



产品手册  
*Product Range*



*Hidden inside – Performance outside!*

**Minerals Ltd.**

A SUBSIDIARY OF THE QUARZWERKE GROUP



## 矿物工程 | *The Mineral Engineers*

### 我们能为您的填料问题提供答案

Quarzwerke 集团是一家独立的家族企业，在工业矿物的提取、加工和精炼方面拥有近140年的历史。

HPF 矿物工程部门基于矿物学与合成原理，通过开发创新高性能填料与添加剂，帮助创建独特的系统性解决方案。为此，我们与客户的开发部门携手合作。通过我们的经验和设备，我们能够在下列领域为客户进行模型配方的初步开发：

- 油漆和涂料
- 建筑化学
- 塑料
- 粘合剂

我们专注于聚合物应用与复合材料产品，并帮助全球客户确保生产力。

### *We develop the answers to your filler questions*

*The Quarzwerke group is an independent family business with almost 140 years of tradition in the extraction, processing and refining of industrial minerals.*

*The division HPF The Mineral Engineers helps to create unique system solutions by developing innovative and functional high-performance fillers and additives on a mineralogical and synthetic basis. To achieve this, we work hand in hand with the development departments of our customers. Thanks to our experience and equipment we are in a position to be able to perform predevelopment work on model formulations for our customers in the sectors*

- paints & laquers*
- construction chemicals*
- plastics*
- adhesives*

*With our focus on polymer applications and composite products we help our customers worldwide to ensure productivity.*

我们的产品经理能够通过与客户直接联系来回答专业技术问题。当需要开发特殊解决方案时，我们会咨询产品开发专家。为了实现我们的目标，我们培养了一支非常专业的团队。经验和培训的水平涵盖各个岗位职责，包括机械师到实验室技术人员、化学技术人员、化学工程师、矿物学家、塑料工程师及拥有博士学位的化学家。因此，我们能够通过团队工作提供有效的量身定制解决方案。

*Our product managers in the technical sales are able to process technical questions in direct customer contact. The specialists of our research and development department are called in when it is a matter of developing approaches to find special solutions. In order to realise our objectives we employ a team of experts. The level of experience and training covers the range: processing mechanics, laboratory technicians, chemical technicians, chemical engineers, mineralogists, plastics engineers and chemists with doctorates. Thus customised solutions can be objectively and effectively drawn up in team work.*

“全面的能力”

*“Competence across the board”*



此外，经验丰富的员工能够灵活快速地调试生产中的新问题和新产品。我们的工厂内拥有不同规模的设备来加工矿物原料。矿物能够在这里进行从毫米到几百纳米的粉碎加工以及表面改性。

*Furthermore our production with its experienced personnel, adjusts itself flexibly and quickly to new problems and products. Units of various sizes are available at our refining plant for the processing of mineral raw materials. By means of these, minerals ranging from a few millimetres down to a few hundred nanometres can be crushed and surface modified.*

通过 DIN EN ISO 14001 的成功认证，Quarzwerke 拥有整体的环境管理能力，其中包含产品设计、生产、物流、能源和资源管理。Quarzwerke 是一家具有令人信服的质量理念的公司，并通过了 DIN EN ISO 9001 认证，因此从开采到交付，一切均能顺畅运行。

*The successful implementation of DIN EN ISO 14001 proves that Quarzwerke exhibits a holistic environmental management, which includes product development, production, logistics, energy and raw materials management. Quarzwerke is a company with a highly convincing quality philosophy, certified in compliance with DIN EN ISO 9001, so that everything runs without a hitch from extraction to delivery.*





位于德国Frechen的石英砂矿 | silica sand deposit Frechen, Germany

# 石英 *Silica*



## 石英：耐化学性与耐候性

石英 ( $\text{SiO}_2$ ) 是一种重要的成岩矿物。它存在于岩浆、变质岩以及沉积岩或沉积物中。在自然界中，二氧化硅通常以石英三方晶系的形式存在。

对工业用途至关重要是强大的可开采石英砂矿床。而化学纯度和均匀性通常不足以直接使用石英作为原料。Quarzwerke 细致彻底地准备石英砂。原材料经过充分的清洗、分级、干燥和无铁研磨过程，如此生产出石英砂、石英粉和精细石英粉。

对于生产具有规定粒度的石英粉/精细石英粉，除了无铁研磨外还需要分离过程。通过结合研磨与分级技术，Quarzwerke 可以生产粒度为  $1\ \mu\text{m}$  的精细石英粉。

另一个精加工步骤是针对特定应用定制的表面改性，例如使用硅烷或烷基物质。

## *Silica: excellent chemical resistance, weatherproof*

*Silica ( $\text{SiO}_2$ ) is one of the most important rock-forming minerals. It is to be found in magmatic, metamorphous as well as sedimentary rocks and deposits. Basically  $\text{SiO}_2$  appears in nature as trigonal silica.*

*For industrial use, mighty, workable silica sand deposits are of decisive importance. Nevertheless, chemical purity and constancy are not enough in order to apply silica directly as a raw material. In Quarzwerke plants silica sands are thoroughly prepared. The raw material has to pass extensive cleaning-, classification-, drying- and iron-free grinding processes in order to produce silica sands, flours and powders.*

*For the production of silica flours and -powders with a defined grain size distribution separation processes are required in addition to iron-free grinding. Quarzwerke are able to produce silica powders with grain sizes down to  $1\ \mu\text{m}$  due to a fine-tuned combination of grind- and classification technology.*

*Another refining step is the surface-treatment with silanes or silan-based substances which can be adjusted to the respective application.*

## 特性

- 密度 2.65 g/cm<sup>3</sup>
- 硬度 7 (莫氏)
- 高耐化学性
- 低热膨胀系数:  
14\*10<sup>-6</sup>/K (于温度 20-300°C)
- 良好的电绝缘性能  
(低介电损耗角正切值)

## Features

- *density 2.65 g/cm<sup>3</sup>*
- *hardness 7 (Mohs)*
- *high chemical resistance*
- *low thermal expansion:  
14\*10<sup>-6</sup>/K (at T 20-300°C)*
- *good electrical insulating properties  
(low tan delta)*

“Quarzwerke  
将石英砂精炼成高性能填料。”  
“*Quarzwerke refine silica sand to  
High Performance Fillers.*”



## 主要应用

- 颜料 / 外部涂料 / 防腐蚀涂料
- 用于电气应用的环氧树脂
- 建筑 / 建筑化学
- 工程石材
- 硅胶

## Key applications

- *paints / external plasters / anticorrosive coatings*
- *epoxy resin for electrical applications*
- *construction / construction chemicals*
- *engineered stone*
- *silicone*

基於石英的高性能填料：  
*High Performance Fillers based on silica:*

MILLISIL® | SILBOND® | SIKRON® | SEPASIL® | 石英砂





牙科模具材料 | dental casting material

## 方石英：纯净的白色

方石英是石英的高温改性产物。相对于石英，它在自然界中非常罕见。因此，方石英是由纯石英于大约 1500°C 时在回转炉内生产的。通过煅烧来扩展晶格结构并将密度降低至 2.35 g/cm<sup>3</sup>。由此产生的气穴将导致负折射率和非常高的白度。方石英和石英一样具有化学惰性。可提供中值粒径从 300 μm 至仅 1 μm 的微米级的产品。

## Cristobalite: dazzling white

Cristobalite is a high temperature modification of silica. In contrast to silica cristobalite is rarely existent in nature. Therefore cristobalite is made out of pure silica by heating it up to 1.500°C. Through this calcination the lattice structure is expanded and the density is reduced to 2.35 g/cm<sup>3</sup>. The thereby generated air bubbles lead to a negative refractive index and an outstanding brightness. Like silica cristobalite is chemically inert. Products from medium grain sizes from 300 μm down to micronised powders with only 1 μm are available.

