

13、Silane in Coatings, Paints and Inks

1. Why we need silane in Coatings, Paints and Inks.

Silane monomer in the form of organic alkoxy silane widely used in coatings which plays as adhesive promoters, paints treatment agent and cross-linking agent. Inorganic groups bond with many kinds of organic functional groups, so that It can form strong covalent bonds between organic polymer and inorganic surface.(such as dye, filler, glass and metal material). Alkoxy silane monomer(in fact is not silicon) is a solvent with the strong polarity and it can mix with many organic resins.

2、 The advantages of USI silane in paintings:

- Resistance to corrosion
- Improve adhesiveness
- Increase rheological property
- Improve dispersion of dyes and fillers
- UV protection
- Water and chemical resistance

3、 USI Silane as adhesion promoters in paintings

When using synthetic artificial rubber and resin coatings on the surface of hydrophilic silicate and metal, we often have adhesive problem especially in high humidity, water and salting. Coatings get the protection function through base material surface adhesive prompter. Silane coupling agent can improve paintings property whether it used as coatings additives or primer coatings.

{2}Fiber Glass Composite

USI silane is widely used in varieties industries, such as: Automobile, Ship and Air Composite, Printed Circuit Board, Architecture and Sports Equipments. At first, silane is used to produce enhanced glass fiber composite to improve the mechanical and electric function. With the markets of filler and enhanced materials broaden, the applications of silane become more and more large.

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1、 The advantages of USI silane in Fiber glass:

- Improve cycle testing performance from heat polar to cold polar.
- Increase fiber glass infiltration and electrical performance.
- Enhance glass fiber precursor strand integrity, protection and treatability.

Glass fiber greatly enhanced composite physical strength and which even reach the results of metal strength. Silane is the premier choice of all glass fiber producers to treat the fiber glass products to get the good product property. Silane coupling usually used to treat glass fiber composite and it is also the key component of glass fiber enhance composite.

{3}Cables & Wires

Vinyl silane is used to cross-linking Polyethylene homopolymer as well as copolymer from 1970s. Silane cross-linking Polyethylene is used as insulation materials and sheath of wires and cables which is suit for high temperature resistance. This technology also applied to make hot water pipeline material to resistance the high temperature longer.

{4}Well Drilling (oil well sand consolidation)

In the process of oil mining, due to oil layer itself cement loosen, and with the raw oil continuously is extracted and there are also soil and sand come out which will seriously impact the normal production of raw oil. In order to increase the bond strength of oil layer, and prevent or reduce sand production, so it is important to research oil well sand consolidation agent. Artificial cementation sand control method (chemical sand control) refers to squeeze into the liquid cement and pore increasing agent from the ground to the oil layer, and then it will form a bond sand layer which has bond strength and penetration in the surface of oil layer to protect the sand. The present used resins are mainly include epoxy resin, furan resin, phenolic resin, urea-formaldehyde resin as well as the mentioned resins above modified derivatives and their composites. Chemical sand consolidation agents main use those resins and gels as the base resin which with the variety of strong adhesives and add silane coupling agent, diluent, emulsifiers, etc. And the dosage of those additives are small, but they will have a great influence on the consolidation of sand. The USI-1302, USI-D1301 are the most commonly used, they have strong affinity to the sand

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and resin, can effectively improve the consolidation strength of resin.

{5}Sealants

Silane is widely used to improve the tightness of sealant and it can also improve the adhesiveness for organic materials, such as: metal, glass and dimension stone. The sealant is based on those kind of elastomers which with the filler and can be solidified, and they have tri-function to resist water, air and chemical products, and in some cases they can also be used as adhesives. They can be applied in aerospace, automotive and construction which depends on permanent bonding of them among the surface of metal, glass, concrete and other surfaces, the bond can resistant the heat, UV, moisture and water. And silane with the following four functions:

1、Adhesion Promoter

USI Silane could reduce water content on the surface of adhesive and materials to play the functions of adhesion promoter and improve.

- moisture resistance
- temperature tolerance •
- chemistry resistance

2、 Cross-linking Agent

USI Silane could cross-link polymers, such as: acrylic acid, polyether, polyurethane and polyester. And the silane can play the following role:

- Tearing resistance
- Breaking elongation properties ٠
- Moisture resistance •
- Abrasion resistance .

3、 Dehydrating Agent

USI Silane can react with water quickly, and they can get the excess water in the formula.

- To prevent premature curing in the mixing process •
- Improve the curing uniformity •

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Improve the packaging stability

4、 Silane Coupling Agent

When you use silane coupling agent, USI Silane used as organic polymers in mineral substance and enhance fillers, play the following roles:

- Improve mixing effect
- Promote pigments or fillers bond to the resin
- Improve the strength of the base materials

{6}Rubbers, Plastic and Elastomers

1、Rubber compounding

With the increasing market of needing this kind of artificial rubbers with variety of colors, not only for the black artificial rubber, and people want this rubber can with the same function as the formula with carbon black. So silane coupling agents play an important role in effective combination between inorganic fillers and organic elastomers.

2、 The advantages of USI silane in inorganic fillers:

- Anti-wearing
- Effective combination among compounds
- Improve rheology controller
- Reduce tire rolling resistance
- Increase the toughness
- Improve electrical properties in wet condition

3、Polymer Production

- Specific silane also called external power supplier together with Ziegler-Natta catalyst in polypropylene production. Silane can be reactive other organic materials to optimize the process of polymerization.
- Reactive organic silicon polymers are also used in manufacturing of the thermoplastic vulcanizate(TPVs). TPVs compound through cross-linking of rubbers in thermoplastic matrix and dynamic vulcanization.

{7 } Water-proof in Building Materials

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1、 silane water repellent agent plays the protection role in concrete

- (1) Effectively reduce Cl⁻ permeate through concrete pore so that prevent inner reinforcement corrosion.
- (2) Greatly reduce concrete water absorption and also prevent concrete corrosion, weathering and breed microorganisms.
- (3) Effectively prevent concrete from freeze-thaw damage.
- (4) Excellent penetration ability and permeability, which can achieve the concrete inside and outside material exchange, to prevent the different pressures between inner and outside.
- (5) Excellent alkali resistance are available for new concrete and high alkalinity base material.

2. Characteristic of silane waterproofing impregnant:

Capillary dispose, appearance no change, greatly reduce capillary water absorption High hydrophobicity, high air permeability, no freeze-thaw damage, greatly reduce weathering

[8] Textile chemicals (Organic Silane Finishing Agent)

Silane coupling agents are used for compounding of silicone oil and silicone emulsion to provide fabric function of comfortable, softness and smoothness. After modified with USI silane, Organic silane finishing agent has the following advantages:

- The fabric has a feeling of beauty and softness.
- Lower yellowing
- Improve tear strength and durability
- According to new compound design, enhance waterproofness (hydrophobicity) and improve water-absorbing quality(hydrophily)
- Improve elastic recovery, anti wrinkle resistance and abrasion resistance
- Reduce shrink degree
- Improve flexibility

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