BRB Silanil® 250

3-Methacryloxypropyltrimethoxysilane

Description

BRB Silanil® 250 is a reactive chemical containing a methacrylate-reactive organic group and a trimethoxysilyl inorganic group. CAS# is specified as 2530-85-0 .
BRB Silanil® 250 possesses both organic and inorganic reactivity, reacting with organic thermoset resins as well as inorganic minerals such as glass and silica.

Features

- Organic and inorganic reactivity
- Improved adhesion between organic resins and inorganic substrates or fillers
- Increased composite wet and dry compressive strength
- Increased composite wet and dry flexural strength and modulus

Benefits

- Act as coupling agent to increase mechanical properties of glass fiber reinforced unsaturated polyester composites
- Able to add in acrylic resins during polymerization as crosslinker to improve film hardness and scrub resistance
- Improve process ability and mechanical properties of artificial marble
- Also act as adhesion promoter when is added in organic resins e.g. acrylic adhesives on inorganic substrates

Typical Data

Parameter	Unit	Value
Appearance		Clear to light-straw liquid
Specific gravity at 25°C		1.045
Refractive index at 25°C		1.43
Flash point, closed cup	°C	> 100
Purity	%	>98
Molecular Weight		248.4
Boiling point at 760mm Hg	°C	190
Viscosity at 25°C	cSt	2.5

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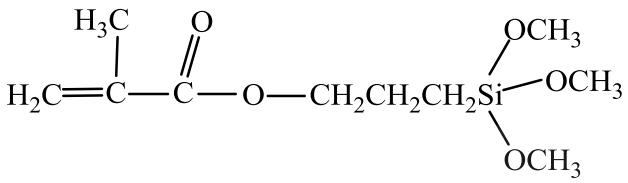
Chemical Structure



How To Use

BRB Silanil® 250 will hydrolyse when combined with water under to form silanol reactive group and released by product as methanol. While methacryl functional group will have organic chemical bond or interact with a polymer or organic surface.

Potential Applications

Composites e.g. Fiber Reinforced Plastics (FRP) and Artificial Marble

BRB Silanil® 250 can be applied to organic resins e.g. unsaturated polyester, acrylic as coupling agent in order to improve adhesion between resins and glass fibers/other mineral fillers. The result of mechanical properties when BRB Silanil® 250 is used shows better flexural strength, impact strength, tensile strength and also higher hardness.

BRB Silanil® 250 is also benefit on higher filler loading which is capable to reduce resin weight in the formulation and still remain good mechanical properties of final composites. It is recommended to add directly ***BRB Silanil® 250*** at 0.2-1% on filler weight into resin, then mix well before adding mineral fillers. Induction time (after silane addition into resin) at least overnight may be needed in order to get consistency result of mechanical properties. In case of unsaturated polyester, do not mix ***BRB Silanil® 250*** directly into peroxide as severe reaction may be incurred. Other additives and colorants are recommended to add after filler dispersion by reason of unexpected interaction between additives and ***BRB Silanil® 250*** which may reduce coupling performance between resin and mineral fillers.

Glass Fiber Size Process

BRB Silanil® 250 can be applied to inorganic surfaces e.g. glass fibers as a dilute aqueous solution. 0.1 to 0.5 percent silane is recommended to add into water solution during size process. pH adjustment is recommended from pH 3.5 to 4.5 by acetic acid and then adding the silane while stirring. After adding the silane to the acidified water, it is necessary to stir the mixture for a minimum of 30 minutes before it hydrolyses and forms a clear homogeneous solution. ***BRB Silanil® 250*** will not form a clear solution if hydrolyzed at higher than pH 5.

Mineral Filler Treatment

In the case of siliceous mineral fillers, the mineral can be treated by slurrying in the aqueous solution at 0.1-1.5 % silane based on filler weight. The silane dosage is up to particle size or surface area of fillers which is shown in the table I. pH adjustment may be needed to accelerate hydrolysis which pH 3.5-4.5 is recommended by a few drop of acetic acid.

Alternative way is mixing with the silane at very high shear (with a Waring 2 or Welex 3 blender) as a 10 percent solution in isopropanol which ratio of solution is recommended at 1:8:1 of silane : isopropanol : water. After applying this silane, the glass or mineral surface can be air-dried or dried briefly at 104 to 121°C (220-250 °F) to effect complete condensation of silanol groups at the surface and to remove water and/or traces of ethanol from hydrolysis. Optimum application and drying conditions, such as time and temperature, should be determined for each application before use in a commercial process.