# 方石英 Cristobalite



### 特性

- 密度 2.35 g/cm<sup>3</sup>
- 硬度 6.5 (莫氏)
- 高耐化学性
- 热膨胀系数:  
54\*10<sup>-6</sup>/K (于温度 20-300°C)
- 极高的白度 (Y-色值 > 94)

### Features

- density 2.35 g/cm<sup>3</sup>
- hardness 6.5 (Mohs)
- high chemical resistance
- thermal expansion:  
54\*10<sup>-6</sup>/K (at T 20-300°C)
- very high brightness (Y-value > 94)

### 主要应用

- 分散型的外用涂料和腻子
- PMMA, UP制工程石材
- 道路标记
- PP 和 PE 薄膜中的开口剂
- 牙科模具材料
- 硅胶密封材料
- 精密铸造

### Key applications

- dispersion outdoor paints and plasters
- engineered stone made of PMMA, UP
- road markings
- antiblocking-additives in PP- and PE-films
- dental casting material
- silicone sealants
- precision casting

基於方石英的高性能填料：  
High Performance Fillers based on cristobalite:

SIBELITE® | SIKRON® | SILBOND® | SILMIKRON®



# 白石英 *White silica*



## 白石英： 带有光亮表面的坚硬核心

白石英是轻微煅烧过的石英。石英核心被方石英壳包覆。因此，白石英颗粒具有石英的稳定性和方石英的高白度。此外，外壳表面略微粗糙。

## *White silica:* *hard core with bright surface*

*Weisser Quarz (White silica) is silica which has slightly been calcined. The silica core is covered by a cristobalite shell. For this reason White silica has the stability of silica but also the high whiteness of cristobalite. Furthermore the grain surface is only slightly chapped.*

### 特性

- 密度 2.60 g/cm<sup>3</sup>
- 化学惰性
- 高白度
- 圆粒形状
- 耐压

### 主要应用

- 工程石材
- 分散型涂料和硅酸盐涂料
- 道路标记

### *Features*

- *density 2.60 g/cm<sup>3</sup>*
- *chemically inert*
- *high brightness*
- *round grain shape*
- *firm against pressure*

### *Key applications*

- *engineered stone*
- *emulsion plasters and silicate plasters*
- *road markings*

提供以下颗粒尺寸的产品 (mm) :

0,1-0,5 / 0,3-0,9 / 0,7-1,2 / 1,0-1,7 / 1,5-2,2 / 2-3

*Products with the following grain sizes are available (mm):*

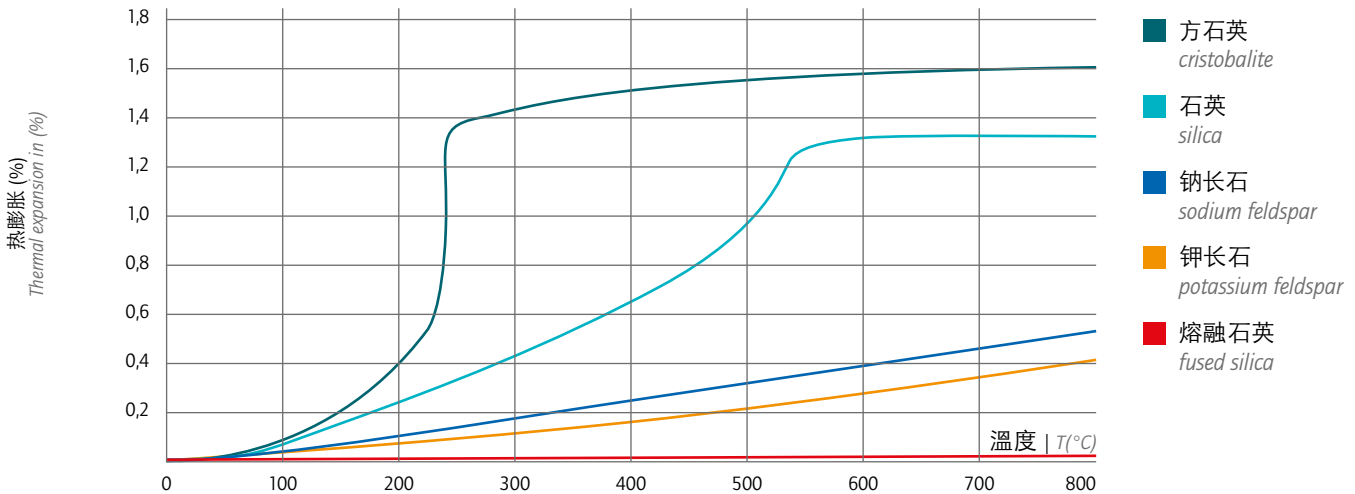
*0.1-0.5 / 0.3-0.9 / 0.7-1.2 / 1.0-1.7 / 1.5-2.2 / 2-3*

基於白石英的高性能填料：  
*High Performance Fillers based on white silica:*

白石英 (*White silica*)

## 选定矿物的热膨胀

Thermal expansion of choosen minerals



# 熔融石英 Fused silica



## 熔融石英：无定形，极低的热膨胀

熔融石英是高纯度的无定形石英。它是在约 2000°C 的电弧中合成生产的，其特征在于极低的热膨胀系数 ( $0.5 \times 10^{-6}/K$ )。

该特性对于变温环境中的特殊应用至关重要。通过特殊的无铁研磨和后续分离过程，我们能够生产低至亚微米级的熔融石英颗粒。除标准产品外，我们还提供特殊的粒度优化型产品。

## Fused silica: Amorphous, extremely low coefficient of thermal expansion

Fused silica is the amorphous modification of high purity silica. It is artificially produced using an electric arc at 2,000°C. The main feature of fused silica is an extremely low coefficient of thermal expansion ( $0.5 \times 10^{-6}/K$ ).

Therefore these products are particularly suitable for special applications with alternating temperature loading. Through special iron free grinding and subsequent air separation we are able to offer grain size distributions down to submicrons. In addition to our standard products we offer a special grain size optimised grade as well.

### 特性

- 密度 2.2 g/cm<sup>3</sup>
- 硬度 6.5 (莫氏)
- 化学惰性
- 极低的膨胀系数：  
 $0.5 \times 10^{-6}/K$   
(于温度 20-300°C)

### 主要应用

- 电子产品
- 树脂浇铸系统
- 电绝缘
- 精密铸造

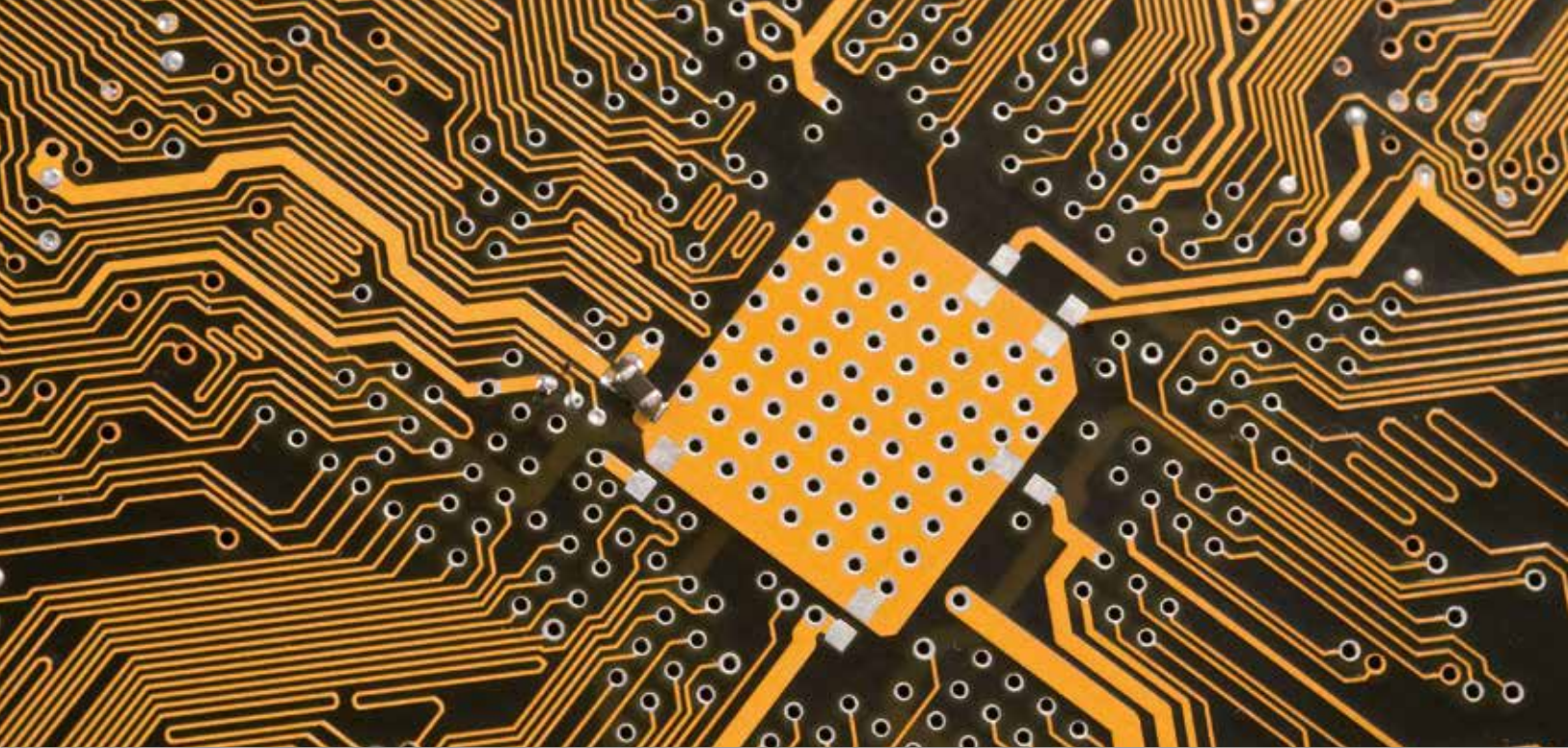
### Features

- density 2.2 g/cm<sup>3</sup>
- hardness 6.5 (Mohs)
- chemically inert
- extremely low thermal expansion:  
 $0.5 \times 10^{-6}/K$  (at T 20-300°C)

