



PERKASIL®

Precipitated Silicas for the Rubber Industry

Grace Materials Technologies

GRACE
Enriching Lives, *Everywhere*.®

The Company

W. R. Grace & Co. is one of the world's largest companies for specialty chemicals. Grace has a focus on silica technology and silica/aluminium oxide technology products and produces a wide range of products, including synthetic, amorphous silica gel, colloidal and precipitated silicas, zeolites, and materials for chromatography. This extensive material portfolio has contributed to Grace's position as a leading global supplier of silica and zeolite adsorbents and catalysts. These specialty chemicals improve product performance or enhance manufacturing processes within a wide range of industrial applications. Our key strengths lie in the development of innovative technologies through which product quality and application characteristics are improved.

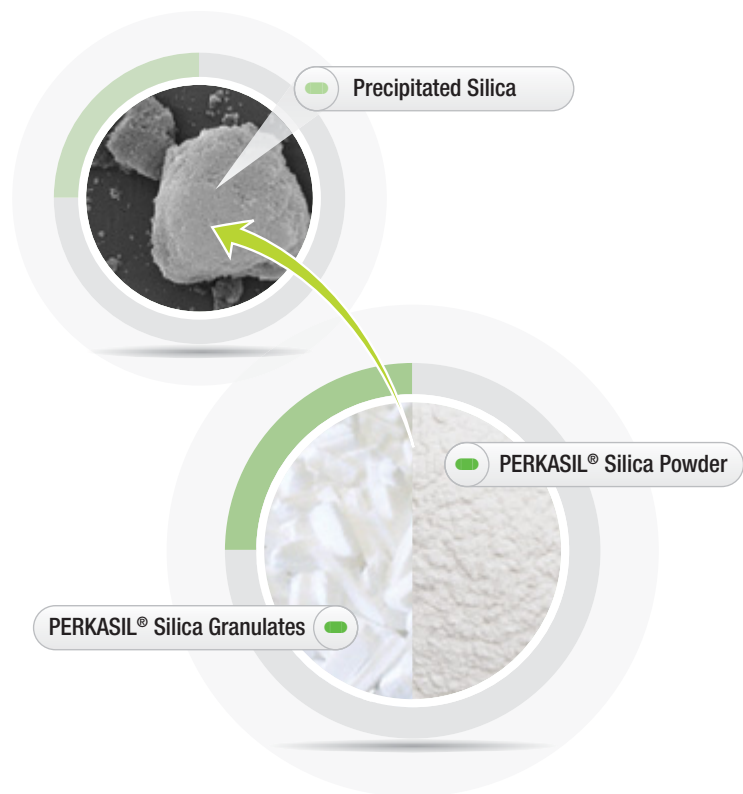
Manufacturing flexibility, global infrastructure and the commitment of our company to close customer relationships are factors that provide high levels of customer satisfaction. With manufacturing sites, research & development centers and sales offices around the globe, we are well prepared to meet the challenges of global market requirements. When it comes to sales, marketing and technical customer services, our business structure combines the strengths of a globally operating company with the flexibility and ability to adjust to regional infrastructure. With our sales offices in all key countries, we are able to quickly react to the needs of our customers.

In order to guarantee a constantly high level of product quality, all Grace sites are ISO certified and carry out Quality Management Systems. Products which are tailored to the needs of the customer, punctual deliveries, specialist technical support at a high level and a reliable customer service department are all factors that make Grace a preferred supplier within the industry.

