-hardness (up to hardness 3 on Mohs scale) with a fineness of several mm down to a one-digit μm -range. These mills are equipped with a rapidly-running rotor with suitable grinding tools around which grinding tracks, screens or counter-rotating pins are used as an impact partner.

The **CONDUX® fine-impact mill** can be used in a broad range of applications. This mill can be optimally equipped with various grinding tools and stators to suit the grinding product and it can also find use in pressure shock resistant or protective gas plants and for cryogenic grinding.

To manufacture a product with a finest particle size distribution and a defined upper particle size limit conventional fine-impact mills are frequently used with an additional downstream unit, e.g. screening machine or classifier. However, the costs for such additional equipment are high. Using the **CSM classifier mill**, a combination of a fine-impact mill and dynamic air classifier, a similar grinding-classifying-effect can be achieved in one system at lower expenditure.

Application example: Sugar

Sugar is a raw product whose uses are many and varied – chocolate, jams and jellies, ice cream, drinks or baked goods such as cookies to name but a few. Depending on the planned use, various particle sizes are required. For many applications, sugar is finely ground to guarantee short dissolving times in the next processing step or to provide an optical finish for delicious desserts.

With the **CONDUX® fine-impact mill** various grinding finesses can be obtained easily using the infinitely variable speed setting on the blower rotor and/or by using different screen inserts.

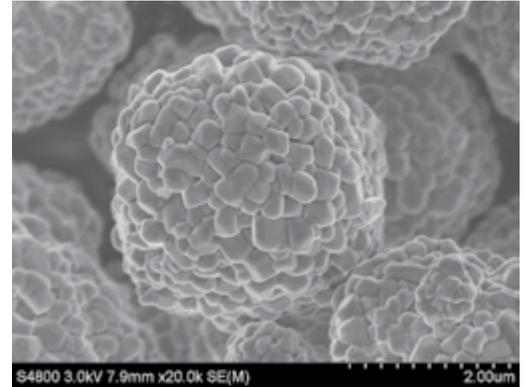


NETZSCH Fine Impact Mill CONDUX® 220 COMPACT

Application Example: Cathode Masses for Lithium-Ion-Batteries

Lithium ion batteries store and supply electrical energy in cell phones, laptops and tools. Electrical vehicles, such as bicycles, scooters and other hybrid concepts are also creating a steadily rising demand for batteries. The goal is to develop increasingly powerful batteries whose features are higher capacity, longer lifetime, shorter charging times, and lower weight and size.

With the **CERAMIC**-execution of the **CSM classifier mill**, dry-grinding of battery masses free from metallic contamination of the ground product is possible! All machine parts in contact with the product being ground are made completely of ceramic material or they have a ceramic coating.