### Key applications

- electronics
- casting resin systems
- electrical insulation
- precision casting





## “满足特殊要求的熔融石英” “Fused silica for special requirements”

BRUCAFIL® 熔融石英产品特别适用于电子元件和组件的生产，其低粘度，优化的颗粒分布和恰当的颗粒形状起着重要作用。

### 特性

- 窄粒度分佈
- 恰当的颗粒形状
- 低粘度

### 主要应用

- EMC / CCL
- 微处理器

利用 SILMIKRON® 1171，我们能够提供合成生产的无定形二氧化硅，可与气相二氧化硅相媲美。这种非常精细的产品的优点在于其高纯度和低比表面积。

### 特性

- 高纯度
- $d_{50} = 0.3 \mu\text{m}$
- 比表面积 (BET)  
 $30 \text{ m}^2/\text{g}$

### 主要应用

- 技术橡胶零件
- 涂料

*Fused silica products of the product range BRUCAFIL® are particularly suitable for the production of electronic parts and components, when low viscosities, optimised grain size distributions and adapted grain forms play an important role.*

### Features

- narrow grain size distributions
- adapted grain shapes
- low viscosities

### Key applications

- EMC / CCL
- micro processors

*With SILMIKRON® 1171 we offer an artificially produced amorphous silicon dioxide comparable to pyrogenic silica. This is a very fine product characterised by its high purity and its low specific BET-surface.*

### Features

- high purity
- $d_{50} = 0.3 \mu\text{m}$
- specific surface (BET)  
of  $30 \text{ m}^2/\text{g}$

### Key applications

- technical rubber parts
- lacquers

基於無定形二氧化硅的高性能填料：  
High Performance Fillers based on amorphous silica:

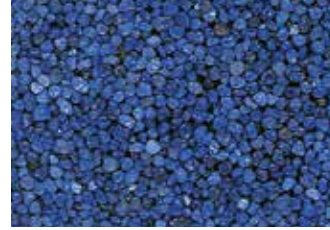
AMOSIL® | BRUCAFIL® | SILBOND® | SILMIKRON®



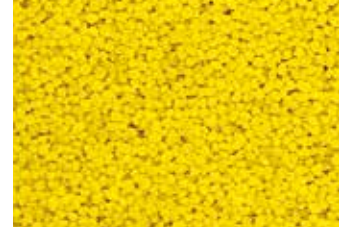
交通紅 | traffic red



雪白 | snow white



群青 | ultramarine



交通黃 | traffic yellow

### 彩色石英： 耐磨与色彩稳定

彩色石英由的高纯度的圆粒石英砂以及具有最高耐光性的合成树脂和颜料制成。每个颗粒都均匀涂覆 2 组分树脂体系。有 7 种标准粒度和 700 多种颜色和混色可供选择。颜色的多样性为高质量和装饰性应用提供了良好的基础。

### Colored silica: Abrasion resistance and colorstability

Coloritquarz (Colored Silica) is produced out of pure silica sand with round particles, special resins and pigments to obtain nonfading products. Every single sand grain is coated with a 2-component-resin-system. There is a choice of 7 standard grain sizes and more than 700 color mixtures. This variety of colors provides an excellent basis for high quality and decorative applications.

# 彩色石英 Colored silica



#### 特性

- 绚丽的色彩和高耐光性
- 色彩种类繁多
- 稳定的再现性
- 对水生生物无害

#### 主要应用

- 基于 PMMA, EP和UP的人造石和工程石材
- 工业地坪
- 彩色石材饰面
- 水族馆
- 道路标记

#### Features

- brilliant colors and high light resistance
- a wide range of colors and blends
- dependable reproducibility
- safe for aquatic life

#### Key applications

- solid surface & engineered stone products made of PMMA, EP, UP
- industrial flooring
- colored plasters
- aquariums
- road markings

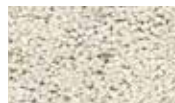
#### 标准粒度 | standard grain sizes (mm):



0.1 - 0.3



0.2 - 0.6



0.4 - 0.8



0.7 - 1.2



1.2 - 1.8



2.0 - 3.5



3.0 - 5.0



## 用于特殊的装饰效果：

此外，我们还提供基于碳酸钙的多种颜色的高品质装饰砂砾。

矿物质混合填料由高品质的，经水洗和工业加工的原料制成。这是用于生产反应性树脂和填料的均相特殊混合物。得益于颗粒组分和不同的原料与添加剂的优化组合，该混合物具有优异的加工性能。同时降低了树脂的需求量。最大填充度和固化时间取决于所用的树脂体系。根据要施加的层厚度和待生产的涂层，无论是光滑着色还是掺有彩色石英，树脂/填料比例可以达到 1:2 甚至接近 1:3。

## For decorative special effects:

We offer as well high class decorative grit (DEKORSPLITT) based on calcium carbonate in many different colors.

Mineral Mix fillers are made from high-quality industrially washed and processed raw materials. They are homogeneous special mixtures for the production of reaction resin bonded filling compounds. Thanks to the optimised combination of grain fractions based on different raw materials and additives they offer excellent processing properties. Simultaneously the binder quantity is reduced. The maximum filling degree and the curing time depend on the used resin system. Depending on the layer thickness of the product, whether smooth pigmented or sprinkled with colored silica, the resin-filler-ratio can be adjusted at 1:2 to approx. 1:3.

“粒度和颜色多样”  
“Diversity in size and color”



## MinMix 的优点

- 预配制的即用型混合物
- 无分离或沉降的倾向
- 凭借高填充量而降低成本
- 支持树脂配方的流动特性
- 实现耐压和耐磨的地板涂料
- 高耐化学性。

## Advantages of MinMix

- pre-formulated, ready-to-use mixtures
- no segregation or settling
- cost reduction due to high filling degrees
- supports flow properties of resin formulations
- enables firm and resistant floor coatings
- high chemical resistance

用於裝飾效果的高性能填料：  
High Performance Fillers for decorative effects:

彩色石英 | 裝飾砂礫 | MinMix



保险杠和扰流板 | bumpers and spoilers

### 硅灰石： 增强，低热膨胀

硅灰石是天然存在的硅酸钙，其在约 450°C 的温度下形成。单个硅灰石颗粒的结构一方面取决于地质构造，还主要取决于采用的加工技术。

根据所选择的技术，HPF 可生产具有低长径比的块状颗粒 (TREMIN® 283 系列) 或具有高长径比的明显针状硅灰石颗粒 (TREMIN® 939 系列)。

### Wollastonite: Reinforcement, low thermal expansion

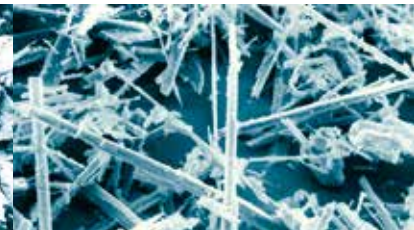
Wollastonite is a natural occurring calcium silicate that is formed at about 450°C. The structure of the wollastonite particles depends not only on natural conditions but also to a large extent on the preparation techniques employed.

Using specific processing technologies HPF wollastonite powders with particle structures from nearly block-like with a low aspect ratio (LAR) (TREMIN® 283-products) to exceptional acicular structures with a high aspect ratio (HAR) (TREMIN® 939-products) can be produced.

# 硅灰石 Wollastonite



TREMIN® 283



TREMIN® 939

### 特性

- 密度 2.85 g/cm<sup>3</sup>
- 硬度 4.5 (莫氏)
- 低热膨胀系数：  
7\*10<sup>-6</sup>/K (于温度 20-300°C)
- 优异的增强特性

### Features

- density 2.85 g/cm<sup>3</sup>
- hardness 4.5 (Mohs)
- low thermal expansion:  
7\*10<sup>-6</sup>/K (at T 20-300°C)
- excellent reinforcing properties



轴封 | Oil seals





## “使用 TREMIN® 的增強特性” “Reinforcing properties through the use of TREMIN®”

### 主要应用

- 工程塑料 (PA, PP, PU 等)  
用于汽车工业
- 含氟弹性体例如用于轴封
- 海上应用的转子叶片涂层
- 粉末涂料
- 摩擦衬片
- 防腐蚀涂层, 例如水基 EP/PUR

TREMIN® 283 产品: 块状颗粒 (长度/直径 3:1) 低长径比

TREMIN® 939 产品: 针状颗粒 (长度/直径 8:1) 高长径比

### Key applications

- *engineering technical plastics (PA, PA, PU etc.)  
for the automotive industry*
- *fluoro elastomers e.g. for oil sealing rings*
- *coating systems for offshore rotor blades*
- *powder coatings*
- *friction linings*
- *corrosion protection i.e. EP/PUR aqueous system*

*TREMIN® 283-products: granular particles (aspect ratio 3:1) LAR*

*TREMIN® 939-products: acicular particles (aspect ratio 8:1) HAR*

基於硅灰石的高性能填料：  
High Performance Fillers based on wollastonite:

TREMIN® 283 | TREMIN® 939



礦床 | quarry – Provençale S.A.

