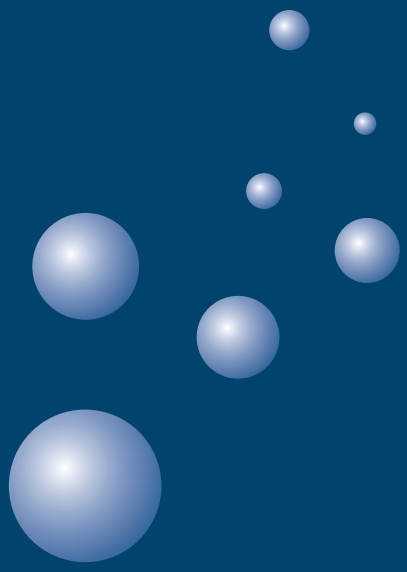
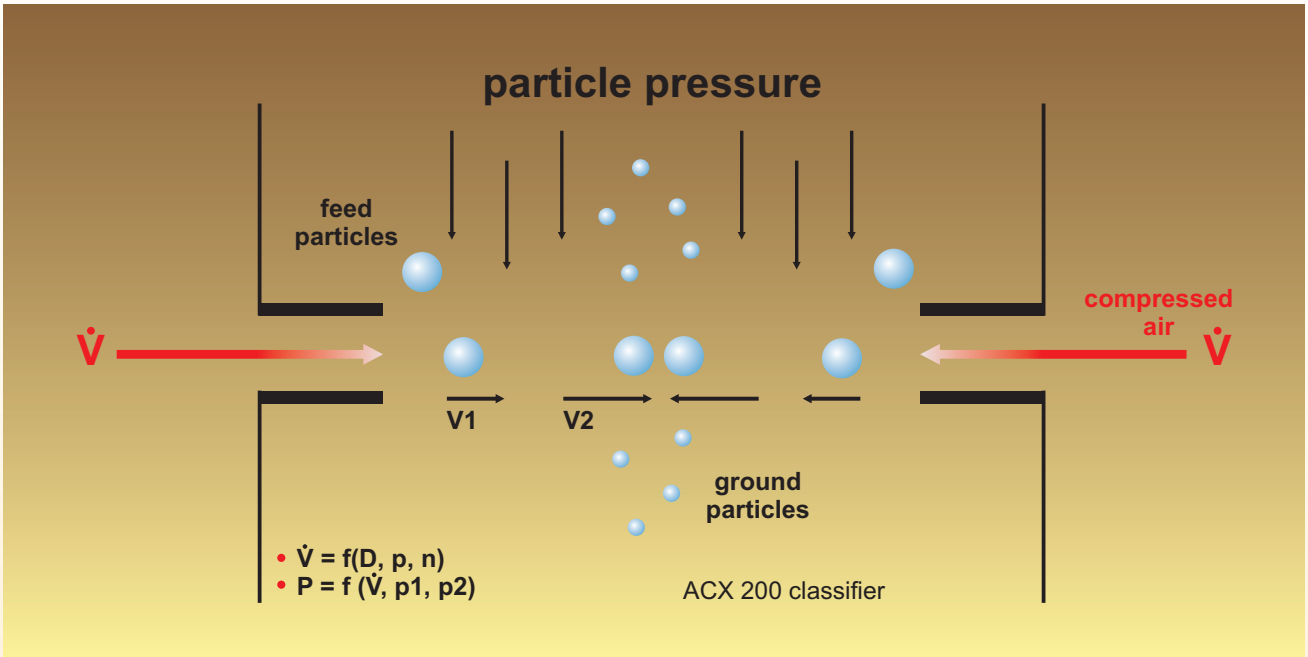
jet milling

jmx jet mill series



Comex

jet milling



Jet mill grinding principle

Jet milling is a common grinding method for high value materials. It often concerns materials which are abrasive or when the grinding process has to be carried out under ultra high purity conditions.

Extremely low wear rate of the mill parts provides possibilities for new demanding applications. On the other hand, jet milling process requires high energy input, which has to be justified by final product added value. It is therefore of critical importance to provide an energy efficient process.

