DP Pulveriser®
since 1962

DP PULVERIZERS

CRYOGENIC MILLING REDEFINED

Ultra-Fine Grinding for Heat-Sensitive, Sticky & Challenging Materials

DP Pulverizers – Engineering Particle Performance at Sub-Zero Temperatures

CONTROL WHAT OTHERS CAN'T

In advanced material processing, particle size is only one part of the equation.

Material behavior—especially under heat, stress, and mechanical force—defines whether a process succeeds or fails.

Polymers smear. Spices lose aroma. Chemicals degrade. Sticky materials clog systems. Heat-sensitive compounds break down.

This is where conventional milling reaches its limit—and cryogenic milling takes control.

At DP Pulverizers, we engineer cryogenic grinding systems that transform difficult materials into precision powders by controlling temperature, brittleness, and particle dynamics at the source.

WHAT IS CRYOGENIC MILLING?

Cryogenic milling is a size reduction process where materials are cooled using liquid nitrogen (LN_2) prior to and during grinding.

By reducing the temperature below the material's glass transition or embrittlement point, materials that are normally elastic, sticky, or heat-sensitive become brittle and fracture cleanly.

Core Outcomes:

- Clean particle breakage instead of deformation
- No thermal degradation
- Preservation of volatile compounds
- Improved grinding efficiency
- Consistent particle size distribution

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THE SCIENCE OF CRYOGENIC GRINDING

Cryogenic milling is driven by thermal-mechanical transformation.

Material Behavior Shift	
Condition	Behavior
Ambient Temperature	Elastic, sticky, deforming
Cryogenic Temperature	Brittle, fracturable

At cryogenic temperatures, internal molecular motion is reduced, allowing materials to fracture instead of stretch or smear.

Result:

- Higher impact efficiency
- Reduced energy waste
- Superior particle uniformity

HOW DP CRYOGENIC MILLING WORKS

1 Pre-Cooling

Material is cooled using controlled LN_2 injection to reach optimal embrittlement temperature.

2 Precision Feeding

Vibratory or screw feeders ensure controlled material input into the grinding zone.

3 High-Speed Grinding (Contra Pin Technology)

Two counter-rotating pin discs generate extreme impact forces with tip speeds up to ~250 m/s

4 Continuous Temperature Control

LN_2 is injected throughout the process to maintain stable cryogenic conditions.

5 Efficient Product Discharge

Fine particles are pneumatically conveyed with minimal agglomeration or buildup.

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WHY CRYOGENIC MILLING IS ESSENTIAL

Cryogenic milling is not a niche solution—it is a critical requirement when processing:

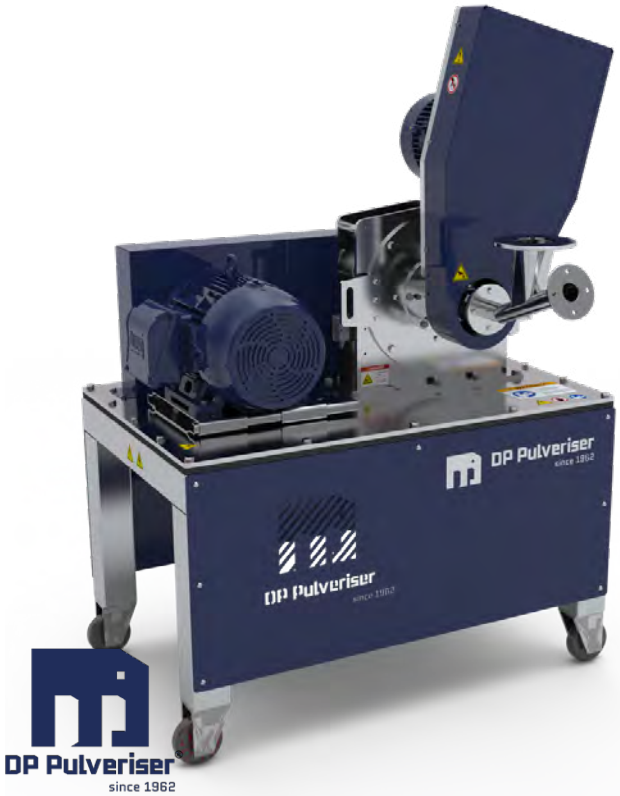
- Heat-sensitive materials
- Polymers and elastomers
- Sticky or greasy products
- High-fat food ingredients
- Materials with volatile compounds