NCA (Lithium-Nickel-Cobalt-Aluminum-Oxide)
Final Product after Grinding



NETZSCH Classifier Mills CSM **CERAMIC**

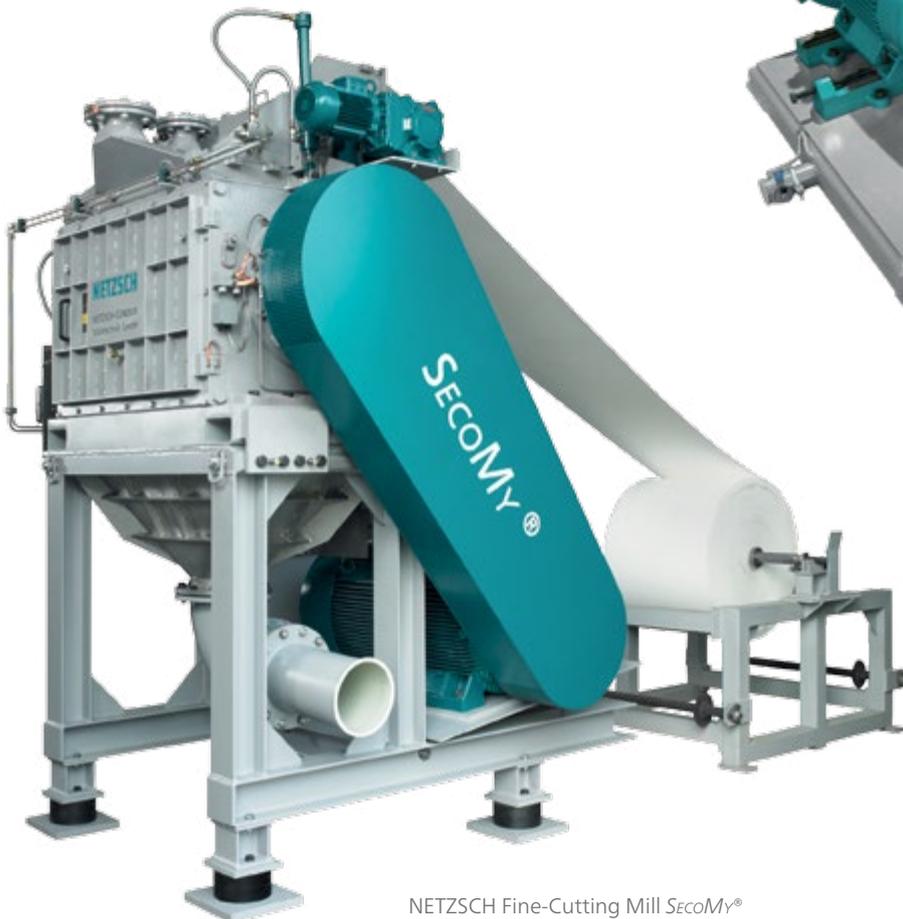
NETZSCH Fine-Cutting Mills

Cutting mills are used to grind and homogenize medium-hard to soft and elastic materials. In this process the material is ground by shearing forces using rotary- and stator knives. As a rule, the material is fed into the machine from above, it falls onto the rotor and is ground between rotor- and fixed cutting knives. As soon as the material has reached the desired fineness, it can leave the grinding chamber via the screen in the lower part of the machine where it then falls into the collection vessel.

Cutting mills made by NETZSCH are characterized by their robust design, their precision and reliability. In addition to the **CS-Z** and **SECOMy®** mills, the newly developed **fine-cutting mill SECOMy® S** with integrated air classifier can achieve finenesses of below 45 µm, thus widening the spectrum of possible uses for this type of mill.



NETZSCH Fine-Cutting Mill CS-Z



NETZSCH Fine-Cutting Mill SECOMy®

Application Example: Cellulose and Cellulose Derivates

Before cellulose and cellulose derivates can be used in food and pharmaceutical products, they must undergo multistage processing.

With the **CS-Z**, **SECO^{MY}**® and **SECO^{MY} S** fine-cutting mills, which exhibit precise and high cutting frequency and are equipped with a screen insert and/or a rotating classifier wheel for determining the discharge size, NETZSCH can offer the ideal solution for the first step. A cellulose powder, which can be used straight away as a filler or additive to the product (foodstuffs) is obtained.

The powder obtained can also be modified and by adding various functional groups it can be converted into cellulose derivates, which display very specific properties such as solubility, viscosity, gelling power and -temperature or surface activity.



NETZSCH Fine-Cutting Mill *SecoMy*® S

Dry Agitator Bead Mill *SPHERHO*®

Wet operating NETZSCH agitator bead mills have been successfully and reliably used for grinding and dispersing solids in suspension in many different industrial branches for decades. There are numerous application areas which demand a high fineness at high throughput capacities with a low energy consumption, especially in the area of dry grinding. For this reason, it was important for NETZSCH to transfer the globally tried and tested agitator bead mill technology to dry-grinding and to complement the triumph of the *ISA MILL* in wet-grinding in the mining sector with the **dry agitator bead mill *SPHERHO*®**.