Comex jet mill, has been developed at SINTEF/NTNU laboratories in Norway. It was constructed to combine high grinding efficiency with the ability to control product particle size distribution. As a result the mill has been used in applications not possible with alternative jet milling solutions.

Grinding principle of the fluidized bed opposed jet mill can be illustrated by an air stream accelerating particles when flowing into the grinding chamber. Particle velocity is very low at the air inlet point and accelerates to supersonic range when approaching the mill centre. Optimal operating conditions are achieved when particle pressure over the air nozzle area is high enough to force enough particles into the air stream and at the same time not too high to reduce the total particle velocity. Highest velocity of maximal number of particles at the collision point in the mill centre, provides the best grinding efficiency.

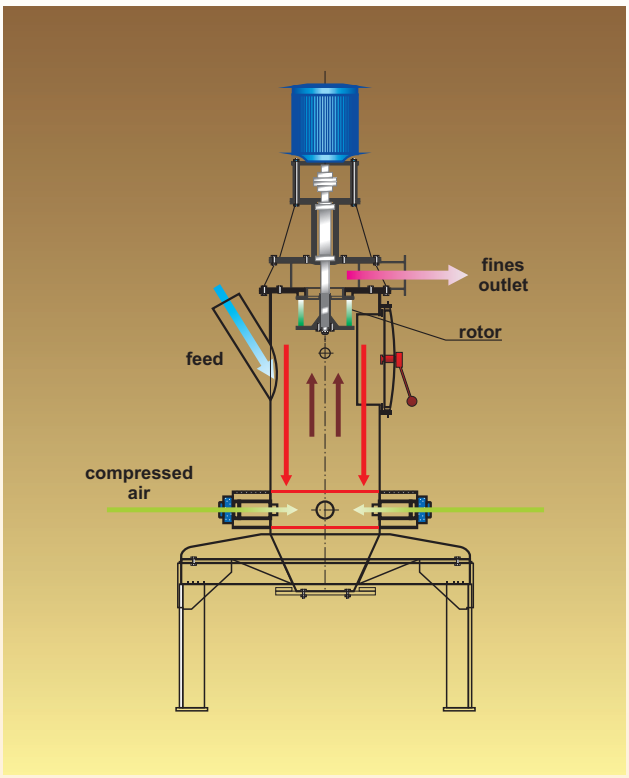
In Comex jet mills the feed material enters the mill chamber by gravitation, through a diagonal inlet pipe. Furthermore, feed material particles enter the grinding area where the air nozzles are located. The air nozzles inject the pure compressed air and material particles are exposed to the air drag forces accelerating particles to very high velocities. Accelerated particles collide in the central part of the mill chamber and consequently are ground to finer sizes. Due to the decompressed air flow, the ground particles are lifted to the upper part of the mill where the air classifier is located. The air classifier provide a size separation and the fine particles leave the mill unit while the coarse ones are falling back to the mill chamber for further grinding. The fine fraction, flowing through the rotor, is discharged from the jet mill through the main air outlet, together with the main air flow and is separated from the air in a cyclone or a filter.

Comex jet mill

Due to the unique construction of the Comex jet mill, high energy efficiency can be achieved. Very precise nozzle alignment in the grinding chamber and concentrated compressed air streams allow efficient particle acceleration and grinding. As the material is ground it is transported to the built-in air classifier. Special geometry of the rotor provides very sharp classification. Many producers are often required to make different materials having specific shape of the particle size distribution curve. Efficient classification will be of critical importance for such applications.

Generally, Comex jet mills provide benefits as listed below:

- good dispersion of the ground material and thus possibility to process feed with difficult flow properties
- high particle delaminating forces which allow production of flaky materials providing conservation of high aspect ratio
- applications with low size reduction ratio
- high purity grinding
- iron free processing
- generally low wear rate of the mill components
- low noise emission level



JMX Comex jet mill

Specific advantages of the Comex jet mill over alternative equipment on the market today, are related to its unique design and efficient build-in air classifier. The most important advantages are shown below:

- high precision of nozzles and therefore highly effective particle collision
- ultra-fine and high-efficiency classifier built in the grinding chamber
- low energy requirement when compared to other jet mill types
- fine cut size down to D97=2 microns
- possibilities for minor correction of the particle size distribution curve shape
- compact mechanical design
- easy inspection and removal of the rotor through the inspection window
- exchangeable blade rotor with quick replacement procedure
- low cost of maintenance for the complete unit.