Without cryogenic control:

- Materials melt or smear
- Screens clog
- Throughput drops
- Product quality suffers

With DP cryogenic systems:

You gain full control over the process and the final product.



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CRYOGENIC MILLING VS. AMBIENT MILLING

WHY TEMPERATURE CONTROL DEFINES PARTICLE PERFORMANCE

In many applications, the difference between ambient and cryogenic milling is the difference between process instability and engineered performance.

THE LIMITATION OF AMBIENT MILLING

Traditional milling operates at ambient temperatures where materials retain their natural properties.

At Ambient Conditions:

- Polymers deform instead of fracturing
- Sticky materials smear and coat internal surfaces
- Heat builds up, degrading sensitive compounds
- Volatile components are lost
- Screens clog, reducing efficiency

Result:

- Inconsistent particle size
- Reduced product quality
- Frequent downtime
- Increased maintenance

THE CRYOGENIC ADVANTAGE

By lowering temperature below the glass transition point, cryogenic systems fundamentally change how materials respond to impact.

At Cryogenic Conditions:

- Materials fracture cleanly
- Sticky products become free-flowing
- Heat generation is eliminated
- Volatile compounds are preserved
- Grinding efficiency increases

DIRECT PERFORMANCE COMPARISON

Parameter	Condition	Behavior
Material Behavior	Brittle, fracturable	Elastic, deforming
Heat Generation	None	High
Particle Size Control	Tight PSD	Broad PSD
Sticky Materials	No buildup	Severe smearing
Product Quality	Preserved	Degraded
Throughput Stability	High	Variable
Maintenance	Low	High

WHEN CRYOGENIC IS NOT OPTIONAL

Cryogenic milling becomes essential for:

- Polymers (PP, EVA, elastomers)
- Rubber and recycled materials
- Spices and food ingredients
- Heat-sensitive chemicals and APIs
- High-fat or sticky materials

In these cases, ambient milling is not inefficient—it is technically incapable of delivering the required result.

TOTAL COST OF OWNERSHIP

Ambient systems often appear simpler—but hidden costs include:

- Product loss
- Downtime
- Cleaning and maintenance
- Inconsistent quality

DP cryogenic systems are engineered to optimize LN_2 usage, delivering high performance with controlled operating cost.

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THE DP ADVANTAGE – WHERE WE WIN

1. TRUE CRYOGENIC ENGINEERING

We don't "add nitrogen"—we engineer temperature-controlled grinding systems.

2. HIGH-ENERGY CONTRA PIN TECHNOLOGY

- Counter-rotating discs
- High relative velocity
- Agglomerate-free grinding

Proven design with scalable performance

3. OPTIMIZED LN_2 UTILIZATION

- Reduced nitrogen consumption
- Efficient cooling profiles
- Lower operating costs

4. SCREEN-LESS DESIGN

- No clogging
- Continuous operation
- Consistent throughput

5. PROCESS FLEXIBILITY

Adjustable:

- Rotor speed
- Temperature
- Feed rate
- Grinding intensity

6. COMPLETE SYSTEM SOLUTIONS

DP provides:

- Feed systems
- Cryogenic dosing
- Dust collection
- Automation & PLC controls

Your current system architecture already reflects this integrated design approach.

