SCHNEEBERGER
LINEAR TECHNOLOGY

Mineral Casting: Eliminating Vibration for Greater Speed, Precision and Environmental Protection in Production Machinery

INTRODUCTION

As manufacturing equipment, electronic devices, and medical instruments require ever-higher precision, the machinery that makes these products must deliver greater speed and accuracy. As a result, machine builders are exploring technologies that can significantly upgrade their products' performance.

One of the factors plaguing machine designers was the cast iron and steel used in their product's bases and foundations. These materials amplified the vibration generated by a machine's operation, limiting its speed and accuracy.

To solve this problem, OEM machine suppliers are adopting mineral casting technology for its exceptional vibration damping, chemical resistance, and environmental sustainability. Originally incorporated in the bases and platforms of metal grinding machines, today mineral casting is being applied in the solar, electronics, packaging, and medical device sectors.

This brief will describe how mineral casting is utilized and will review the impressive technical, economic, and environmental benefits it brings to machine builders and their customers.

What is mineral casting technology?

Mineral casting is the ideal material for machine supporting structures and foundations where dynamic and highly precise movements are required. The technology uses a proprietary cold-casting process that mixes several sizes of quartz stone (60-70 mm to powder size) into a matrix. The matrix is bonded with a small amount of epoxy, placed into a mold, and solidified. The result is an exceptionally hard quartz stone-based material. Mineral-cast products weigh about the same as aluminum and are three times lighter than steel. They exhibit low heat conductivity and chemical and corrosion resistance.

Mineral cast developed for a customer doing heavy duty precision product inspections.

Depending on the OEM's requirements, the casting can be designed with threaded inserts and precision and coated surfaces. This flexibility makes it easy to integrate components, sensors, instruments, and connections within the machine's foundation. Mineral casting provides machine builders with a ready-to-use product that shortens their processing times and accelerates final product assembly.

All mineral-cast products are built to the OEM customer's design. At a best-practice supplier, such as SCHNEEBERGER, the company's engineering department reviews the design, builds the mold, and develops the technology definition. The vendor's mineral casting specialists and applications engineers will suggest methods to improve performance and reduce cost while evaluating the OEM's design.

Casting bases, tables, and foundations for virtually any production machine

While the application of mineral casting started with grinding machines, the technology quickly spread across the high-precision machine tool industry. These applications included beds for large machining centers, side pieces for gantry machining, and structures for demanding 5-axis machining systems.

Today, OEMs are incorporating mineral casting products in a wide variety of industries such as semiconductors, packaging, electronics, optical instruments, medical technologies, food, and flat-panel instrumentation.

Case Study #1

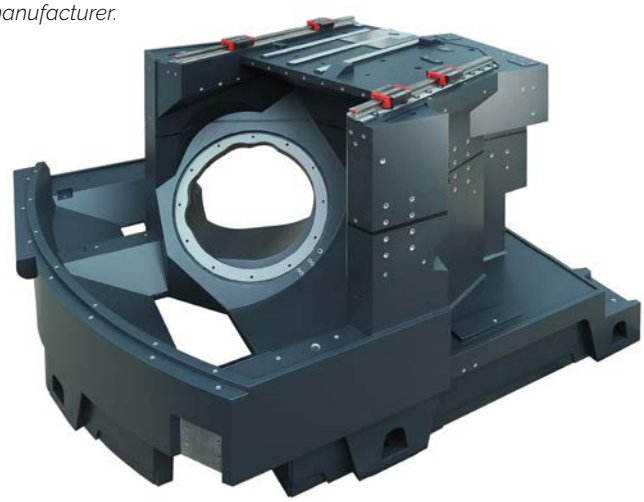
Speeding up pharmaceutical packaging

A pharmaceutical packaging company experienced problems with its blister-packing machines. The equipment was unable to accurately position the blister pack's layers, wasting a significant amount of aluminum foil and slowing the machine's operation. The company commissioned the production of a new blister packing machine with three mineral-cast bases that held all of the packaging line's equipment. 320 cast-in parts (pneumatic piping, water tanks, bonding wires, etc.) were pre-assembled in the bases. Because of the mineral-cast components' ability to eliminate vibration, the packaging machine could operate at extremely high speed and precisely position the aluminum and paper layers of the blister pack.

The result: The machine produced 700 to 1,300 blister sheets (up to 1.56 million pills) per minute, depending on pill size. This compared to the closest competitor's steel-based machine that operated at only one-third of the mineral-cast machine's output.

Casting for an EDM Machine (eroding technology) for one of the world's leading providers of complete solutions for precision components and tools manufacturers and the mold-making industry.

This mineral cast was produced for a 5 axis milling machine for a large machine tool manufacturer.



Eliminating vibration for higher speeds and greater accuracy

Design engineers cannot achieve high speed and micron-level accuracy without eliminating machine vibration. Mineral-casting technology's exceptional damping properties are up to 10 times better than steel or cast iron solving the vibration problem. The result is exceptional dynamic stability for the machine structure that enables high-speed operation with much greater precision.