# 碳酸钙

## Calcium carbonate



### 碳酸钙：一种柔软的矿物质

碳酸钙是地球上含量最丰富的矿物质之一，主要存在于大量的石灰岩沉积岩中。碳酸钙是无数应用的重要原料。

我们的产品包括具有不同粒度和细微颜色差别的类型。它们将影响最终产品的粘度或改善其不透明度或白度。

### Calcium carbonate: A soft mineral

Calcium carbonate is one of the most common mineral compounds on Earth and is found primarily in massive limestone sedimentary rocks. Calcium carbonate is an important raw material for countless applications. Our product range includes types with different particle sizes and shades. They influence the viscosity of the end products or improve their opacity or whiteness.

#### 特性

- 密度 2.7 g/cm<sup>3</sup>
- 硬度 3 - 4 (莫氏)
- 高耐磨性
- 块状颗粒

#### 主要应用

- 分散涂料
- 工业涂料
- PVC / 塑料溶胶
- 粘合剂

#### Features

- density 2.7 g/cm<sup>3</sup>
- hardness 3 - 4 (Mohs)
- high abrasion resistance
- blocky particles

#### Key applications

- dispersion paints
- industrial coatings
- PVC / Plastisole
- adhesives

基于碳酸钙的高性能填料：  
High Performance Filler based on Calcium carbonate:

Calatem | Criscal | Mikhart





在木材上有良好透明度 | *Good transparency on wood*

## 无水硫酸钙 *Anhydrite*



无水硫酸钙 | *Anhydrite*

### 无水硫酸钙：一种抗湿度的填料

精细的天然无水石膏属于无水硫酸盐。它通常作为海水的蒸发产物而形成。无水石膏会形成稳定的石膏矿床沉积体，并可单独开采。

### *Anhydrite: A filler that withstands humidity*

*Finely ground and dressed natural anhydrite is a waterless sulphate. It is often formed as an evaporation product from sea water. Anhydrite makes up the sturdy solid base of gypsum deposits and can be mined separately.*

#### 特性

- 密度 3.0 g/cm<sup>3</sup>
- 硬度 3.5 (莫氏)
- 高白度
- 良好的透明特性
- 块状结构

#### 主要应用

- 透明涂层
- 工业涂料
- 建筑化学
- 粘合剂

#### *Features*

- *density 3.0 g/cm<sup>3</sup>*
- *hardness 3.5 (Mohs)*
- *high degree of whiteness*
- *good transparent properties*
- *tabular structure*

#### *Key applications*

- *clearcoat systems*
- *industrial coatings*
- *construction chemicals*
- *adhesives*

基於無水石膏的高性能填料：  
*High performance fillers based on anhydrite:*

TREFIL® 1313

## SILATHERM®: 通过创新填料改善塑料的导热性

对新型和创新型塑料的需求正在不断增加。未来，导热塑料将发挥越来越巨大而重要的作用，因为它们的使用创造了许多值得关注的优势。除了轻质结构的优点之外，塑料的应用提供了利用注塑成型快速且高成本效益地生产复杂几何形状的可能性。

通过添加具有高自热导性的特殊填料，可以显著提高塑料的导热性。凭借 SILATHERM® 产品系列，开发出了一种基于矿物填料的高效解决方案，用于改善塑料的导热性，它们具有电绝缘的效果并同时提高了机械强度。

## SILATHERM®: Improved thermal conductivity of plastics through the use of innovative fillers

The requirements for new and innovative plastics rise continuously. In this, heat-conductive plastics will play an increasingly larger and more important role in the future, because their use creates a number of remarkable advantages. Apart from the benefits of lightweight construction the use of plastic offers the possibility to manufacture complex geometries by injection moulding quickly and cost efficiently.

Through the addition of special fillers having a high intrinsic thermal conductivity the thermal conductivity of plastic materials can be significantly increased. With the product family SILATHERM® an efficient solution based on mineral fillers for improving the thermal conductivity has been developed. At the same time these fillers have an electrically insulating effect and improve the mechanical strength.

# SILATHERM®



### SILATHERM® 的特性

- 密度 3.6 g/cm<sup>3</sup>
- 硬度 5 (莫氏)
- 化学惰性
- 耐高温
- 粗针状颗粒

### Features SILATHERM®

- density 3.6 g/cm<sup>3</sup>
- hardness 5 (Mohs)
- chemically inert
- heat-resistant
- blocky-needled particles

### SILATHERM® Lite 的特性

- 密度 2.35 g/cm<sup>3</sup>
- 硬度 6.5 (莫氏)
- 化学惰性
- 耐高温
- 非常高的白度 (Y > 94)

### Features SILATHERM® Lite

- density 2.35 g/cm<sup>3</sup>
- hardness 6.5 (Mohs)
- chemically inert
- heat resistant
- very high brightness (Y > 94)

对于更高的导热性能，SILATHERM® Extra SILATHERM® Next 和 SILATHERM® Ultra 牌号可供选择。请与我们联系！

For even higher thermal conductivities, SILATHERM® Extra, SILATHERM® Next and SILATHERM® Ultra grades are available on request. Please contact us!





## SILATHERM® Plus: 进一步发展

例如在汽车领域，电气和电子应用的数量在自动化和网络方面正在稳步增长。而且在可替代能源领域，散热塑料也具有潜力。在许多此类应用中，热量的形成及其有效耗散的主题提出了巨大的挑战。树脂和填料巧妙的选择与组合，可以开发技术上和经济上可行的替代金属的解决方案。

SILATHERM® Plus 是一种具有最佳堆积密度的导热填料，高填充量和出色的流动性能相结合。SILATHERM® Plus 特别适用于需要高导热性的电气绝缘应用。

## SILATHERM® Plus: The logical development

*For example in automotives the number of electronics and electro applications in terms of automation and crosslinking is steadily increasing. But also the field of alternative power drives poses potential for heat conductive plastics. The issue of heat generation and their effective conduction is a major challenge in many of these applications. Through the smart combination of plastics and fillers technically and economically viable alternatives to metal solutions can be developed.*

*SILATHERM® Plus is a range of thermally conductive fillers with optimised packing density. Very high filling degrees are combined with excellent flow properties. SILATHERM® Plus is particularly suitable for applications where electrical insulation is associated with higher thermal conductivity.*

## 用于改善导热性的填料

### Fillers for increased thermal conductivity

#### SILATHERM® Plus 在环氧树脂体系中的优点

- 超过4 W/mK的高导热性能
- 高填充水平
- 低粘度
- 良好的机械学特性

#### Advantages of SILATHERM® Plus in epoxy resins

- thermal conductivity higher than 4 W/mK
- increased filling degree
- low viscosity
- good mechanical properties

#### SILATHERM® 产品系列的主要应用

- 导热热塑性化合物
- 导热环氧树脂复合材料
- 高能量密度的电气元件
- LED、传感器
- 微处理器、EMC、CCL

#### Key applications of the SILATHERM® family

- thermally conductive thermoplastic compounds
- thermally conductive epoxy resin composites
- electrical components with high energy density
- light emitting diodes, sensors
- microprocessors, EMC, CCL

不同的粒度和混合物可供选择。对于所有类型，针对于使用的树脂体系而进行的表面处理可以明显提高均匀性。这将带来更好的机械学性能和更高的导热性。

*Various grain sizes and mixtures are available. A much better homogenization is achieved with all types by a surface treatment specially adapted to the polymer. This leads to even better mechanical properties and even higher thermal conductivities.*



用於導熱塑料的高性能填料：  
High Performance Fillers for thermally conductive plastics:

SILATHERM® Extra, Lite, Next, Plus, Ultra



# 高岭土/煅烧高岭土 *Kaolin / calcined Kaolin*

## 高岭土：具有增强特性的精细填料

高岭土是一种天然存在的原料，通过复杂的加工过程能精制成工业原料。高岭土将在湿法机械处理过程中与伴随的矿物质分离。通过滚筒洗矿机、旋风分级机和离心机能将其分类成不同的粒度级别。下游操作通过沉淀，过滤及烘干来进行脱水处理。然后再通过漂白和磁选进一步获得不同的高岭土产品。