◄ JMX-200 jet mill unit

Mill size range

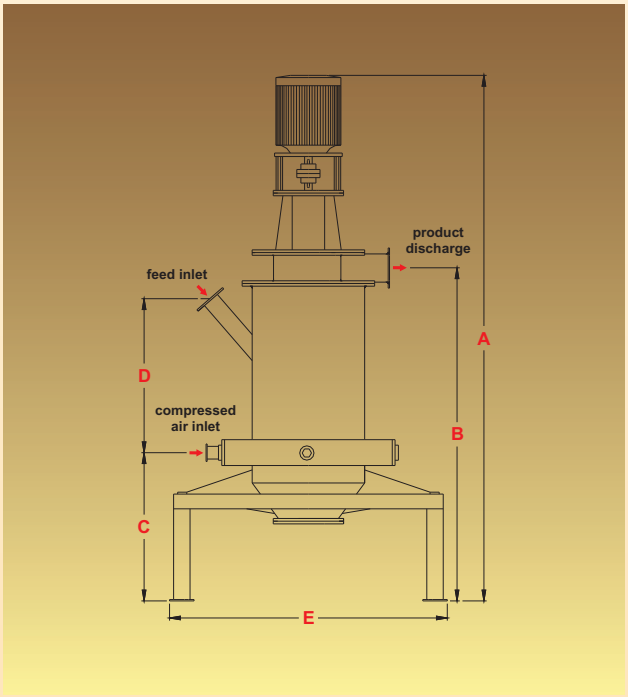
The Comex jet mills are produced in different sizes. The production capacity of the mill is very much depending on the feed material properties and the final product fineness. Generally, the grinding capacity ranges from 5-800 kg/h for the smallest unit (JMX200) up to 0.3-5 t/h for the largest one (JMX350). The table below shows the range of jet mills including the most important operating and construction parameters. Unit number related to a specific jet mill size indicates the internal classifier rotor diameter in mm.

JMX 200 is used in pilot plant tests for carrying out small scale investigations. This gives possibilities for necessary performance verification and data for scale up to larger circuits. However, for small volume applications this unit (JMX200) can be used as an industrial size mill. Laboratory test results can be directly used for industrial circuit evaluation and a material sample production.

Technical specification of JMX jet mills.

Jet mill type*	Scale factor	Compressor motor power [kW]	Classifier motor power [kW]	Capacity [kg/h]	Air flow rate [m^3/h]	Fineness D97 [μm]
JMX 200	1	80	4	40 - 500	700	2 - 110
JMX 350	3	240	7.5	120 - 1 500	2100	3.5 - 130
JMX 500	6.25	500	15	250 - 3 200	4 300	5 - 250

*-other mill sizes are available on request



JMX	200	350	500
Approximate weight [kg]	360	900	2200
A	2309	3112	4413
B	1597	2067	2955
C	740	560	799
D	770	1128	1612
E	1020	1400	2000