Achieving lower costs and faster lead times

The production of steel machine bases and tables has become expensive due to the rising energy and production costs of steelmaking. In addition, these products must be cut, milled, polished, painted, and drilled adding considerable expense.

Mineral casting uses a stone-based material that does not require energy or additional processing to construct the product. In many instances, the mineral-cast components are molded to final dimensions with virtually no contraction during hardening. This process achieves costs savings of up to 30 percent compared to steel and iron castings. It also results in faster production cycles and shorter lead times than alternative materials.

Protecting the environment

Mineral casting is a cold-casting process that does not require an external heat source during production. Instead, heat is generated by an exothermic reaction between the chemical components. As a result, the technology consumes less energy and saves 1.6 ton of CO_2 emissions per year versus steel and cast iron production. As an added environmental bonus, mineral-cast products can be fully recycled by returning them to their vendor.

Case Study #2

Eliminating maintenance in an integrated optical lens production machine

An optical company produced 85 mm-diameter lenses for eyeglasses and microscopes. The firm's production process included individual milling, grinding, polishing, and checking machines. Temperature and pressure fluctuations were creating vibration and movement in the machines' hydraulic and electrical lines. This motion resulted in increased maintenance that caused machine downtime and higher costs.

The optical firm decided to integrate all four processes into one machine using a mineral-cast base. This platform provided space for all the machine's internal components, plus 42 pneumatic and hydraulic lines. The mold also included the indentations and wiring and piping holes for the internal components. The mineral-cast base was delivered pre-assembled with 284 cast-in parts.

The result: The integrated lens processing machine's mineral-cast base stopped the vibration and movement of the internal components, virtually eliminating the maintenance required for the old machines. In addition, the new machine increased production to 110 lenses per hour.

Flexible shaping and integration for design freedom

Because products are cast to final form, designers enjoy exceptional freedom with respect to component shapes. The technology enables the production of products weighing from 80 grams to 30 tons. The material's characteristics allow for unconventional processes such as bonding, which in turn permits the creation of complex product structures. Wiring and piping holes and spaces can be cast in and around the machine. The material is easily milled and does not require the costly processing required by steel and iron castings. The freedom and flexibility to shape designs make the material ideal for small applications such as medical devices and laboratory equipment.

Mineral cast for a grinding machine that includes many integrated parts such as tubes, pipes, wiring and controls.

SCHNEEBERGER COMPANIES

SWITZERLAND
SCHNEEBERGER AG
Lineartechnik
St. Urbanstrasse 12
4914 Roggwil/BE
+41 62 918 41 11
+41 62 918 41 00
info-ch@schneeberger.com

GERMANY
SCHNEEBERGER GmbH
Gräfenau
75339 Höfen/Enz
+49 7081 782 0
+49 7081 782 124
info-d@schneeberger.com

ITALY
SCHNEEBERGER S.r.l.
Via Soldani 10
21021 Angera (VA)
+39 0331 93 20 10
+39 0331 93 16 55
info-i@schneeberger.com

USA
SCHNEEBERGER Inc.
44 Sixth Road,
Woburn, MA 01801-1759
+1 781 271 0140
+1 781 932 4127
info-usa@schneeberger.com

INDIA
SCHNEEBERGER India Pvt. Ltd.
406, Satra Plaza,
Palm Beach Road, Sector 19D
Vashi,
400 703 New Mumbai
+91 73 0454 0119
info-in@schneeberger.com

JAPAN
Nippon SCHNEEBERGER K.K.
Crane Toranomon Bldg 7F
3-20-5 Toranomon, Minato-ku
Tokyo 105-0001

日本シュネーベルガー株式会社
〒105-0001
東京都港区虎ノ門3-20-5
クレイン虎ノ門ビル7階

+81 3 6435 7474
+81 3 6435 7475
info-j@schneeberger.com

CHINA
SCHNEEBERGER
(Shanghai) Co., Ltd.
Rm 606, Shang Gao International Building
No. 137 XianXia Road
200051 Shanghai

施耐博格（上海）传动技术有限公司
上海市长宁区
仙霞路137号盛高国
际大厦606室，上海 200051

+86 21 6209 0027
+86 21 6209 0102
info-cn@schneeberger.com

KOREA
SCHNEEBERGER Korea Ltd.
Garden5 Tool
10, Chungmin-ro,
Songpa-gu, Seoul,
Korea 05840

슈니베거코리아 유한회사
05840 서울시 송파구 충민로 10
가든파이브 툴관 10층

+82 2 554 2971
+82 2 554 3971
info-kr@schneeberger.com

SINGAPORE
SCHNEEBERGER Linear
Technology Pte. Ltd.
38 Ang Mo Kio Industrial Park 2
#01-04, Singapur 569511
+ 65 6841 2385
+ 65 6841 3408
info-sg@schneeberger.com

www.schneeberger.com

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