在 1000°C 进行煅烧将白色高岭土转化为适合橡胶应用的产品。

## 特性

- 密度 2.6 g/cm<sup>3</sup> | 2.4 g/cm<sup>3</sup> 针对煅烧高岭土
- 硬度 2 | 3 (莫氏) 针对煅烧高岭土
- 低热膨胀系数: 5\*10<sup>-6</sup>/K (于温度 20-300°C)
- 高长径比 (1:40)
- 明显的薄片结构

## 主要应用

- 分散涂料
- 分散粘合剂 (例如 PVA)
- 橡胶
- 阻燃剂
- 化妆品

基于高岭土和煅烧高岭土的高性能填料:  
*High Performance Fillers based on kaolin and calcined kaolin:*

Kaolin TEC | CHINAFILL | FDK | K-BRITE | CALK | PHARMAKAOLIN

## *Kaolin: fine filler with reinforcing properties*

*Kaolin is a natural occurring raw material, which is refined to an industrial raw material by extent processing. Kaolin is separated of its accessory mineral by water separator technique. The classification in different grain size distributions takes place through drum washers, cyclone classifier and centrifuges. Subsequent dewatering by sedimentation, filtration and drying takes place. Bleachery and magnetic separator improve several kaolin products.*

*A calcination at 1000 °C transfers our white kaolin into a product ideally suited for rubber applications.*

## *Features*

- *density of 2.6 g/cm<sup>3</sup> | 2.4 g/cm<sup>3</sup> for calcined clay*
- *hardness 2 | 3 (Mohs) for calcined clay*
- *low thermal expansion: 5\*10<sup>-6</sup>/K (at T 20-300°C)*
- *high aspect ratio (1:40)*
- *pronounced lamellar structure*

## *Key applications*

- *dispersion paints*
- *dispersion adhesives (i.e. PVA)*
- *rubber*
- *flame retardance*
- *cosmetics*



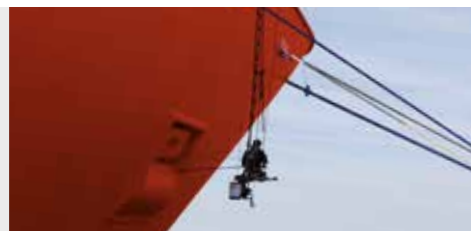
## 云母：耐高温填料

云母是天然存在的层状硅酸盐，其特征在于明显的薄片结构。有不同类型的云母。在工业上使用亮的白云母和暗的金云母。两种矿物都需要精细加工。它们将经过粉碎、水力旋流分离过程、浮选并最后进行干燥和研磨。

## Mica: High thermal stability

Mica is a natural phyllosilicate which features a pronounced lamellar structure. There are different types of mica. For industrial purposes the bright muscovite and the dark phlogopite are preferred. Both minerals have to pass extensive processing such as crushing and separation with hydrocyclones and floatation. Finally they are dried and milled.

# 云母 Mica



## 特性

- 密度 2.85 g/cm<sup>3</sup>
- 硬度 2.5 (莫氏)
- 高耐温性
- 低吸油值
- 高长径比 (1:30)
- 薄片形状颗粒

## Features

- density 2.85 g/cm<sup>3</sup>
- hardness 2.5 (Mohs)
- high thermal stability
- low oil absorption
- high aspect ratio (1:30)
- laminar particles

## 主要应用

- 工程热塑性塑料如 PA，适用于汽车应用中的大面积、低变形、耐高温部件
- 硅酸盐涂料
- 在分散颜料和涂料中防止开裂
- 防腐蚀涂层
- 粉末涂料用消光剂
- 高温涂层
- 装饰效果
- 装饰化妆品

## Key applications

- engineering thermoplastic polymers as PA for large, dimensional- and thermal stable parts for the automotive industry
- silicate paints
- cracking prevention in dispersion paints and plasters
- anti-corrosive coatings
- matting agents for powder coatings
- high temperature coatings
- decorative effects
- decorative cosmetics

基於雲母的高性能填料：  
High Performance Fillers based on mica:

TREMICA® | TREFIL®





## 霞石正长岩 *Nepheline syenite*

霞石正长岩：  
一种不含石英的矿物

霞石正长岩由长石和长石族矿物组成，诸如钠长石、微斜长石和霞石。

这种矿物原料不含结晶石英。霞石正长岩是惰性的，并且与长石一样，其特征在于高莫氏硬度6和高白度。

### 特性

- 密度 2.6 g/cm<sup>3</sup>
- 硬度 6 (莫氏)
- 高耐化学性
- 高白度
- 低折射率 1.53 – 1.55
- 在许多粘合剂系统中透明
- 厚板状结构

### 主要应用

- 分散颜料以及硅酸盐颜料和涂料
- 透明涂层系，诸如紫外线固化涂层系
- 塑料薄膜防粘连

*Nepheline syenite:*  
*a crystalline silica-free mineral*

*Nepheline syenite consists of feldspars and feldspar-type minerals such as albite, microcline and nepheline.*

*This mineral raw material contains no crystalline silica. Exactly as feldspar, nepheline syenite is inert and is characterised by a Mohs hardness of 6, and a high degree of whiteness.*

### Features

- density 2.6 g/cm<sup>3</sup>
- hardness 6 (Mohs)
- high chemical resistance
- high degree of whiteness
- low refraction index of 1.53 – 1.55
- transparent behaviour in many binder systems
- thick-slatted structure

### Key applications

- dispersion paints as well as silicate paints and plasters
- clear lacquer systems, i.e. UV-hardening lacquer systems
- anti-blocking in plastic films

基於霞石正長岩的高性能填料：  
*High Performance Fillers based on nepheline syenite:*

MINEX® | TREMINEX®



# 长石 *Feldspar*



## 长石： 一种具有高耐化学性的填料

在可进入的地壳构造中拥有近 60% 的含量，使得长石作为迄今为止最常见的矿物群。长石是一种耐化学性的硅酸盐，具有厚板状的颗粒形状。HPF 提供钾长石和钠长石，它们通过精细的加工技术进行分离、分级和微粉化。

### 特性

- 密度 2.6 g/cm<sup>3</sup>
- 硬度 6 (莫氏)
- 高耐化学性
- 高白度
- 低折射率 1.53 - 1.55
- 在许多粘合剂系统中透明
- 厚板状结构

### 主要应用

- 分散颜料以及硅酸盐颜料和涂料
- 透明涂层系，诸如紫外线固化涂层系统
- 塑料薄膜防粘连
- 牙科

## *Feldspar:* *a filler with a high degree of chemical resistance*

*With a proportion of almost 60 % by weight of the accessible structure of the earth's crust, feldspars are by far the most frequent group of minerals. Feldspar is a chemically resistant tectosilicate with a thick-slatted grain morphology. HPF offers potash as well as sodium feldspars which are processed and separated by an elaborate screening technique, then classified and micro-ground.*

### *Features*

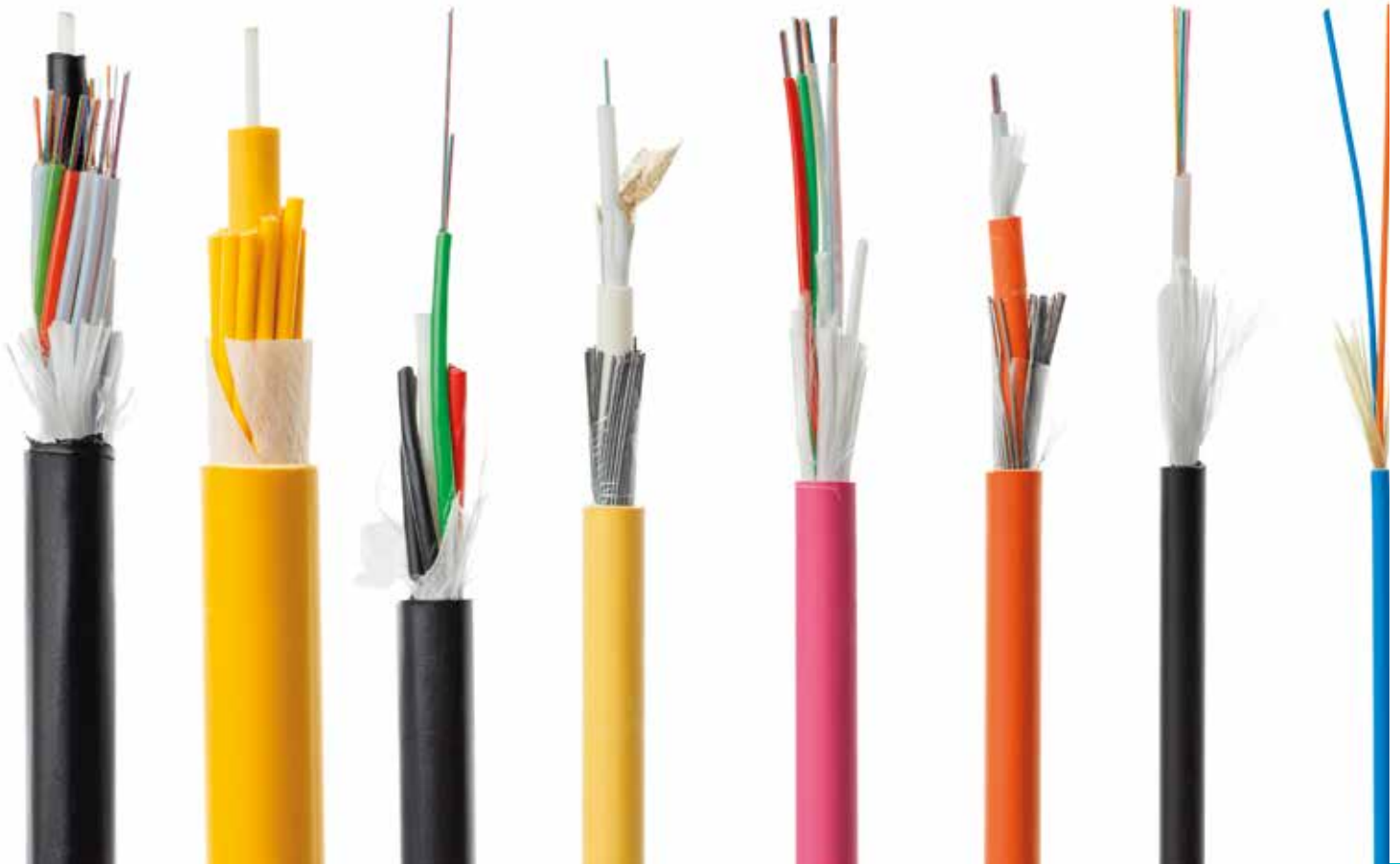
- *density 2.6 g/cm<sup>3</sup>*
- *hardness 6 (Mohs)*
- *high chemical resistance*
- *high degree of whiteness*
- *low refraction index of 1.53 - 1.55*
- *transparent behaviour in many binder systems*
- *thick-slatted structure*