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DESIGNED FOR DIFFICULT MATERIALS

DP Cryogenic Mills are engineered to process:

- Sticky
- Greasy
- Elastic
- Heat-sensitive
- Agglomerative

Result:

Stable processing + free-flowing powders + consistent output

PROCESS CONTROL & SAFETY

- Temperature sensors
- Vibration monitoring
- Safety interlocks
- Explosion protection up to 10 bar
- Metal separation options

PERFORMANCE CAPABILITIES

- Particle size range: 10–500 microns
- Adjustable PSD
- Safety interlocks
- High throughput
- Consistent particle shape

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CRYOGENIC MILLING APPLICATION PLAYBOOK

SPICES & FOOD INGREDIENTS

Challenge:
Heat destroys aroma and essential oils

DP Solution:
Cryogenic grinding preserves volatile compounds

Result:
- Stronger flavor
- Higher product quality
- Increased shelf value

HIGH-FAT & GREASY MATERIALS

Challenge:
Smearing and buildup

DP Solution:
Embrittlement enables clean fracture

Result:
- No clogging
- Continuous operation

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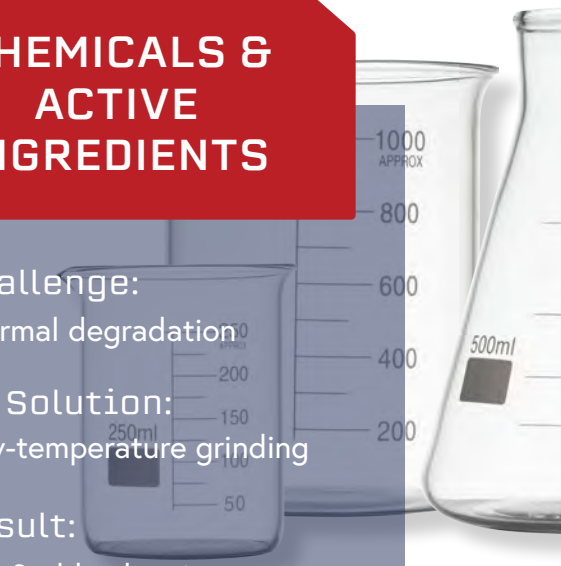
POLYMERS & PLASTICS

Challenge:
Elastic deformation and melting

DP Solution:
Cryogenic embrittlement + high-speed impact

Result:
- Fine powders
- Recyclable material streams

CHEMICALS & ACTIVE INGREDIENTS



Challenge:
Thermal degradation

DP Solution:
Low-temperature grinding

Result:
- Stable chemistry
- Consistent product

RUBBER & ELASTOMERS

Challenge:
Impossible to grind at ambient temperature

DP Solution:
Sub-zero brittleness + impact grinding

Result:
- Uniform crumb
- Efficient recycling

NUTRACEUTICALS

Challenge:
Loss of potency

DP Solution:
No heat + controlled processing

Result:
- Maximum active retention
- High-value product output

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Cryogenic milling is not about grinding harder.

It is about engineering material behavior through temperature control.

At DP Pulverizers, we combine:

