Boyee

One-stop nanomaterials solution provider

High-quality, High-stability

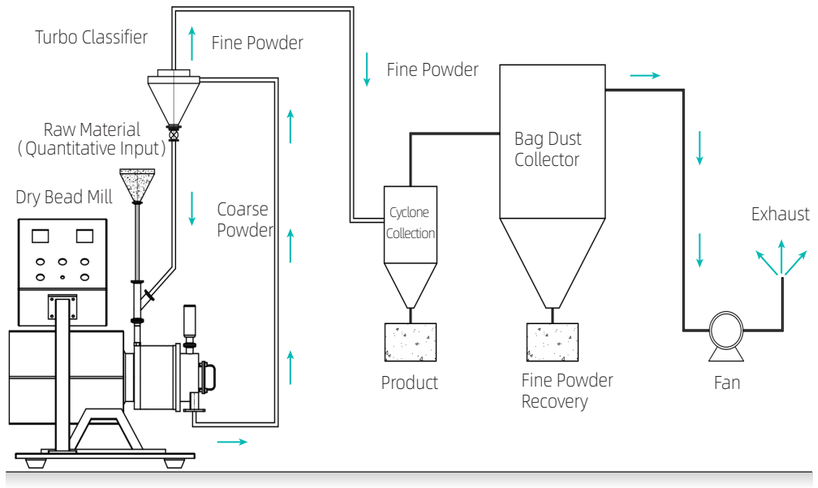
Grinding for Refined Powder Particles

The GFM-IL Dry Bead Mill is a highly efficient and precise hydration processing equipment, designed for laboratory and dry grinding applications.

Its core advantages lie in refining or improving medium precision and particle refinement, making it suitable for processing high-temperature materials, ceramic fibers, metal oxides, and other wear-resistant applications.

The equipment features full-chain integration, a dynamic centrifugal force system, and loop temperature management, ensuring grinding efficiency while delivering contamination-free, high-stability grinding results.

Dry Grinding Process



① Quantitative Input of Raw Material

The raw material is measured by a high-precision quantitative feeder and transported to the GFM dry bead mill.

② Crushing Coarse Powder Particles

Coarse powder is sent to the crushing zone, where particles are broken by high-frequency collisions between the impeller and grinding beads in the grinding chamber.

③ Full Shear Crushing

Under the action of the grinding rotor, the beads and material fully collide and undergo shear crushing, then are sent to the classification zone.

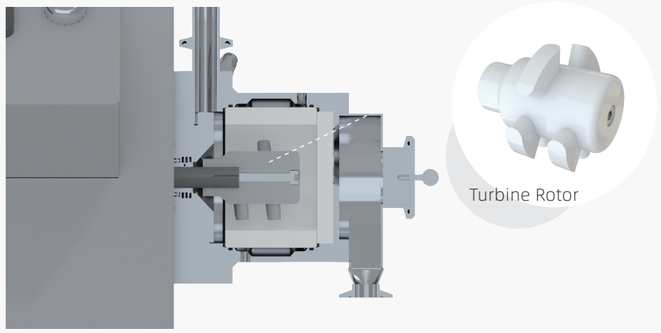
④ Grinding and Classification

After crushing, the material is classified into coarse and fine powder by centrifugal force; coarse powder returns to the grinding zone.

⑤ Fine Powder Separation and Recovery

Fine powder is discharged from the GFM dry bead mill and recovered via a cyclone separator and bag filter.

Spiral Counterflow Impeller



Dynamic Gap Design Prevents Material Agglomeration

Asymmetric membrane design and plastic flow separation device; spindle speed: Φ590/1min; impeller speed: 4~6m/s; bidirectional vortex formed by counter-rotation.

Cooling via stirring; counter-vortex reduces blade pressure, enhances inter-blade friction, and improves lubrication efficiency.

Crushing Principles

Shear Crushing

The impeller typically has gaps between blades and liquid, with hardness differences. As shear force decreases, impeller deformation increases, and mold size gradually reduces.

Impact Crushing

Higher expansion of grinding media requires resistance from passively thinned blades to maintain lifespan and improve grinding efficiency.

