



TAKING THE BUMP OUT OF YOUR GRIND

Air Products' Jon Trembley explains how a growing demand for ultra-fine particles in the plastics and polymer industries is leading to new advances in grinding at cryogenic temperatures.

As market demand for finer and finer particles grows, many process industries are increasingly looking for new grinding technologies that are capable of consistent particle size, higher throughputs and maximizing yields. Especially in the manufacture of high performance plastics and polymers ultra-fine particles are required: for example, when producing plastic films for the food packaging industry, ultra-fine films are helping to ensure the end product is lightweight and to reduce packaging waste.



Back to the grind

Dry-milling is one of the most commonly-used particle size reduction process. This method typically involves the use of a 'roll' to compress and yield particles of different sizes so they can be sorted and separated more easily. It is widely used for grinding flour for example, where the outer husks of the grain must be removed. However, as polymer and plastics production becomes more complex and variable and where the toughest polymers are used, dry milling alone is not always sufficient to achieve the ultra-fine particles required.

Other particle size reduction technologies include controlled crystal growth or high-density jet milling. Like dry milling, these solutions are easier to scale up but do not necessarily deliver the required throughputs or ultra-fine particle distribution required by some production processes. As demand for size reduction increases to particle sizes of less than 10 microns, the plastics industry is realising the benefits of cryogenic grinding. Not only can cryogenic grinding systems achieve ultra-fine particle sizes and uniform particle distribution, they are also efficient – helping to maximize production rates and minimize overall operational costs.

Cryogenic grinding technology uses a cryogenic fluid such as liquid nitrogen to make components brittle before mechanical grinding. This rapid cooling makes the product particularly easy to grind.

Most sophisticated cryogenic grinding solution

The recently developed high performance cryogenic grinding systems use a combination of size reduction mechanisms, including impact, attrition and particle-particle collision, which can be adapted to meet the needs of the specific production process. These technological developments equipped with a range of design-led features have effectively extended the range of cryogenic grinding solutions, offering optimum efficiency as part of a single system, without the need to use any complementary grinding equipment.

Alongside finer, more consistent particle size distribution, these recent cryogenic grinding systems can increase throughput of material by as much as 100%, deliver higher yields in a particular target range, improve quality due to minimal or no heat damage, and reduce recycling and production costs.

Size matters

The science of particle size reduction has evolved to become a hi-tech process, requiring complex technological solutions. Therefore, many

processors now review size reduction systems before they make any capital investment. For this purpose, Air Products offers advance-testing services which allow the manufacturer to compare the technology against more traditional grinding systems. Under laboratory conditions, it is possible to test whether the required production rates and particle size distribution can be achieved as well as providing an insight into how the technology will scale up together with the required usage of liquid nitrogen.