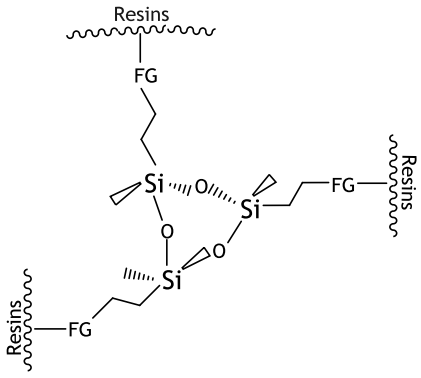
Table I. Silane dosage recommendation based on particle size of mineral fillers

Average particle size of fillers	Silane dosage (% on filler wt.)
< 1 micron	1.50%
1 to 10 microns	1.00%
10 to 20 microns	0.75%
> 20 microns	0.10%

Crosslinker for Polymer Modification

BRB Silanil® 250 is widely used to modify polymer structure especially in surface coating resin for both of waterborne and solventborne such as acrylic latex which is commonly added in polymerization step either in pre-emulsion tank or monomer mixture tank .
Double bond in methacryl group is grafted on polymer chain while silanol groups are crosslinked as -Si-O-Si- or siloxane bond to increase strength and Tg (glass transition temperature) of polymer.

Picture I. Polymer modification by silane crosslinker with -Si-O-Si- bond



Recommendation

- In Soventborne : recommended silane dosage at 0.4-10.0% on total monomer wt.

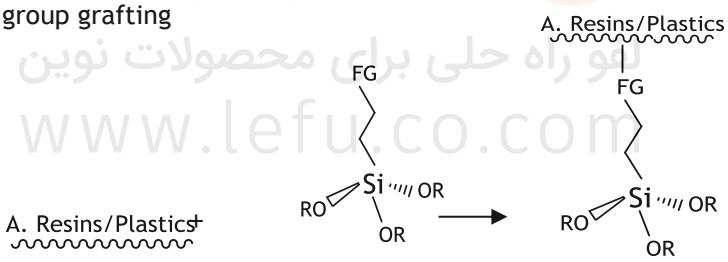
- In Waterborne : recommended silane dosage at 0.1-2.0% on total monomer wt.
- For emulsion polymerization, it is recommended to add silane in the Pre-emulsion stage. In case of None pre-emulsion stage, recommended to add silane into the monomixture at the remaining of 10-15% monomers feeding time .
- For Waterborne : pH is recommended close to neutral or < = 8.5 pH for stability purpose.

Adhesion Promoter in Paints and Adhesives

BRB Silanil® 250 can be added directly to a resin system without other additives or pigments at 0.5 to 2.0 pph to promote unprimed adhesion. For waterborne resin, pH of resin is preferred near to neutral or pH of resin should be < 8.5 before adding silane.
Induction time is needed after adding silane into resin which pH may be increased during induction time comparing to resin without silane. Typical induction time is 5-48 hours. Proper induction time is able to study by pH evolution curve/time until flat point which is pH evolution became stable. High shear and agitation is also able to accelerate the induction time.
Additives, Fillers and Pigments are recommended to add after induction time. If pH adjustment is required for final coatings, it is recommended to adjust pH after the induction time as well.

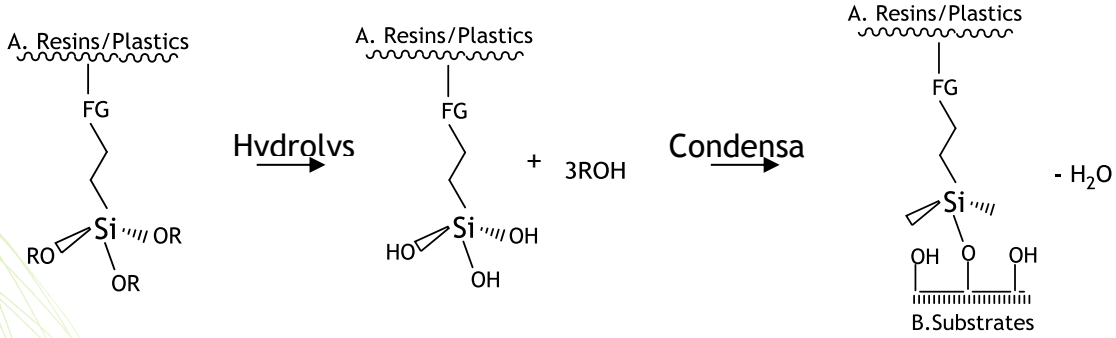
Example of silane as adhesion promoter in post addition process is illustrated below :
2 mechanisms are incurred, 1) functional group grafting and 2) hydrolysis and condensation.

1) Functional group grafting



Silan

2) Hydrolysis and condensation



Storage Recommendation
Store in dry and cool (approx. 20-25 ° C) condition. After opening, avoid exposure to atmospheric moisture. Inert gas e.g. N_2 gas is required to purge into the container after opening to prevent hydrolysis by moisture.
Avoid sunlight exposure which causes turn yellowing. Amber container is recommended to store ***BRB Silanil® 250***.

A Product Safety Data Sheet should be obtained from your BRB office prior to use.
ATTENTION: Before handling, read product information, Product Safety Data Sheets and container labels for safe use, and any physical and/or health hazard information.