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Silanes for Engineered Stone

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SiSiB SILICONES

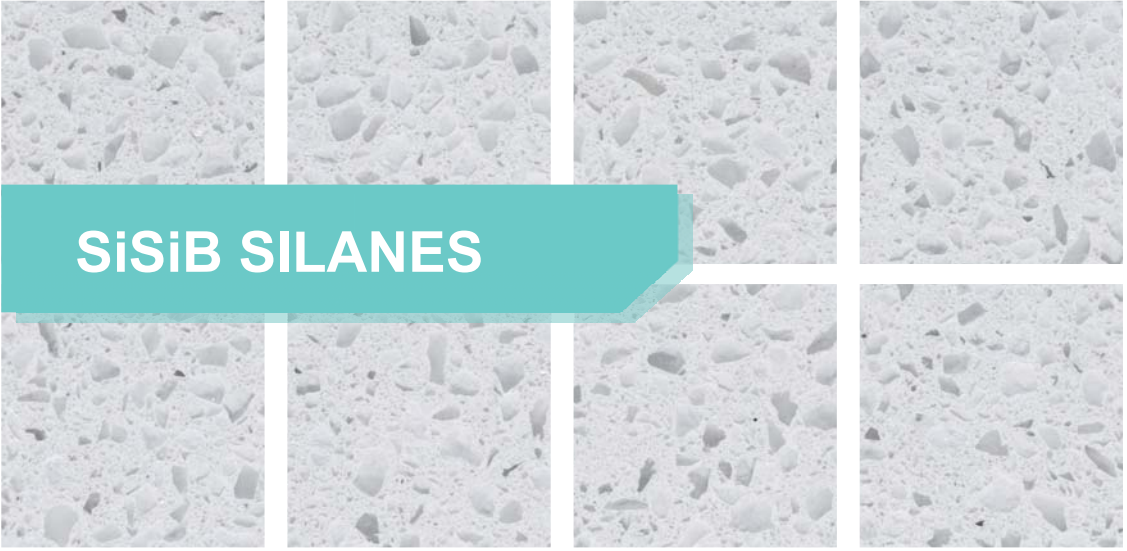
SiSiB SILICONES, a part of SINOPCC group established in 1989, is one of the leading manufacturers in silicone industry, focusing on the development and manufacture of silanes and silicones.

Strategically positioned within the silicone supply chain, SiSiB SILICONES provide a comprehensive range of performance-enhancing products and solutions to meet the need of customers. These include silanes and siliconates, silicone fluids, silicone emulsions, silicone rubber, silicone gum and fumed silica.

Today our products are used successfully throughout the world in the adhesives and sealants, agriculture, artificial marbles, building protection, coatings & paints, fillers & pigments, foundries, fiber glass, leather & textile, lubricants, personal care, pharmaceuticals, plastics & thermoplastics, polyurethane foam, rubber & tyre, wires & cables.

Why select SiSiB SILICONES?

- Strong silane and silicone manufacturing capabilities built over 30+ years history.
- Flexible manufacturing facility able to handle kilograms to thousands of tons per years.
- Rapid and professional process development and scale-up capabilities.
- Offer tailored options while adhering to high quality and safety standards.



SiSiB SILANES

Engineered Stone Introduction

Engineered stone is the latest development of artificial stone. A mix of crushed marble or quartz powder, resin, and pigment is cast using vacuum oscillation to form blocks. Slabs are then produced by cutting, grinding, and polishing. Engineered stone is also commonly referred to as agglomerate or agglomerated stone.

This category includes engineered quartz, polymer concrete and engineered marble stone. The application of these products depends on the original stone used.

Engineered marbles are most commonly used as indoor flooring and walls, but unlike terazzo, the material is factory made in either blocks or slabs, cut and polished by fabricators, and assembled at the worksite.

Engineered quartz is widely used in the developed world for kitchen counter tops, window sills, and floor and wall coverings as an alternative to laminate or granite.