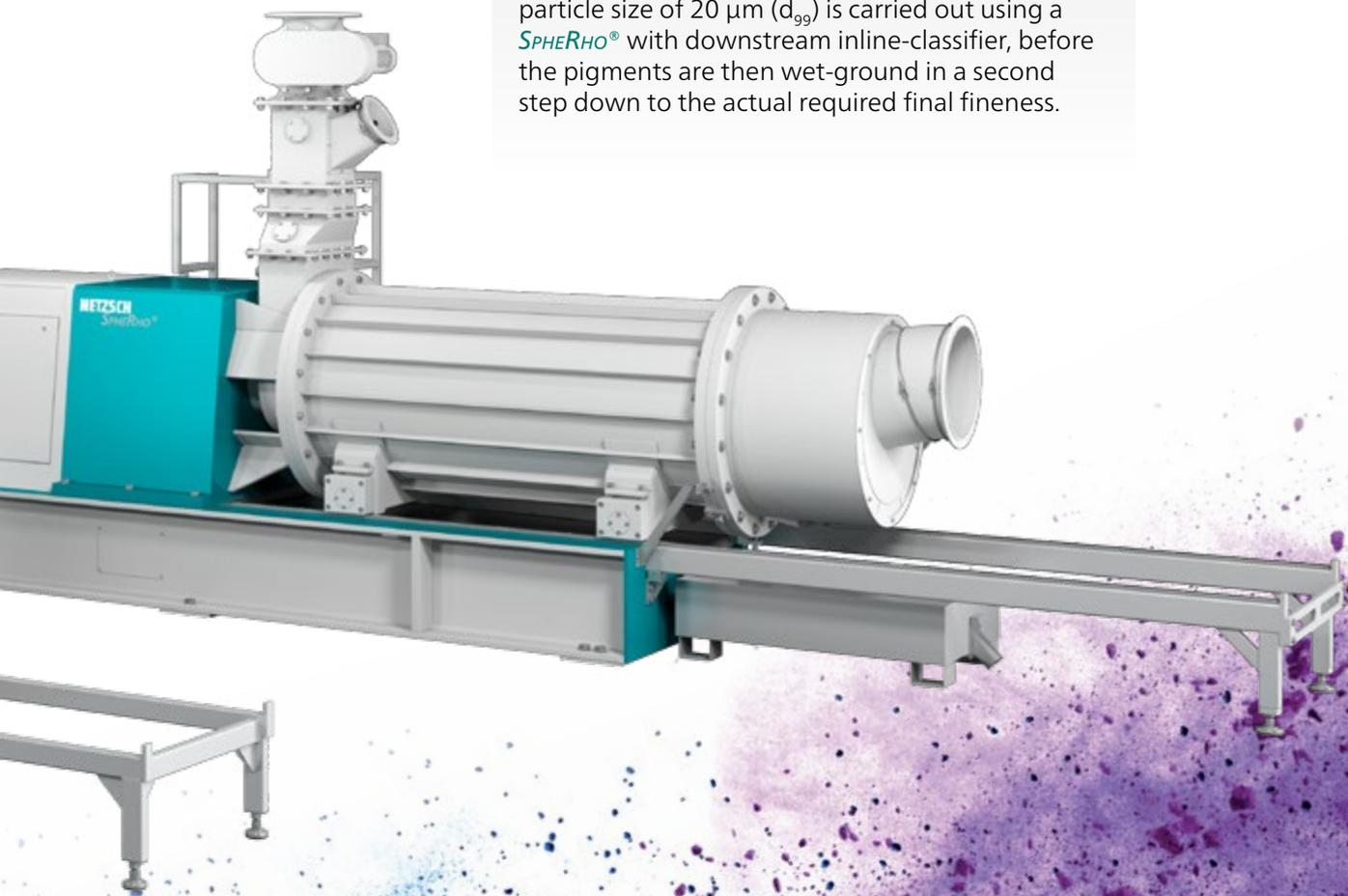
Thanks to its mode of operation and load characteristic and compared to conventional ball mills, with the *SPHERHO*®, it is possible to achieve very high finenesses combined with high throughput capacities. At the same time, the specific energy consumption is low. In combination with a NETZSCH *INLINESTAR*, products such as mineral filler with a particle size $< 2 \mu\text{m}$ can be manufactured in a grinding-/classifying circuit. Further applications for the *SPHERHO*® include ceramic pigments or products to be mechanically activated.



Application Example: Ceramic Inkjet

Ceramic inkjet has revolutionized the manufacturing of decorated tiles. Since the very beginning, NETZSCH has been pivotal in the development of ceramic inkjet technology and is market leader and the first port of call for questions regarding this technology.

The processing of the color pigments used, necessary before printing, is carried out by targeted finest grinding and is an important production step, which has a direct impact on the subsequent quality of the decorated tile. In NETZSCH's two-step process the initial dry grinding of the pigments to a maximum target particle size of $20\ \mu\text{m}$ (d_{99}) is carried out using a *SPHERHO*® with downstream inline-classifier, before the pigments are then wet-ground in a second step down to the actual required final fineness.



NETZSCH Fine Classifier

Due to their particle size distribution, some products can still not be used even after the production- or grinding process. Their subsequent treatment to produce an exact particle size fraction is necessary to optimize the desired properties of the product or to obtain these in the first place. Classifying in a particle size range of $> 100 \mu\text{m}$ is generally achieved with screening machines. If a particle separation in a range $< 100 \mu\text{m}$ is desired, then the use of air classifiers for a controlled separation is often inevitable. The separating out of undesirable coarse particles as well as the considerable reduction of fines (dedusting) are both typical applications for an air classifier.

Depending on the cut point or application, various machine executions in a corresponding range of construction sizes of the **air classifier CFS, CFS/HD-S** and **INLINESTAR** are available. Individual machines as well as complete classifier plants are planned, produced and commissioned by NETZSCH.