◄ Jet mill weights and dimensions

Applications for JMX

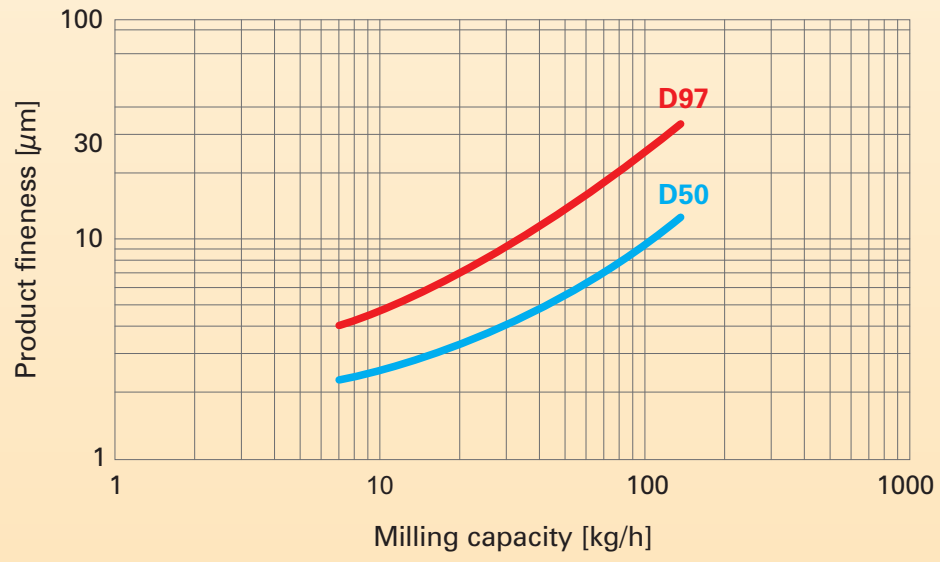
Comex jet mills have been successfully applied in industrial circuits since 1996 for processing of various materials having different physical properties like:

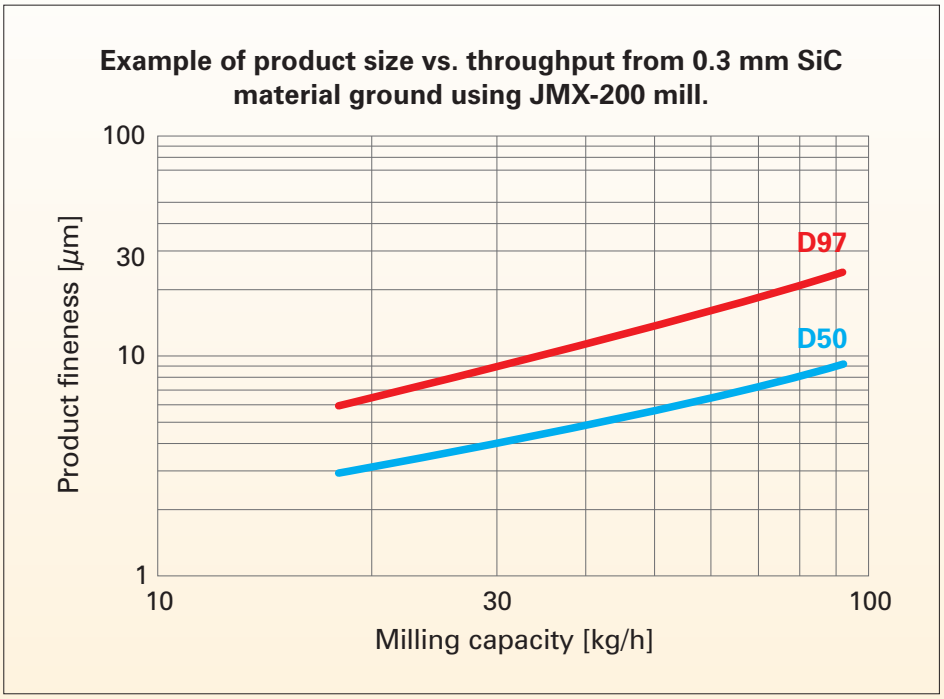
- mineral powders
- abrasives
- ceramic materials
- ultra high purity products for microelectronics
- raw materials for fibre optics
- chemicals
- advanced composite materials
- pigments and dyes

Comex jet mills will basically be operated in configuration with compressor, cyclone, filter and fan. In this configuration the ground material from the mill, is transported pneumatically to the cyclone (optional) and filter where it is separated from the air. To provide an underpressure in the system the complete circuit has to be connected to a fan. Additionally, the jet mill units can be operated in parallel configuration according to the required product fineness and capacity.