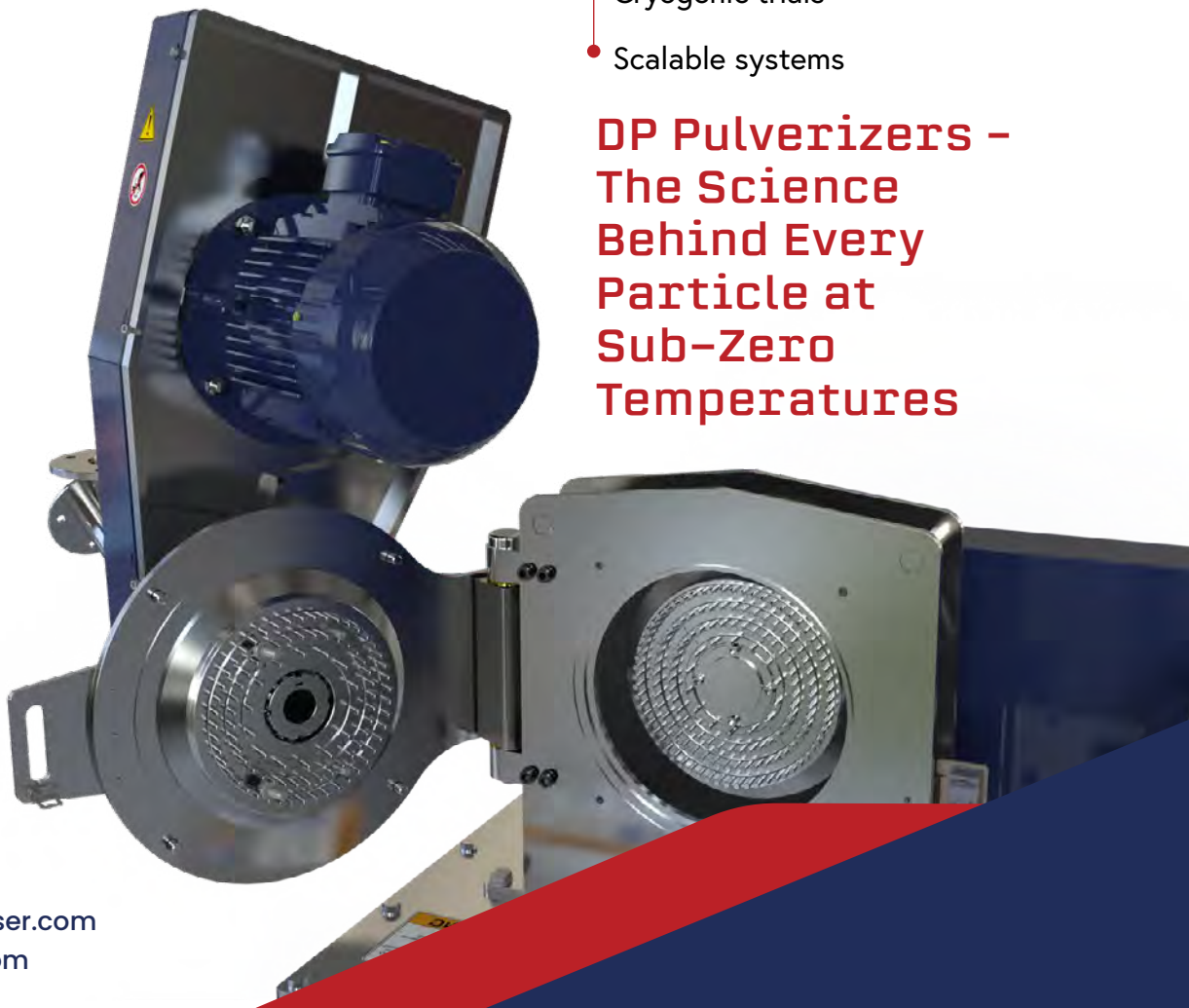
- Advanced cryogenic systems
- High-speed impact technology
- Application-driven engineering

To deliver solutions that transform the most difficult materials into high-value, precision powders.

Bring us your most difficult material. We'll engineer your solution.

- Lab testing available
- Cryogenic trials
- Scalable systems

DP Pulverizers – The Science Behind Every Particle at Sub-Zero Temperatures



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Our Global Footprint

Australia	Bahrain	Bangladesh	Bhutan	Canada	China	Estonia
Bremen	Ghana	Hongkong	Iran	Indonesia	Kenya	Mauritius
Mexico	Malaysia	Newzealand	Nepal	Nigeria	Oman	Philippines
	Saudi Arabia	South Africa	Singapore	Sri Lanka	Tanzania	
	Qatar	U.A.E	Guatemala	Zambia	Uraguay	

Contact Us

North America (Factory)
Chicago, Illinois, 60601, USA
Contact: John Paul
Tel: +1 312-883-7432
Email: john.paul@permixtec.com
www.permixmixers.com

UK
Scotland, Great Britain
Contact: Laura Griffin
Email: laura.griffin@permixtec.com
www.permixmixers.co.uk

www.dppulveriser.com
www.dpmills.com