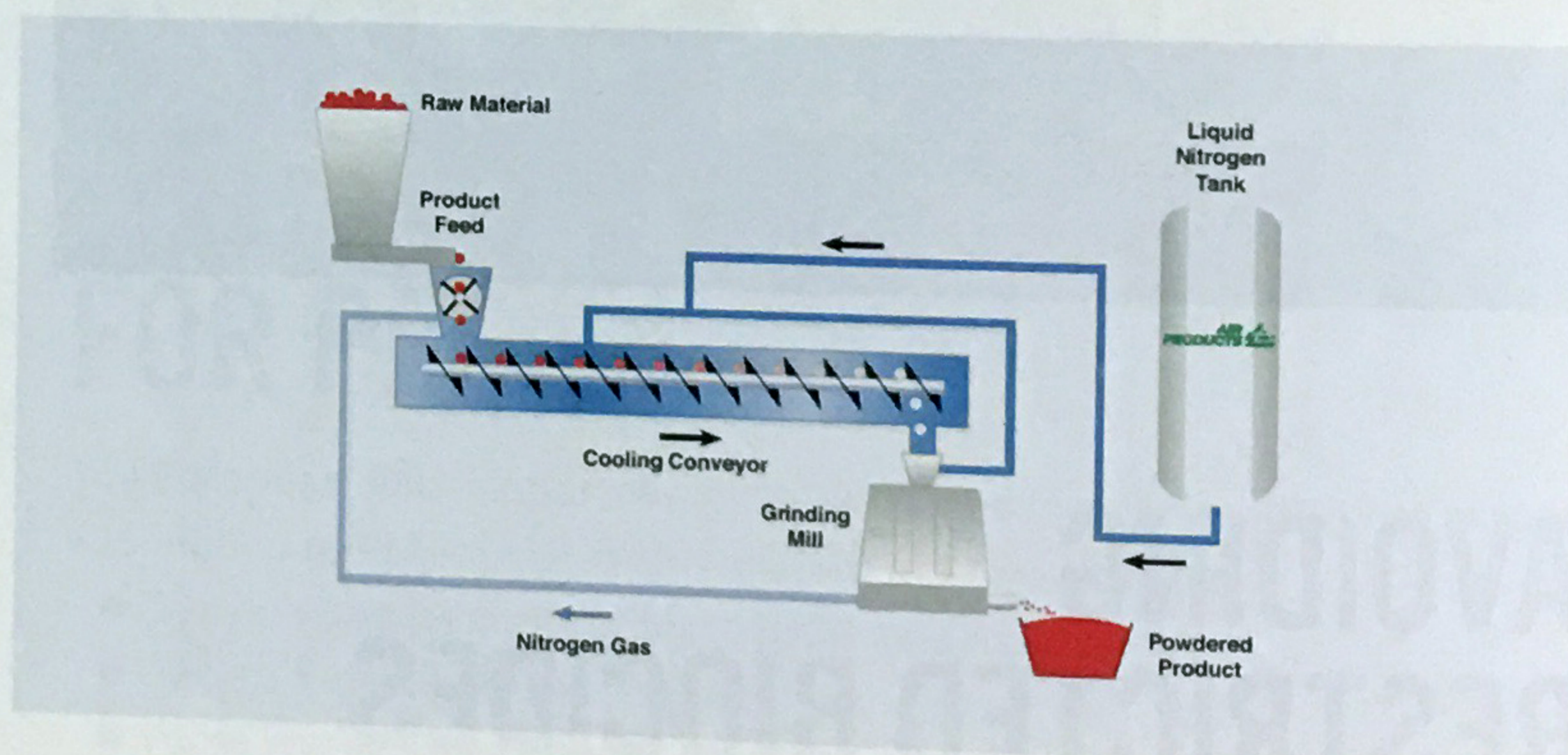
The added power of liquid nitrogen

Main benefits of ultra-fine-grinding systems using liquid nitrogen:

- Ultra-fine particle size
- More uniform particle distribution
- Higher yields of particles
- Improved product quality due to minimal or no heat damage
- Less recycling and lower production costs
- Improved process safety.

Embrittling tough, resilient materials with liquid nitrogen in a cooling conveyor

Tough, resilient materials require complete embrittlement prior to actual grinding in a cooling conveyor that transfers the feedstock from the hopper to the grinding mill. Liquid nitrogen sprays onto the material as it moves along the conveyor, resulting in a high heat transfer coefficient on the pellet surface. This rapid cooling makes the material brittle and easier to grind by a variety of impact-type mills.



A cool future

As the demand for finer particles increases, so does the need for greater efficiency, in the form of maximized yields and throughputs. Research into this area continues to progress and cryogenic grinding is meeting the increasingly complex process demands of today's polymer and plastics industry. As the process is refined even further, cryogenic grinding continues to prove itself as a viable and effective alternative to other size reduction technologies, capable of bringing about a number of process efficiencies and at the same time delivering uniform particle size and material conditions.

The future looks cool!

CONTACT

Jon Trembley
Cryogenic Technology Manager, Industrial Gases EMEA
Air Products
Basingstoke, UK
T: +44 (0) 1256 728 328
www.airproducts.com/cryogenics