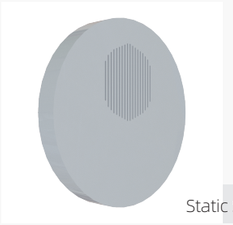
Shear Force Enhancement

Relative speed difference (≥3.5m/s) between impeller edge and screws thickens vortex, accelerating blade gap compression.

Centrifugal Force Control

Counter-rotation extends spiral adjustment time by 40%, paired with 16~19KG bearing sliders to form a 3D conical Vvalve.

Static Screen and Labyrinth Seal System



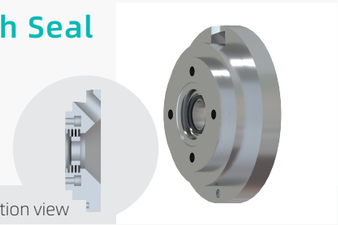
Static Screen

Screen Structure

Oxidation filter (pore size gradient design) with maximum surface density processing and filling performance (>99.2%).

Labyrinth Seal

The labyrinth seal uses precision fine circular sealing (0.05~0.1mm) and multi-stage closure, applicable for environmental air treatment within ~30 minutes. Inner and outer walls feature tensile protection, and gas absorbs heat from external swirling channels.



Section view

Cooperative Interaction

Dynamic Pressure Balancing

The screen intercepts the unqualified particles, and the qualified powder is transported to the material tank by airflow.

Zero Leakage

Combined labyrinth seals inhibit dust leakage.

Differences Between Dry and Wet Grinding/Dispersion

Key Technical Parameters: GFM-1L Dry vs. NMM-1L Wet Bead Mill

※ Basic Parameter Comparison

Parameter Category	GFM-1L Dry Bead Mill	NMM-1L Wet Bead Mill
Spindle Speed	0-950r/min	0-2800r/min
Bead Diameter	1-8mm	0.1-0.6mm
Bead Loading	1.6-1.9KG	1.6-1.9KG
Energy Consumption	3KWh	1.8kWh（per experiment）
Temperature Control	≤45℃	≤45℃

※ Batch Processing Capacity Comparison

Model	Optimal Batch Capacity	Maximum Capacity	Minimum Capacity
GFM-1L Dry Bead Mill	1.5-2KGpowder/batch	5KGpowder/batch	1.5KGpowder/batch
NMM-1L Wet Bead Mill	1.5-2Lslurry/batch	5Lslurry/batch	1.5slurry/batch

※ Flow Area Comparison

Model	Flow Area	Screen Gap
GFM-1L Dry Bead Mill	740/mm^2	0.5-4mm
NMM-1L Wet Bead Mill	134.7/mm^2	0.15mm

GFM-1L Technological Innovations & Performance Comparison

Technology Module	Traditional Dry Bead Mill	GFM-1L Innovative Design	Performance Improvement
① Impeller Design	Unidirectional spiral	Reverse dual-spiral + TiN coating	Particle size CV value reduced by 42%
② Separation System	Single-stage metal screen	Ceramic segmented screen	Separation efficiency increased to 99.2%
③ Energy Control	Standard asynchronous motor	Permanent magnet synchronous motor + direct drive	Energy intensity reduced to 0.65kWh/kg
④ Temp. Control Precision	Air cooling	Multi-channel water cooling + PID control	Temperature fluctuation ≤±2℃

How to Choose Grinding Method Based on Material Properties?

Material Property	Dry Grinding	Wet Grinding
Thermal Sensitivity	Limited for temperature-sensitive materials (friction heat)	Liquid medium enables effective heat dissipation
Agglomeration Tendency	Requires shear force; airflow may worsen agglomeration	Liquid medium coats particles to suppress agglomeration
Flowability	Poor powder flow may clog chamber	Controllable slurry flow suits complex channels
Dispersion Precision Requirement	Risk of over-grinding for surface-sensitive materials	Gentle dispersion preserves particle integrity

Industry Applications

Electronic materials, Non-metallic minerals, High-hardness materials, Metal materials, Ceramic raw materials, Chemical & pharmaceutical

Boyee

One-stop nanomaterials solution provider

High-Efficiency Precision Micron-Level Powder Solutions

GFM Dry Bead Mill

Laboratory Grade

Boyee (Shenzhen) Industrial Technology Co., LTD

Building 7, Xiaweishui Industrial Zone, Baoan District, Shenzhen 0755-8176 6076 www.boyeemill.com