Silica Solutions for the Rubber & Tire Industry

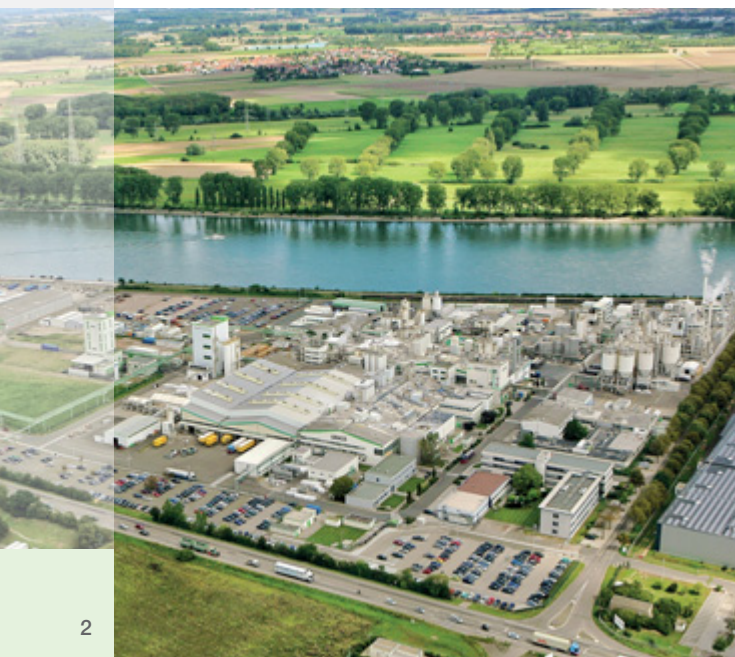
PERKASIL® precipitated silica products have been used successfully for many years as reinforcement fillers in rubber and tire applications. Our PERKASIL® portfolio covers a wide range of silica surface areas and porosities suitable for a broad variety of applications and are offered both in powder and granulated form.

To improve easily dispersible silica products, we extended our portfolio with high dispersible silica grades to meet today's requirements for green tires. For many years, Grace has been dedicated to working on innovative amorphous silica solutions to meet the needs of the rubber and tire industry. Our global product portfolio, coupled with our know-how and global presence, allows our customers to meet the global and local challenges of the rubber and tire industry.



Safety First

Our first priority is to ensure the safety of all those who work with us or come into contact with our products. Our safety data sheets and information concerning the way in which Grace's products adhere to application-related provisions are available on request. At Grace, the environment is a major priority and we are proud to maintain an outstanding record of leadership in safety standards and good corporate citizenship. Through the Responsible Care® Program, every Grace facility worldwide fulfills both stringent health and safety requirements as well as environmental requirements. It demonstrates the high priority of work safety within the organization, which has led to a substantial reduction in workplace injuries.



The products

Our PERKASIL® grades for rubber and tire applications combine excellent processing with good dispersion, improve tear and tensile strength, impart good abrasion and crack resistance.

Benefits of PERKASIL® Synthetic Amorphous Silica

- Reproducible quality
- High degree of chemical purity
- Amorphous silica, without crystalline quartz species
- Safe to handle
- Non-dusting granules, low product loss during handling
- Large accessible surface area (CTAB)



PERKASIL® KS 207 is a general purpose, medium reinforcing, white functional additive for all common polymers. Typical applications are: footwear, flooring, technical rubber goods and cable insulations.

PERKASIL® KS 300 PD is a precipitated silica with a medium surface area and a fine particle size. Its primary application is for the rubber industry as a medium to high reinforcing filler. Other typical applications are: cover, belt and hose compounds, seals and gasket materials, textiles and industrial rubber goods and cable insulations, and adhesion promoters.

PERKASIL® KS 300 GRAN is a precipitated silica with a medium surface area supplied in a granular form. Its primary application lies in the tire industry as a medium to high reinforcing filler, but it's also used in industrial rubber goods.



PERKASIL® KS 408 PD is a precipitated silica with a high surface area and a fine particle size. It is a high reinforcing filler for rubber and can replace carbon black in white and colored technical rubber articles.

PERKASIL® KS 408 GRAN is a precipitated silica with a high surface area supplied in a granular form. Its primary function lies in the tire industry as high reinforcing filler. Other typical applications include footwear and industrial rubber goods.

PERKASIL® GT 3000 GRAN is the newest member of our PERKASIL® precipitated silica product family for the rubber industry. At a medium surface area, the highly porous structure of PERKASIL® GT 3000 GRAN brings significant improvement in all major performance properties compared to conventional types of silica. By using the highly redispersible PERKASIL® GT 3000 GRAN, tires with improved reinforcement index, good tread wear properties, low rolling resistance and excellent wet grip properties can be built.