### *Key applications*

- *dispersion paints as well as silicate paints and plasters*
- *clear lacquer systems, i.e. UV-hardening lacquer systems*
- *antiblocking in plastic films*
- *dental*

基於長石的高性能填料：  
*High Performance Fillers based on feldspar:*

MICROSPAR®



# 氢氧化铝 Aluminium hydroxide

## 氢氧化铝 (ATH) : 白色和阻燃

氢氧化铝由铝土矿合成而获得。氢氧化铝的突出特点是其阻燃特性 (180°C 起脱水), 高白度和低硬度。

### 特性

- 密度 2.4 g/cm<sup>3</sup>
- 硬度 3 (莫氏)
- 热膨胀系数  
15\*10<sup>-6</sup>/K  
(于温度 20-300°C)
- 高白度 (Y-色值 > 94)
- 阻燃

### 主要应用

- 电缆
- 纺织品应用  
例如地毯
- 环氧树脂浇铸
- 化学工业中的不同应用
- SMC / BMC 以及乳胶

## Aluminium hydroxide (ATH): white and flame retardant

Aluminium hydroxide is produced synthetically from bauxite. The outstanding features of aluminium hydroxide are flame retardance (dehydration at 180°C), high whiteness and low hardness.

### Features

- density 2.4 g/cm<sup>3</sup>
- hardness 3 (Mohs)
- thermal expansion:  
15\*10<sup>-6</sup>/K  
(at T 20-300°C)
- high brightness (Y>94)
- flame retardance

### Key applications

- cables
- textiles like carpets
- epoxy casting resins
- different applications in the chemical industry
- SMC / BMC as well as latex

基於氢氧化铝的高性能填料:  
High Performance Fillers based on aluminium hydroxide:

HYDRAFIL®



## 氧化铝：坚硬而透明

氧化铝是一种合成产品。它是通过在电弧炉中熔化氧化铝制成的，含有 99 % 以上的  $\alpha$ -氧化铝。高硬度和高透明度是其突出特点。只有金刚石比它更坚硬。高硬度对各种研磨过程都是一项挑战。SEPASIL® 刚玉精细粉末的突出特点是窄粒度分布。另外一个精制加工是针对不同的应用进行表面的化学处理。

### 特性

- 密度 3.95 g/cm<sup>3</sup>
- 硬度 9 (莫氏)
- 化学惰性
- 在许多粘合剂系统透明
- 窄粒度分布
- 根据加工工艺：圆形或尖碎

### 主要应用

- 高度耐磨的木材和装饰涂料
- 层压板
- 浇铸树脂和高电压绝缘子

## White fused alumina: hard and transparent

White fused alumina is an artificial product. It is molten of high quality alumina in an electric arc furnace. White fused alumina consists of about 99 %  $\alpha$ -aluminium oxide. The outstanding property of white fused alumina is its high hardness and transparency. Only diamonds are harder. This high hardness is a challenge for all grinding technologies. Our micronised white fused alumina flours SEPASIL® are characterised by a narrow grain size distribution. Another refining step is the surface-treatment with silanes or silane-based substances which can be adjusted to the respective application.

### Features

- density 3.95 g/cm<sup>3</sup>
- hardness 9 (Mohs)
- chemically inert
- transparent performance in many binding systems
- narrow grain size distribution
- depending on processing: the grain shape is round or splintered

### Key applications

- abrasion-resistant wood and decorative coatings
- laminates
- casting resin systems and high voltage isolators

基於熔融氧化铝的高性能填料：  
High Performance Fillers based on white fused alumina:

SEPASIL® EK

# 氧化铝和碳化硅 White fused alumina and silicon carbide

## 碳化硅：如金刚石般坚硬

碳化硅是硅和碳的化合物，其结构和性质与金刚石相似。碳化硅为黑绿色，并且其莫氏硬度超过9。由于其高硬度和高熔点，该材料主要用于研磨料。HPF 矿物工程通过极其复杂的表面改性，使得该合成物与聚合物体系有更好的结合性能。

### 特性

- 密度 3.21 g/cm<sup>3</sup>
- 硬度 > 9 (莫氏)
- 极高的熔点

### 主要应用

- 研磨和抛光剂
- 涂层系统

## Silicon carbide: hard as diamond

SiC is a chemical compound of silicon and carbon. Structure and properties of this chemical composition are similar to diamond. Technical silicon carbide is black-green and has an extremely high hardness of more than 9 (Mohs). Because of this high hardness but also the high melting point, the material is mainly used as an abrasive. Due to an extremely sophisticated surface modification HPF The Mineral Engineers have created a synthetic product with excellent binding properties in polymeric systems.

### Features

- density 3.21 g/cm<sup>3</sup>
- hardness > 9 (Mohs)
- extremely high melting point

### Key applications

- grinding and polishing
- coating systems

基于碳化硅的高性能填料：  
High Performance Fillers based on silicon carbide

SEPASIL® SIC

## 滑石：具有高熔点的最软填料

滑石属于层状硅酸盐族。单个滑石薄片的尺寸和所得的长径比会根据沉积矿床而变化很大。由于片层之间的结合力很小，因此各个片层容易分离。这导致其拥有独特的柔软性。额外的防水特性使得滑石应用特别广泛。我们产品的品质特点是高亮度、高纯度和精细的结构。

### 特性

- 密度 2.85 g/cm<sup>3</sup>
- 硬度 1 (莫氏)
- 化学惰性
- 片状结构

### 主要應用

- 塑料 (PP) 和橡胶
- 建筑防护和防腐蚀
- 防粘连
- 制药和化妆品
- 肥料载体

基於滑石的高性能填料：  
High Performance Fillers based on Talc:

TIKRON®

## Talc: The softest filler in the world with high melting point

Talc belongs to the group of phyllosilicates. Depending on the deposit, the size and resulting aspect ratio of the individual talcum platelets can vary widely. The bonding forces between the elementary layers are low, with the result that the individual layers easily slide apart. This results in its characteristic softness. Due to the additional high water-repellent properties talc can be used in a variety of applications. Our qualities are characterised by high brightness, purity and fine-grained structure.

### Features

- density 2.85 g/cm<sup>3</sup>
- hardness 1 (Mohs)
- chemically inert
- very pronounced lamellar structure

### Key applications

- plastics (PP) and Rubber
- building and corrosion protection
- anti-blocking
- pharmaceutical and cosmetics
- carrier for fertilisers

## 滑石和珍珠岩 Talc and perlite



珍珠岩是一种火山喷发后，经急剧冷却而成的玻璃质岩石。经过风化过程后，变成了松散的岩石。

SIPOR®产品系列由珍珠岩组成。加热到1000°C，颗粒体积增加膨胀。膨胀珍珠岩的密度非常低，颜色为白色。在显微镜下观察，形态类似于爆米花。

The term perlite is used for so-called volcanic glasses, which have been transformed into loose rock by numerous weathering processes.