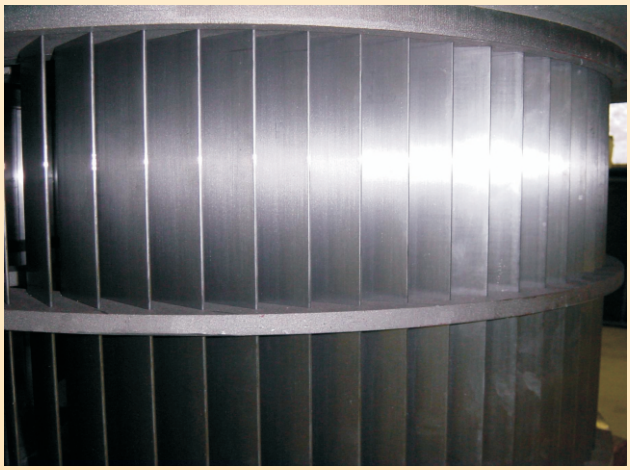
Example of the JMX-200 based production plant

Example of product size vs. throughput from 0.5 mm quartz material ground using JMX-200 mill.





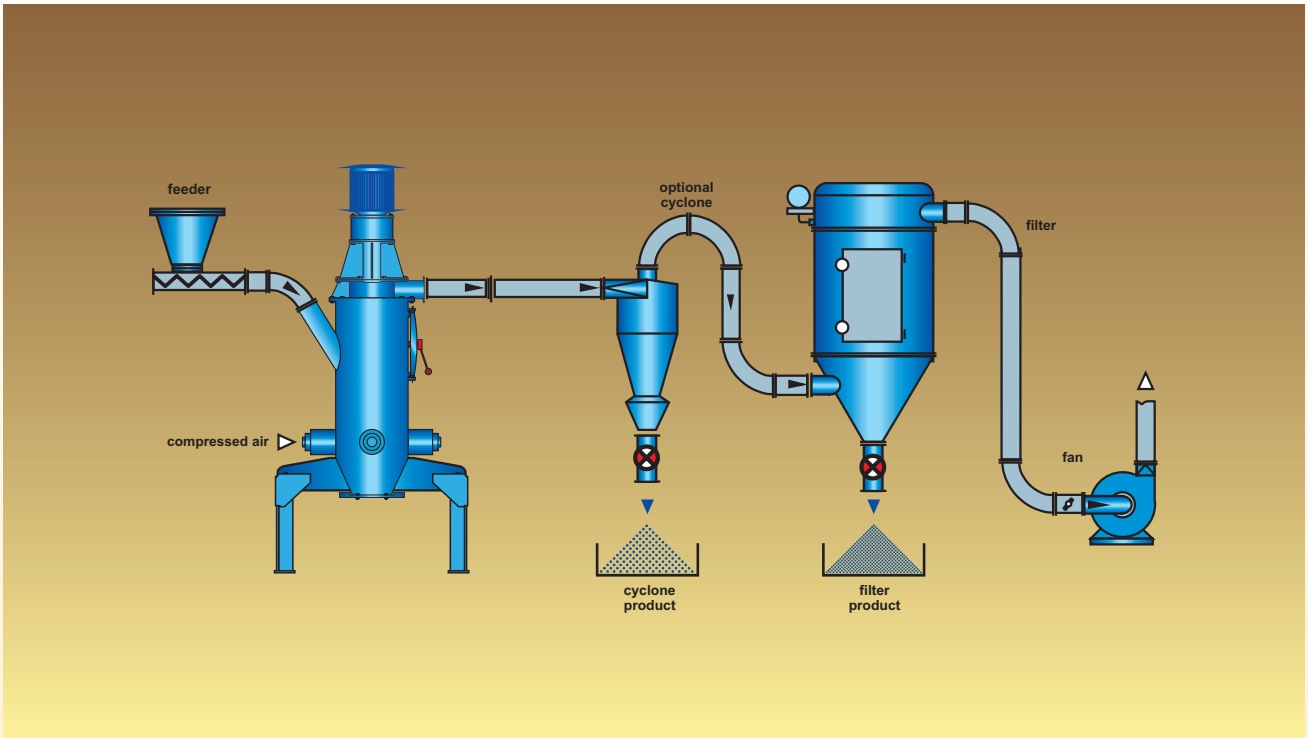
Parallel jet mill operation allows the use of a common filter and fan unit thus reducing investment and operating cost. Additionally, finer material can be produced as the smaller size classifier rotors, which are build in the jet mill units, provide finer particles. Finally, higher production flexibility can be achieved with the parallel jet mill configuration thus reducing unnecessary maintenance downtime for production circuits.