	PERKASIL® Grade					
	KS 207*	KS 300 PD	KS 300 GRAN	KS 408 PD	KS 408 GRAN	GT 3000 GRAN
Specific Surface Area (m ² /g)	80	125	125	175	175	160
pH of 5% Suspension	10.5	6.9	6.9	6.6	6.6	6.5
Compacted Bulk Density (kg/m ³)	170	190	330	170	300	275
Moisture Content (LOD, 2h/105°C)	4.5	5.0	5.0	5.5	5.5	6.2

*PERKASIL® KS 207 = Sodium Aluminium Silicate

All figures are typical data and for information purpose only

Application characteristic / Grade selection

	PERKASIL® Grade					
	KS 207*	KS 300 PD	KS 300 GRAN	KS 408 PD	KS 408 GRAN	GT 3000 GRAN
Specific Surface Area (m ² /g)	80	125	125	175	175	160

Tire applications

Processing			●●		●●	●●
Reinforcement			●●		●●●	●●●
Dispersion			●●		●●	●●●
Hysteresis			●●●		●●	●●
Abrasion Resistance			●		●●	●●●

Technical Rubber Articles

Processing	●●●	●●	●	●●	●	●●
Reinforcement	●	●●	●●	●●	●●●	●●●
Dispersion	●●●	●●	●	●●●	●	●●●
Compression Set	●●●	●●	●●	●	●	●

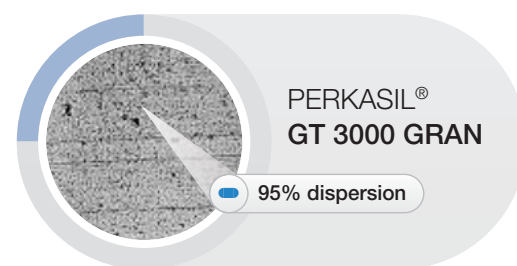
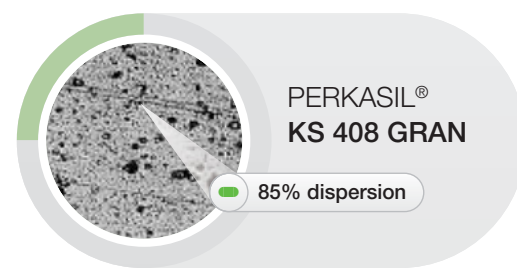
● Good ●● Very good ●●● Excellent

PERKASIL® GT 3000 GRAN

The newest development within the Grace Silica product range for the tire and rubber industry is the PERKASIL® GT 3000 GRAN. Compared to the conventional EDS (Easy Dispersible Silica) grades, PERKASIL® KS 300 GRAN and KS 408 GRAN, PERKASIL® GT 3000 GRAN is a real High Dispersible Silica (HDS), which combines excellent dispersion with good processing properties, making it extremely suitable for the production of fuel efficient tires.

The highly porous structure of PERKASIL® GT 3000 GRAN provides a significant improvement in dispersion properties compared to the conventional PERKASIL® KS 300 GRAN and KS 408 GRAN, without having negative impact on the mixing and processing properties. Furthermore, the designed pore structure of PERKASIL® GT 3000 GRAN provides optimal accessibility for rubber to have better interaction with the silica, resulting in an improved reinforcement index and good tread wear properties. PERKASIL® GT 3000 GRAN also provides lower rolling resistance for better fuel economy, in combination with excellent wet grip properties.

The quality of our dispersion properties of PERKASIL® GT 3000 GRAN in combination with the excellent processing properties make this product also extremely suitable for technical rubber applications, including footwear. Especially in technical applications where besides dispersion, abrasion and reinforcement are important application characteristics.



Precipitated Silica Technology – How our products are made

Precipitated silica is produced by the chemical reaction of sodium silicate with a mineral acid or aluminium sulphate (for making sodium aluminium silicate). This reaction takes place under stirring in an aqueous solution. The initially formed silica primary particles of 15 – 30nm size proceed by reacting with each other, forming first solid silica aggregates and thereafter loose silica agglomerates. Having reached a certain aggregate size, these silica particles would settle (= precipitate) if not stirred in the reaction slurry.

By varying the precipitation conditions a broad variety of products can be manufactured for a large number of different applications.

In order to separate the silica particles from their mother liquor, the slurry is filtered. Sodium sulphate as the reaction by-product is removed from the silica filtercake by washing. Using the appropriate conditions in the subsequent drying step then further determine the pore structure and other properties of the resulting coarse silica powder. After milling, the finished fine powder is packed or optionally granulated before packing.