NETZSCH Ultra-Fine Classifier CFS



NETZSCH High-Performance Fine Classifier *INLINESTAR*

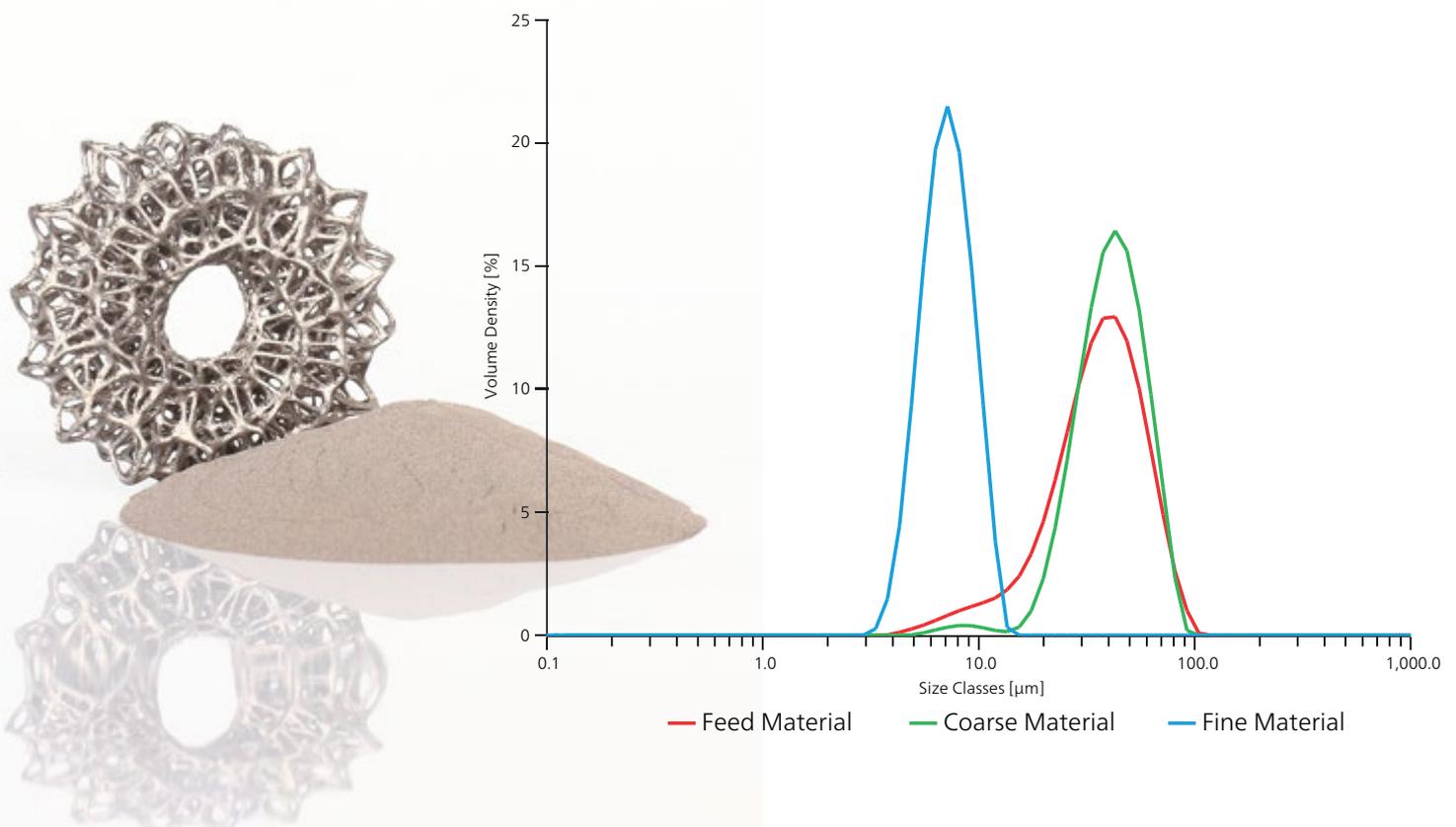
Application Example: Dedusting of Metal Powders for the Manufacturing Process for Additives (3D-printing)

In particular, the market for 3D-printing is growing at a furious rate. An ever-increasing number of applications in the automotive, aircraft construction, tool and prototype manufacturing sectors are based on the additive manufacturing process. 3D-printing facilitates the manufacture of complex shapes with defined characteristics, which had previously not been possible or was only possible by joining several parts together.

To ensure that a good quality product is achieved, it is important that the metal powders used have a narrow particle size spectrum, typically of between 20 and 60 μm . Therefore, separation technique plays a decisive roll and the **NETZSCH High-Efficiency Fine Classifier CFS/HD-S** comes into play. With this machine a sharp separation is achieved during dedusting and a product with a very steep particle size distribution is obtained, which is adapted to suit the special requirements of the final application.



NETZSCH High-Efficiency Fine Classifier CFS/HD-S



NETZSCH Laboratory Plants

Today, in the chemical industry and especially in the area of dry-grinding, well-appointed laboratories are essential for the development of new products, the optimization of products as well as for the manufacture of very small quantities of material. The tried and tested NETZSCH technology is also applied on a laboratory-scale in the form of suitable laboratory machines.

NETZSCH laboratory plants are setting new benchmarks as regards operating convenience, compactness and flexibility. Depending on the application, these plants are rounded off with fluidized bed jet mills, high density bed jet mills, classifier mills and impact mills, as well as fine-classifiers and high-performance fine classifier.