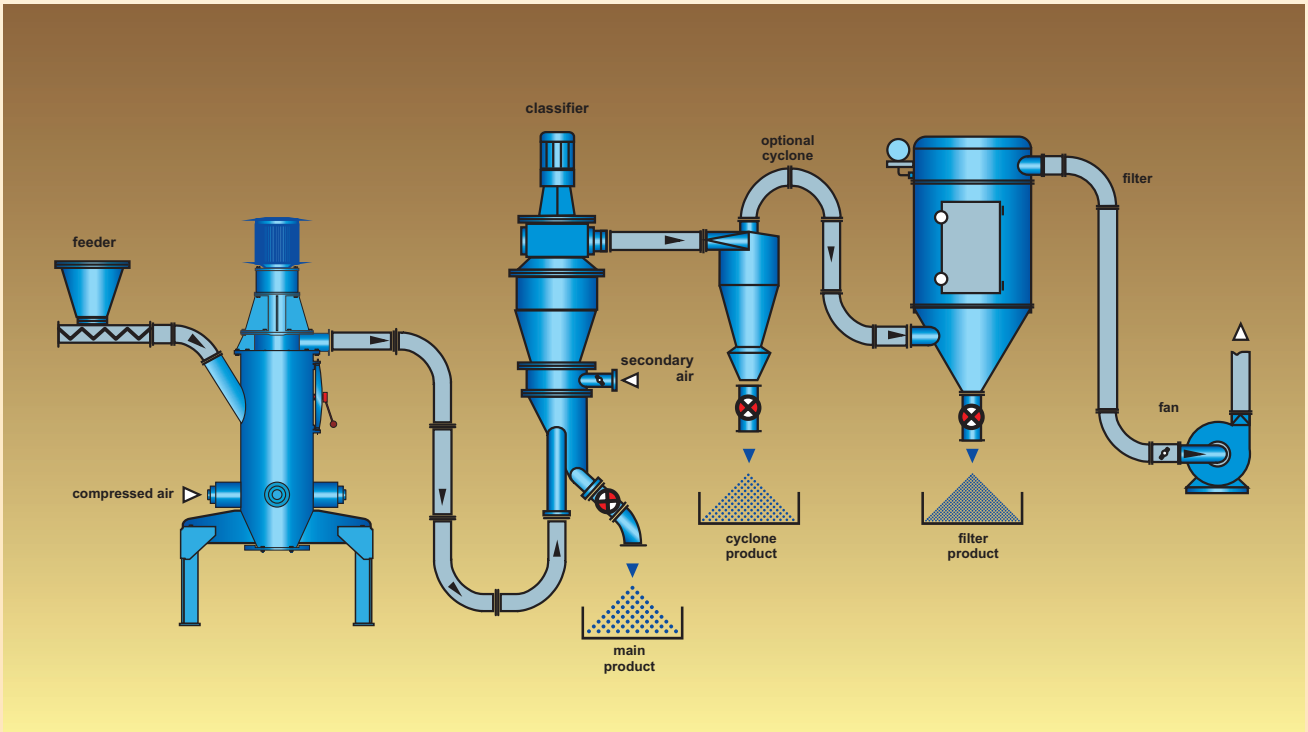
◄ JMX-500 rotor

Research and Development

Comex offers extensive test and development facilities where different products can be produced for customers evaluation and technical data obtained prior to final design for determination of the optimal process. The pilot scale facilities include different sizes of JMX jet mills together with a wide range of alternative grinding equipment like air classifiers, ball mills, AG/SAG mills and high intensity mills. This provides possibilities for direct comparison between different grinding techniques mainly in terms of energy consumption and production capacity. The equipment used in pilot scale can normally be scaled-up to industrial circuits for production capacity indication and for calculating approximate capital cost of an industrial circuit. Extensive instrumentation of the pilot scale circuits, including on-line particle size analysis, makes it possible to verify best operating and construction parameters for the optimal configuration of a final circuit. ■



Typical jet mill plant configuration



Jet mill plant configuration example when the fines are removed from the main product

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