The SIPOR®-product range consists exclusively of perlite, which is heated up to 1,000 °C in industrial plants. Through this process, the volume is extremely increased. Expanded perlite has a very low density, is white in color and visually resembles popcorn when viewed under a microscope.

### 特性

- 封闭的多孔球体
- 高光泽度
- 中性pH值
- 轻质
- 生态友好

### 主要应用

- SIPOR® PC用于油漆和涂料
- SIPOR® CC用于建筑化工产品
- 由于其高标准和精心的生产，SIPOR® SP适用于化妆品，并被推荐作为护理产品中微塑料的环保替代品使用。

### Features

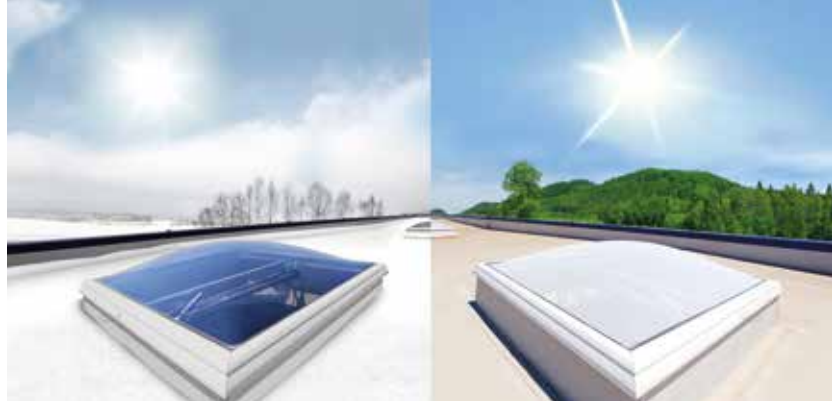
- closed porous sphere surface
- high brightness
- neutral pH-value
- very lightweight
- eco-friendly

### Key applications

- SIPOR® PC for paints and coatings
- SIPOR® CC for construction chemical products
- SIPOR® SP is suitable for cosmetic applications and is recommended as an alternative to microplastics.

基于珍珠岩的高性能填料：  
High Performance Fillers based on perlite:

SIPOR®



低温下透明而高温下呈现乳白色  
Transparent at lower and milky white at higher temperatures

## ACRYSMART®：智能母粒

ACRYSMART® 是特别针对丙烯酸玻璃的应用而开发的。丙烯酸玻璃透明度高，重量轻，并且具有良好的机械性能和优异的耐候性。此外，丙烯酸玻璃易于成型，因此被广泛应用于建筑中。常见的实施方案主要是实心、多壁板和波纹状片材。ACRYSMART® 玻璃能够根据环境温度改变其对光和太阳辐射的通透性。它具有在较高温度下自动遮光和在低温下实现最佳日光利用的优点。在炎热的夏天，经 ACRYSMART® 改性的丙烯酸玻璃将从透明状态 (OFF) 变为乳白色状态 (ON)。在较低温度下，塑料玻璃将再次转换至透明状态 (OFF)。

## ACRYSMART®: The intelligent masterbatch

ACRYSMART® has been developed specifically for use in acrylic glass. Acrylic glass is highly transparent, lightweight, has good mechanical properties and excellent weather resistance. In addition, acrylic glass is easy to shape and is therefore in construction widespread. Major forms are especially solid sheets, multi-wall sheets and corrugated sheets. ACRYSMART® glass changes its transmittance of light and solar radiation as a function of ambient temperature. It offers the advantage of automatic shading at higher temperatures and the optimal use of daylight at low temperatures. On hot summer days the modified ACRYSMART® acrylic glass switches from a transparent state (OFF) into a milky white state (ON). At lower temperatures, the plastic glazing becomes transparent again (OFF).

### 特性

- 自我调节
- 节约能源
- 免维护
- 适用于挤出和注塑

### 主要应用

- 天窗和采光带
- 温室和暖房
- 车棚和檐篷
- 外墙部分

ACRYSMART® 以塑料颗粒的形式提供。它易于混合和均匀分布。它既能与增韧改性的 PMMA 模塑化合物均匀混合，也能在挤出过程中通过计量装置进料。

### Features

- self-regulating
- energy saving
- maintenance-free
- suitable for extrusion and injection molding

ACRYSMART® is available as plastic pellets. It can easily be mixed and spread evenly. It is either homogeneously mixed with impact-toughened PMMA-molding compounds or fed via a dosing device during extrusion.

### Key applications

- skylights and rooflights
- conservatories and greenhouses
- carports and canopies
- facade elements



基於 PMMA 的智能色母粒：  
The intelligent masterbatch based on PMMA:

ACRYSMART®





## 表面处理是我们的专长 *Surface treatment is our know how*

在矿物质粉末的加工过程中，分子键被破坏。不饱和的末端硅原子和氧原子与来自空气的水分子反应形成羟基，更多的水分子可以吸附在羟基上。该水层显著削弱了填料与聚合物基质的结合。这些水分子在干燥过程中，即使通过减压、升温 and 长时间干燥也不能完全除去。

我们的许多高性能填料都经过表面改性。利用硅烷或硅烷基化合物对矿物质填料进行表面处理，确保了聚合物基质和填料体系间界面的最佳相容性。因此实现并充分利用了无机物填对系统机械学性能的改变。

*During the production of mineral flours, molecular bonds are broken. The unsaturated terminal silicon and oxygen atoms react with water molecules out of the air to form hydroxyl groups, onto which other water molecules can be adsorbed. This water film weakens the bonding between fillers and polymere system and cannot be removed completely by drying, even under vacuum conditions at elevated temperature over a long treatment time.*

*A lot of our High Performance Fillers are surface treated. This surface treatment of mineral flours with silanes or silane-based compounds enables optimised effects at the interfaces of the polymer matrix and the filler system. Thus better mechanical system properties of the inorganic filler.*

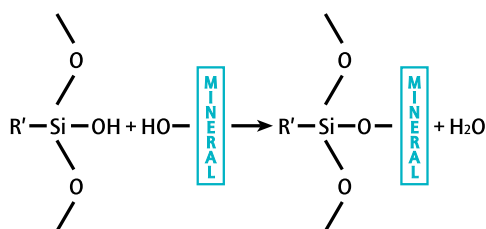
## 应用推荐

关于何种表面修饰对于某种聚合物能给出最佳结果的问题必须通过实验来回答。

## Recommended application

The most reliable way to find out which coating produces the best results for a specific polymer is by experiment.

| 聚合物体系<br>polymer systems   | 产品标识<br>labelling |
|--|-------------------|
| EP、EPDM、FA、MF、PA、PC、PE、PF、PP、PUR、PVC、UF、<br>聚砜   polysulfone, 水性分散体系   aqueous dispersions                               | - AST             |
| ABS、EP、MF、UP、SAN、PA、PC、PE、PF、PP、PS、PUR、PVC、<br>醇酸树脂   alkyd resins, 多硫化物   polysulfide, 水稀释的体系   water-dilutable systems | - EST             |
| EP、PE、PMMA、PP、PS、SAN、UP  | - MST             |
| 硅橡胶   silicone rubber  | - RST / - TST     |
| EPDM、EPM、EPT、PDAP、PE、PP、SBR、UP   | - VST             |



矿物质表面烷基化  
Silan reaction  
at the surface of the mineral



## 用于填料和聚合物之间的最佳相互作用

硅烷是由稳定的有机官能团和可水解的活泼的端基构成的双官能团化合物。可水解的基团与填料表面结合，而有机官能团与聚合物相协调。

各种硅烷诸如环氧树脂和氨基硅烷，已证明可用于我们的高性能填料的表面处理。将硅烷化的填料直接掺入聚合物体系中的方法的决定性优点在于，在涂覆矿物质期间，缩合副产物已经逸出，并且不会像在原位硅烷化处理，副产物残留在在聚合物体系中并使其变弱。

经表面修饰的填料比未修饰的填料更容易掺入聚合物中。聚合物和功能性填料之间的最佳结合是通过专门针对聚合物体系的涂层剂而实现的。

## For an optimum interaction between filler and polymer

Silanes are bifunctional compounds that consist of stable organofunctional and hydrolysable reactive terminal groups. The hydrolysable group combines with the filler surface, while the organofunctional groups harmonise with the polymer.

Different silanes as epoxy- and aminosilanes are well proven for surface treatment of our High Performance Fillers. An important advantage of this method of incorporating surface treated fillers directly into a polymer system is that the condensation by-products escape during coating of the filler. They do not remain in the polymer system, as they do in the case of in-situ post-silan treatment.