NETZSCH Laboratory Impact Mill CONDUX® 60



NETZSCH Laboratory Steam Jet Mill S-JET® 25

NETZSCH Laboratory Scale Machines

- Fine Impact Mill *CONDUX*®
- Fluidized Bed Jet Mill *CGS*
- High-Density Bed Jet Mill *CONJET*®
- Classifier Mill *CSM*
- Fine Classifier *CFS*
- High-Efficiency Fine Classifier *CFS/HD-S*
- Steam Jet Mill *S-JET*®



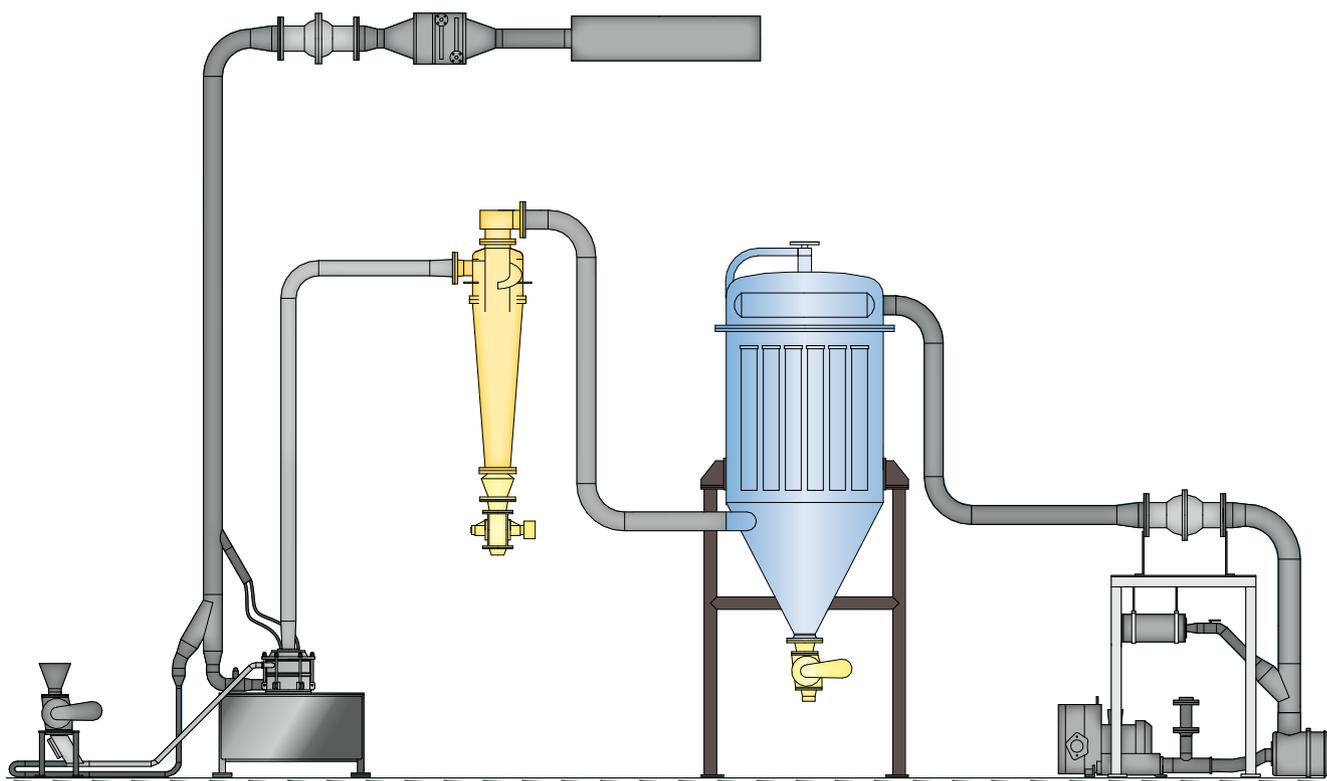
NETZSCH *LABPILOT* with High-Density Bed Jet Mill *CONJET*® 10 and High-Efficiency Fine Classifier *CFS* 5 HD-S

NETZSCH Filter & Cyclones

Use of Cyclones and Filters in Dry-Processing

Mechanical process technology by crushing, fine-grinding and classifying is constantly gaining in importance, as an almost infinite number of different products within a production process are ground. The separation of the product being ground from the grinding gas takes place in a cyclone and/or a dust filter installed downstream from the mill and/or classifier or in a combination of both.

For cleaning dust-laden air NETZSCH can offer tailor-made dry-grinding technology solutions. The filters (rectangular- as well as round filters) and plants are designed and manufactured according to customers' wishes and adapted individually to suit the particular application. Filters can be offered in type-tested ATEX-execution, heated and insulated (for steam applications) and in various materials and surface qualities.



Example of a Plant with Classifier Mill CSM, Cyclone and Dust Filter



Grinding Plant with Filter and Cyclone in NETZSCH *FoodLAB* in Hanau

NETZSCH Application Laboratories

NETZSCH's application laboratories which are equipped with the latest technology are part of a comprehensive service offer. A **test lab for dry-grinding and classifying** of products from the **chemistry** and **food industries** is located at NETZSCH Trockenmahltechnik in Hanau, Germany.