Depending on your needs, our product can be packed in bags or big bags in various sizes and pallet weights/types. Customers preferring bulk delivery will be served with packing into silo trucks.

Having the best products to meet your needs, also tomorrow. R&D and Technical Service care for this.

To serve our missions of innovation and customer dedication we have:

- Bench and pilot scale production facilities
- State of the art analytical equipment
- Particle characterization
- Different types of driers, mills and classifiers
- Global technical service support and analytical centers
- Co-operation with ISO-certified institutes for application testing in elastomers

Total Quality Management

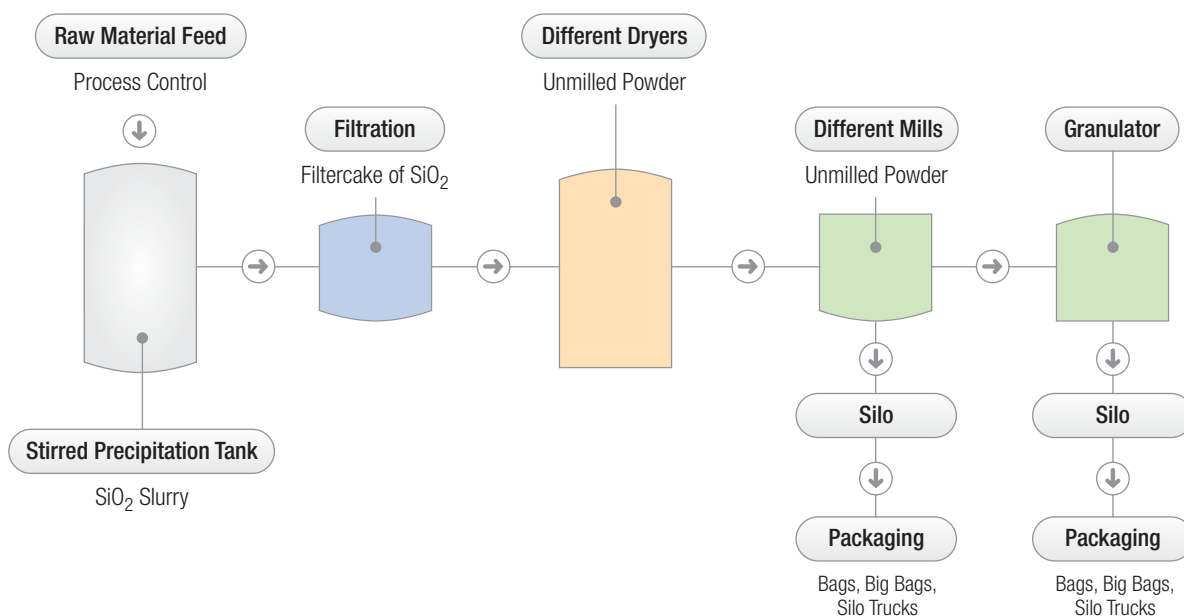
To maintain our high standards, we employ Grace's Six Sigma® philosophy of process optimization designed to continually investigate and optimize process parameters in order to achieve the highest efficiencies.

Our Six Sigma® initiative involves the improvement of product consistency, production flexibility and capacity, employing advanced statistical methods and evaluation procedures for the benefit of our customers. Our sites are all ISO 9001 or 14001 certified. External and internal audits are conducted on a regular basis as an important component of our efforts to improve our capabilities, products and services. We are not only committed to Total Quality Management, but also to continuously improving our processes.

Packaging

We offer a wide range of flexible packaging options for our PERKASIL® products, including:

- Palletised bags
- Big bags
- Silo trucks for bulk deliveries



Grace is a leading global supplier of catalysts; engineered and packaging materials; and, specialty construction chemicals and building materials. The company's three industry-leading business segments – Grace Catalysts Technologies, Grace Materials Technologies and Grace Construction Products – provide innovative products, technologies and services that enhance the quality of life. Grace employs approximately 6,000 people in over 40 countries.

Grace has met all REACH requirements for the given deadline for Tier 1, December 1, 2010, and can hereby assure our current and future customers full REACH compliance of its products. This assurance also includes the very diverse use of a spectrum of our products.

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