It is also easier to incorporate coated fillers into a polymer than uncoated ones. To achieve an optimum bond between the polymer and the functional filler, a surface treatment specially adapted to the polymer system must be applied to the filler.

| 矿物质<br>Mineral                            | 高性能填料<br>High Performance Fillers  | 中值粒度<br>medium grain size<br>d <sub>50</sub> [µm] | 密度   density<br>[g/cm <sup>3</sup> ] | 莫氏硬度<br>Mohs hardness | pH 值   pH-value | 亮度 Y-色值<br>brightness Y-value | 热膨胀系数<br>thermal expansion<br>[10 <sup>-6</sup> /K] | 吸油率<br>oil absorption<br>[g/100g] |
|---|--|---|--------------------------------------|-----------------------|-----------------|-------------------------------|---|-----------------------------------|
| 石英   <i>silica</i>                        | 石英砂 (QS)   <i>silica sand</i>  | 80-2000   | 2.65                                 | 7                     | 7               | 25-50                         | 14  | -                                 |
|   | MILLISIL® / 石英粉   <i>silica flour</i>  | 16-90   | 2.65                                 | 7                     | 7               | 67-85                         | 14  | 14-21                             |
|   | SIKRON® / 石英微粉   <i>silica fine flour</i>  | 2-11  | 2.65                                 | 7                     | 7               | 81-89                         | 14  | 23-28                             |
|   | SILBOND® / 硅烷化石英粉末   <i>surface treated silica flour</i>                         | 3-40  | 2.65                                 | 7                     | 7-9             | 71-89                         | 14  | 11-26                             |
|   | 白石英 (WQ)   <i>White silica</i>   | 100-3000  | 2.60                                 | 7                     | 6.5             | 60-68                         | 20  | -                                 |
| 方石英   <i>crystalite</i>                   | SIBELITE® / 方石英粉末/砂   <i>crystalite flour/-sand</i>                              | 3-310   | 2.35                                 | 6.5                   | 9               | 92-95                         | 54  | 21-28                             |
|   | SIKRON® / 石英微粉   <i>crystalite fine flour</i>                                    | 2.5-29  | 2.35                                 | 6.5                   | 8.5             | 96-98                         | 54  | 25-34                             |
|   | SILMIKRON® / 极细粉   <i>ultra fine crystalite flour</i>                            | 0.5   | 2.35                                 | 6.5                   | 8.5             | 97                            | 54  | 34                                |
|   | SILBOND® / 硅烷化方石英粉末   <i>surface treated crystalite flour</i>                    | 2.5-33  | 2.35                                 | 6.5                   | 8.5             | 89-97                         | 54  | 21-27                             |
| 熔融石英   <i>fused silica</i>                | AMOSIL® / 熔融石英粉末   <i>fused silica flour</i>                                     | 4-37  | 2.20                                 | 6                     | 6               | 94-97                         | 0.5   | 15-27                             |
|   | SILMIKRON® / 极细粉   <i>ultra fine fused silica flour</i>                          | 0.5   | 2.20                                 | 6                     | 8               | 97                            | 0.5   | 34                                |
|   | SILBOND® / 硅烷化熔融石英粉末<br><i>silane treated fused silica flour</i>                 | 4-28  | 2.20                                 | 6                     | 6.5-9           | 89-94                         | 0.5   | 17-27                             |
|   | BRUCAFIL® / 硅烷化熔融石英粉末<br><i>silane treated fused silica flour (spherical)</i>    | 4-39  | 2.20                                 | 6                     | 6               |                               | 0.5   | -                                 |
| 硅灰石   <i>wollastonite</i>                 | TREMIN® 283 / 硅烷化硅灰石粉末<br><i>silane treated wollastonite (low aspect ratio)</i>  | 2.5-15  | 2.85                                 | 4.5                   | 10              | 90-94                         | 6   | 23-27                             |
|   | TREMIN® 939 / 硅烷化硅灰石粉末<br><i>silane treated wollastonite (high aspect ratio)</i> | 17-99   | 2.85                                 | 4.5                   | 10              | 80-91                         | 6   | 31-50                             |
| 高岭土   <i>kaolin</i>                       | Chinafill / 高岭土粉   <i>kaolin flour</i>   | 1.4 - 6.5   | 2.60                                 | 2                     | 5-7             | 82-88                         | 5   | 46-56                             |
| 云母   <i>mica</i>                          | TREMICA® / 硅烷化白云母粉   <i>silane treated mica flour</i>                            | 3-7   | 2.85                                 | 2.5                   | 9.5             | 79-83                         | 7   | 62-71                             |
|   | TREFIL® / 硅烷化金云母粉   <i>silane treated phlogopite flour</i>                       | 30-50   | 2.80                                 | 2-2.5                 | 9.5             | 39-45                         | 27  | -                                 |
| 长石   <i>feldspar</i>                      | MICROSPAR® / 长石粉   <i>feldspar flour</i>   | 0.5-10  | 2.60                                 | 6                     | 10              | 96-97                         | -   | -                                 |
| 霞石正长岩   <i>nepheline syenite</i>          | MINEX® / 霞石正长岩粉末   <i>nepheline syenite flour</i>                                | 4-13  | 2.60                                 | 6                     | 10              | 85-93                         | 6.5   | 13-27                             |
|   | TREMINEX® / 硅烷化霞石正长岩粉<br><i>silane treated nepheline syenite</i>                 | 2-32  | 2.60                                 | 6                     | 10              | 85-93                         | 6.5   | 13-27                             |
| 无水硫酸钙   <i>anhydrite</i>                  | TREFIL® / 无水硫酸钙粉   <i>anhydrite flour</i>  | 3   | 3.00                                 | 3                     | 9               | 89                            | -   | 19                                |
| 碳酸钙   <i>calcium carbonate</i>            | CALATEM / CRISCAL / MIKHART  | 1-400   | 2.70                                 | 3                     | 9               | 96.5                          | -   | 18                                |
| 氧化铝   <i>alumina</i>                      | SEPASIL® EK / 硅烷化刚玉粉<br><i>silane treated white fused alumina flour</i>          | 3-45  | 4.00                                 | 9                     | 8.5             | 97-99                         | 7   | -                                 |
| 氢氧化铝<br><i>aluminium hydroxide</i>        | HYDRAFIL® / 硅烷化氢氧化铝粉<br><i>silane treated aluminium hydroxide</i>                | 0.8-106   | 2.40                                 | 3                     | 8               | 91-99                         | 15  | 15-31                             |
| 滑石   <i>talc</i>                          | TIKRON® / 硅烷化滑石粉   <i>silane treated talc flour</i>                              | 2   | 2.80                                 | 1                     | 9               | 93                            | -   | 73                                |
| 珍珠岩   <i>perlite</i>                      | SIPOR® CC 用于建筑化学品   <i>for building chemicals</i>                                | 125-1100  | -                                    | 7                     | 7               | -                             | 0.08  | -                                 |
|   | SIPOR® PC 用于涂料和油漆   <i>for paints and coatings</i>                               | 55-115  | -                                    | 7                     | 7               | -                             | 0.08  | -                                 |
|   | SIPOR® SP 用于个人护理产品   <i>for personal care</i>                                    | 70-300  | -                                    | 7                     | 7               | -                             | 0.08  | 10-56                             |
| 导热填料<br><i>thermal conductive fillers</i> | SILATHERM®   | 2-31  | 3.65                                 | 5.0                   | 6               | 78-87                         | 5.7   | 25                                |
|   | SILATHERM® Lite  | 5-6   | 2.40                                 | 6.5                   | 8.5             | 98-99                         | -   | 23-26                             |
|   | SILATHERM® Next  | 2.5   | 4.00                                 | 9                     | 8               | 98                            | 7.3   | 16                                |
|   | SILATHERM® Plus  | 6-118   | 4.00                                 | 9                     | 9               | 88-97                         | 7.3   | 94-99                             |
|   | SILATHERM® Ultra   | 3-20  | 2.3                                  | 1                     | -               | white                         | -   | -                                 |

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根据欧洲 CLP 法规 (EC/1272/2008)，我们的部分产品带有 STOT RE (特定目标器官毒性 - 重复接触) 1 类或 2 类标记。每个产品的详细信息可在相应的安全数据表中找到。本应用技术文档中列出的值已经过确定并尽我们所知，敬请知悉，我们对个别案例的结果以及我方建议的适用性和完整性不承担任何责任，且不保证第三方财产权利免收损害。使用符号®表示该品牌名称至少在一个或多个国家/地区注册。如需进一步咨询，我们将竭诚为您服务。在高岭土纸张上印刷。

Some of our products are classified into the STOT RE cat. 1 or 2 according to the European CLP Regulation (EC/1272/2008). More detailed information is available from the respective material safety data sheet. The figures documented in this application technique report were collected and shown to the best of our knowledge. However, we ask for understanding that we cannot take over liability for the results in individual cases and for the suitability and completeness of our recommendations, and cannot guarantee that no third-party patent rights are restricted. The use of the symbol ® herein signifies the registration of the associated trademark in one or more, but not all, countries. We are available for further questions and consultation. Printed on paper containing kaolin.

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