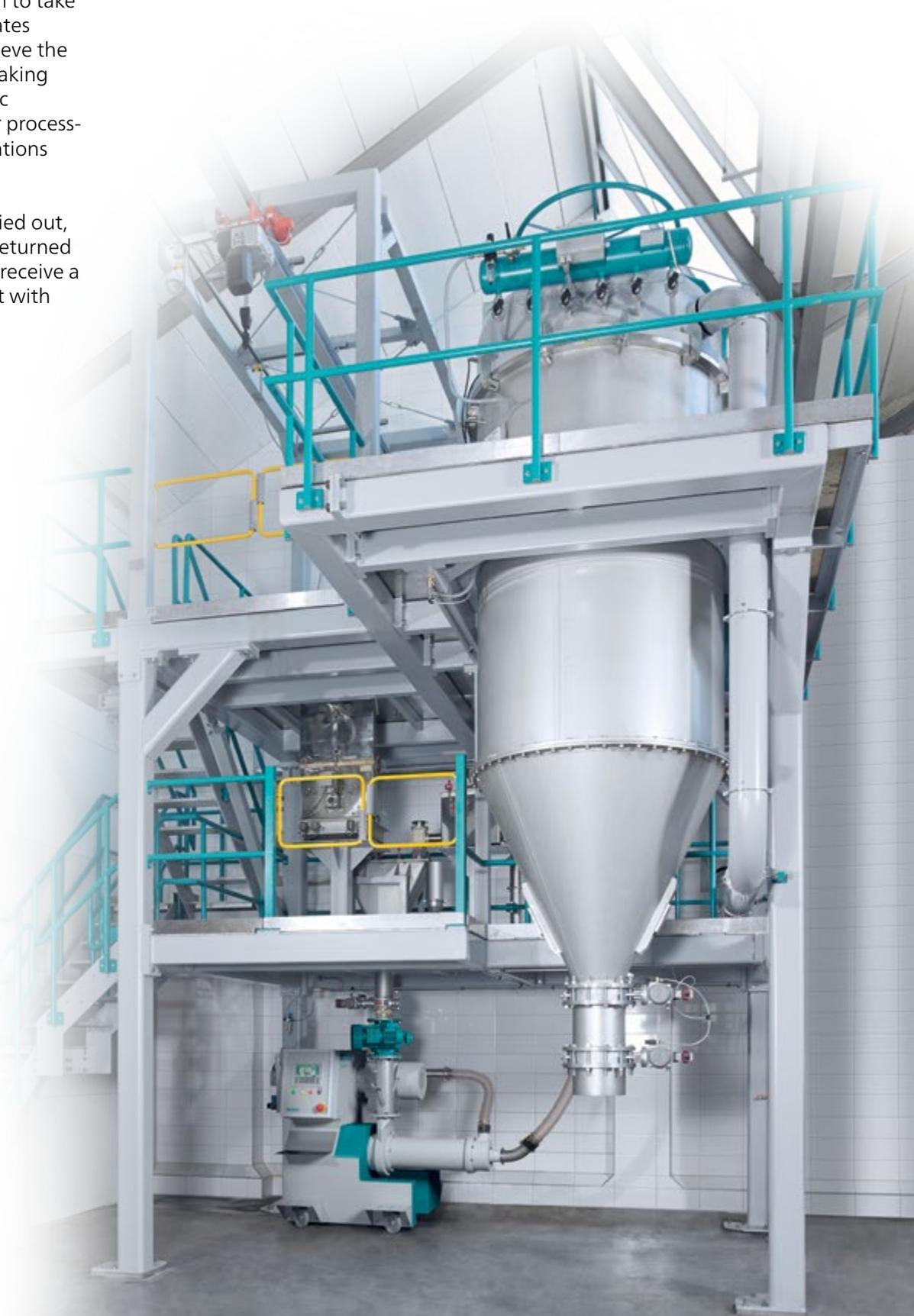
In this laboratory NETZSCH processes and/or grinds products which are supplied by customers and analyzes their behavior to achieve higher efficiency and the best possible grinding result. Grinding tests can be run on both laboratory scale and production sized machines. For this purpose, the complete NETZSCH mill and classifier portfolio for dry-processing is available.

In the **NETZSCH FoodLAB** tests are carried out under food-grade conditions in two testing rooms, which can both be seen from a meeting room through a large viewing window and which are separated from the visitor- and employee areas by a hygiene sluice.



NETZSCH is pleased to welcome customers and invite them to take part in testing. This facilitates closer cooperation to achieve the best possible test results taking both the customer-specific product expertise and our process-engineering recommendations into consideration.