Engineered Stone Composition

90~95% of the filler by weight dispersed in a matrix of unsaturated polyester resin (5~10%) mixed with peroxide catalyst and cobalt accelerator which facilitates the curing of the thermoset at ambient temperature.

The cured material is normally kept for 24~48 hours before polishing and finishing absorbers are also dosed into the chemical mix to inhibit the discoloration as a result of reaction of unsaturated polyester resin with UV light.

Engineered quartz stones manufactured by using unsaturated polyester resins are characterized by low water absorption, superior chemical durability, high hardness, flexural Strength and good thermal shock resistance compared to granite and marble.

Silanes for Engineered Stone

Engineered Stone Process

Compaction by vacuum vibratory compression process, using elastomeric molds, to cast the crushed stone/resin mixture on a moving conveyor belt. The mixture of stone aggregates and polyester resin is heated and compressed under vacuum in a large press. The vibration helps compact the mixture and results in an isotropic slab with virtually no porosity.

Engineered Stone Properties

Engineered stone is non porous, more flexible, and harder than many types of natural stone. Since it has a uniform internal structure, it does not have hidden cracks or flaws that may exist in natural stone and also has a color/pattern consistency from slab to slab. Polyester resin binding agents allow some flexibility, preventing cracking under flexural pressure. But, the binding agents often continue to harden, leading to a loss of flexural strength over time.

The polyester resins are not completely UV stable and engineered stone should not be used in outdoor applications. Continuous exposure to UV can cause discoloration of the stone, and breakdown of the resin binder. This problem can be improved by adding a UV absorber, usually PowerSorb 531 is used.

Difference between Engineered Marble and Engineered Quartz

Although both the marble- and quartz-based engineered stones are created through a similar process, and multiple companies produce both at the same time, there are distinct differences in their properties and applications.

Engineered Marble is a relatively soft material that can be easily scratched, but is simple to maintain. Typically it can be repeatedly polished until it becomes too thin. Marble is much more common and accessible around the world, and comes in a wider variety, which gives its engineered counterpart a significant edge in pricing, and more variety in pattern and colors. Engineered Marble is typically used as flooring materials for large commercial projects such as hotels, shopping centers, business lobbies, where it combines the attractive appearance of marble with budget-friendly cost and reliable delivery time.

Engineered Quartz is a much harder material. The Mohs scale hardness of engineered marble is roughly 3, whereas that of engineered quartz is around 7. This makes it much more resistant to scratching, however it also makes re-polishing and general processing a more difficult task, which is why it is most commonly used for kitchen counter tops, where the value added through processing can offset its considerably higher cost.

SiSiB SILANES

The Key of Success: Silanes

The critical stage in the manufacture of engineered stone (composite stone) is the coupling between the organic resin and inorganic mineral. SiSiB® PC4100 create a chemical bond between fillers and resins.

SiSiB® PC4100: 3-Methacryloxypropyltrimethoxysilane

SiSiB® PC4100 is a methacrylicfunctional trialkoxysilane. As a bifunctional, unsaturated organic compound, it can be incorporated into organic polymers by free radical addition, where it acts as a molecular bridge between inorganic and organic substrates.

Chemical Name	3-Methacryloxypropyltrimethoxysilane
CAS No.	2530-85-0
EINECS No.	219-785-8
Formula	$C_{10}H_{20}O_5Si$
Molecular Weight	248.35
Boiling Point	255°C [760mmHg]
Flash Point	108°C
Appearance	Colorless Clear liquid
Density 25/25°C	1.045
Refractive Index	1.430 [25°C]

Silanes for Engineered Stone

Silanes Benefit in Engineered Stone

- Enhanced mechanical properties
- Improved filler dispersion
- Better wetting of the filler surface
- Improved hydrophobicity
- Improved UV resistance

A typical artificial stone formulation contains a very high proportion of filler (>90%), a relatively small amount of unsaturated polyester resin (< 5%) and 1 ~ 2% silane coupling agent (based on the resin content). 1% SiSiB® PC4100 is enough to improve the strength.

Chemical Process in the Manufacturing of Engineered Stone