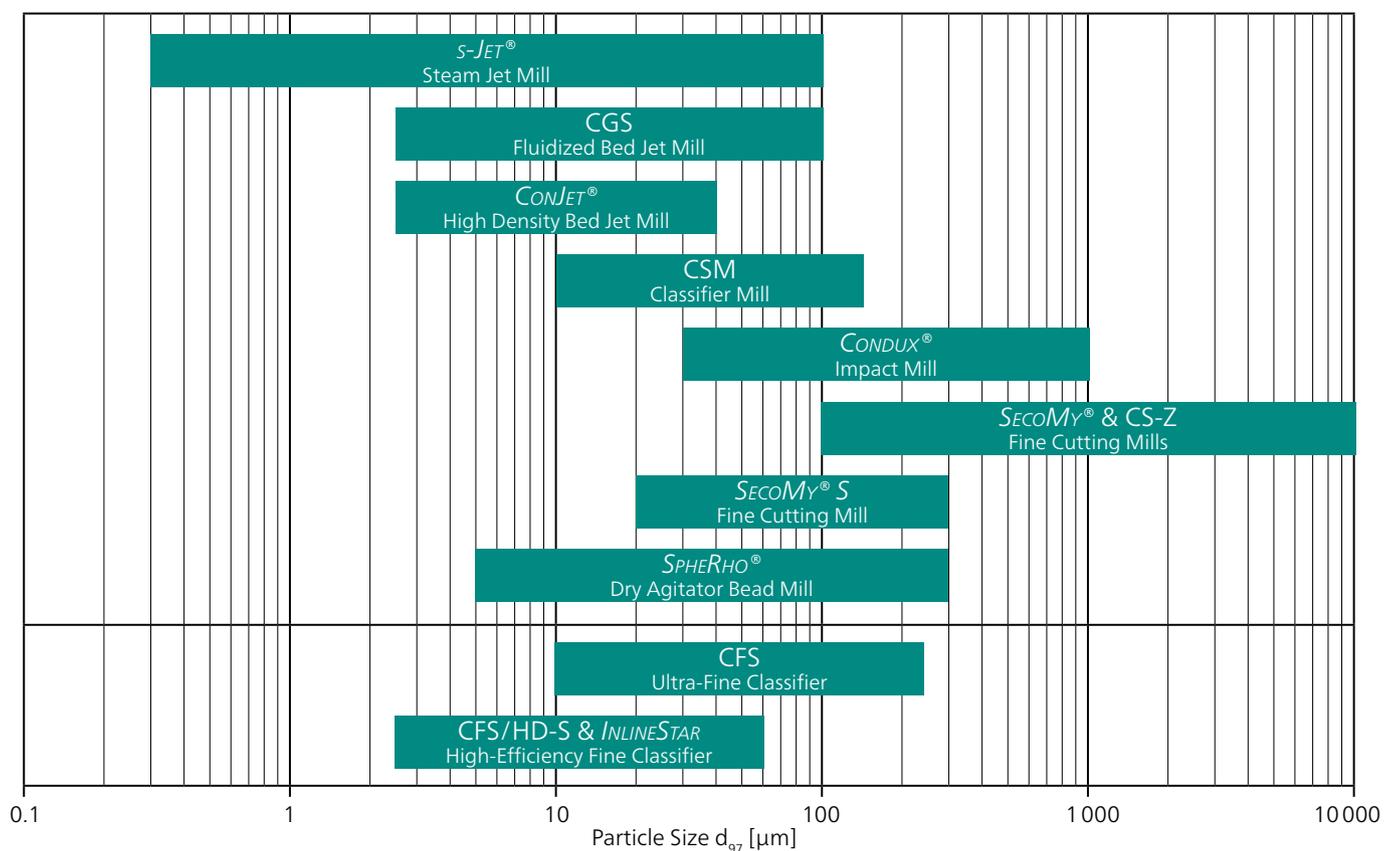
After tests have been carried out, the processed product is returned to the customer and they receive a comprehensive test report with the results of the tests.



Range of Fineness

The most important factors for determining the type of size-reduction and the selection of the suitable machine are the required particle size, particle shape and particle size distribution. A further factor is the subsequent processing of the product or also the amount of product to be processed. The deformation behavior of the material to be ground, which can vary from brittle-elastic to inelastic and elastic-plastic to elastic-viscous, is an additional criterium for the selection of the most suitable machine technology.

NETZSCH Trockenmahltechnik GmbH offers you a machine portfolio with a tailor-made solution for each customer's application and covers a range of fineness from 0.3 μm to several mm (d_{97}).



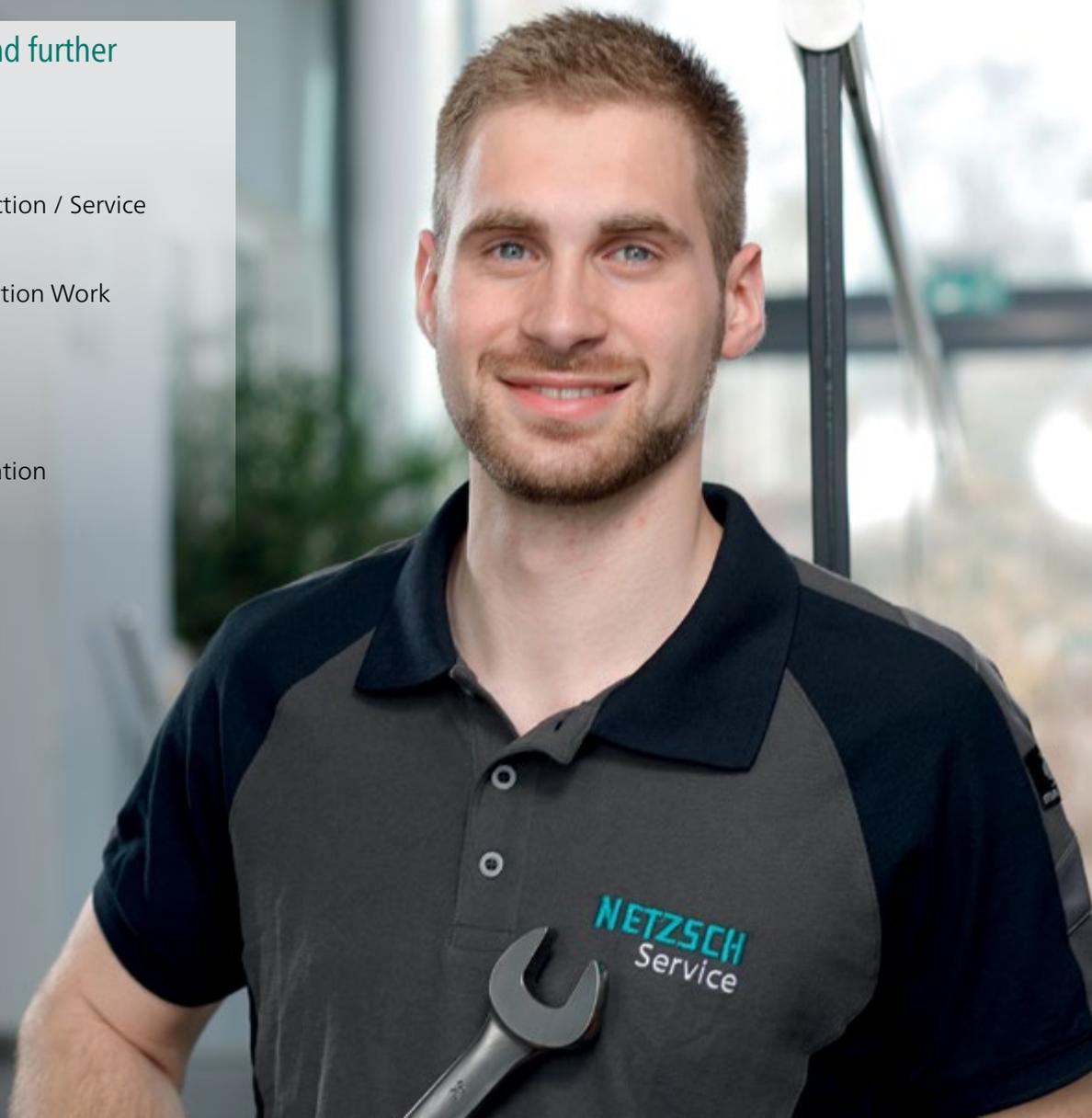
NETZSCH Service

The Business Unit Grinding & Dispersing has been market leader in its field for decades. Its core competencies lie in service, development, design and construction of dry- and wet grinding systems, mixing-, kneading- and dispersing machines as well as dry-classifying systems of all sizes for every imaginable application. We use this competence to serve the needs of our customers and offer a complete, global service to round off our machine and plant portfolio.

NETZSCH Trockenmahltechnik's customers profit from the NETZSCH Group's global sales- and service network with a current local customer support in a total of 60 locations.

AFTERSALES Support and further Service Products

- Spare Parts
- Repair Work
- Maintenance / Inspection / Service Agreements
- Commissioning
- Overhauls & Modification Work
- Process Optimization
- NETZSCH-BEADS®
- Toll Processing
- Laboratory Testing
- Seminars
- Qualification & Validation





The NETZSCH Group is an owner-managed, international technology company with headquarters in Germany. The Business Units Analyzing & Testing, Grinding & Dispersing and Pumps & Systems represent customized solutions at the highest level. More than 4,000 employees in 36 countries and a worldwide sales and service network ensure customer proximity and competent service.

Our performance standards are high. We promise our customers Proven Excellence – exceptional performance in everything we do, proven time and again since 1873.

Proven Excellence. ■

Business Unit Grinding & Dispersing – The World's Leading Grinding Technology

NETZSCH-Feinmahltechnik – Germany
NETZSCH Trockenmahltechnik – Germany
NETZSCH Vakumix – Germany
NETZSCH Lohnmahltechnik – Germany
NETZSCH Mastermix – Great Britain
NETZSCH FRÈRES – France
NETZSCH España – Spain
ECUTEK – Spain

NETZSCH Machinery and Instruments – China
NETZSCH India Grinding & Dispersing – India
NETZSCH Tula – Russia
NETZSCH Makine Sanayi ve Ticaret – Turkey
NETZSCH Korea – Korea
NETZSCH Premier Technologies – USA
NETZSCH Equipamentos de Moagem – Brazil

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