Dynasylan® Silanes for Coatings Formulations and Binder Modification

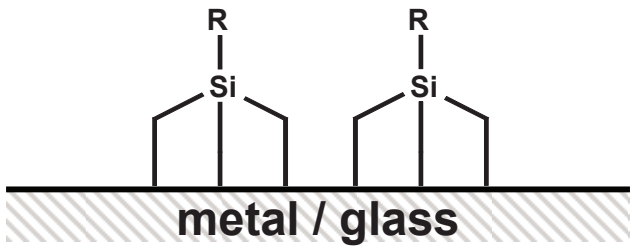
EVONIK INDUSTRIES

Main Use of Silanes in the Coatings Industry

Application \ Industry	Automotive	Marine and Protective	Decorative	Industrial	Glass coatings	Special application	Coil coating	Wood coating
Adhesion Promoter				+	+		+	
Zinc silicate		+		+				
Curing agent	+	+						+
Resin synthesis	+	+	+			+		
Sol-gel systems						+		
Hydrophobic and oleophobic surfaces	+				+	+		+

Use of Silanes in Coatings I

Surface Modification



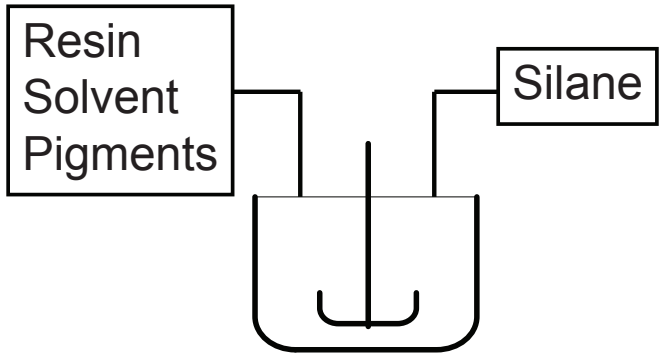
Oleophobic / hydrophobic/ primers

Application:

- Primer to improve adhesion of the next coat on an inorganic substrate

Example: Wash-coat on aluminum

Additive



Additive to coatings / metal treatment formulations

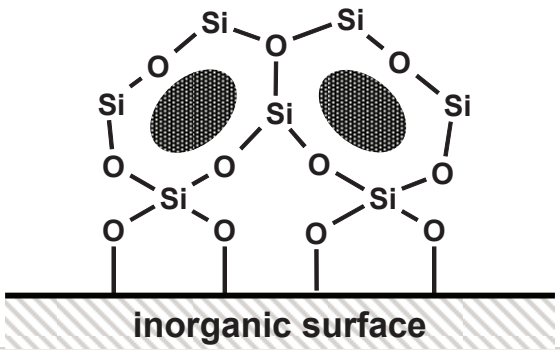
Application:

- Addition of a silane to a coatings formulation to improve adhesion on an inorganic substrate.

Example: Glas coatings

Use of Silanes in Coatings II

Silane based resins



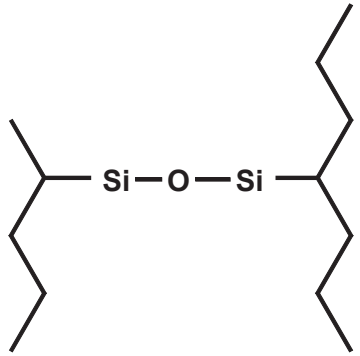
Resins for metal treatment

Application:

- Silanes are the basis for inorganic binders

Example: Zinc silicate coatings

Crosslinking



Silane crosslinking of resins

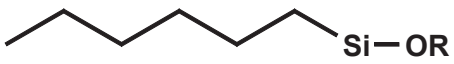
Application:

- Silane crosslings a special resins and functions as a curing agent

Example: Polysiloxane based marine and protective coatings

Use of Silanes in Coatings III

Resin synthesis



Silane modified resins

Application:

- Silane functions as monomer for the synthesis of silane modified resins.

Example: Acrylic dispersions

Outline

Application \ Industry	Automotive	Marine and Protective	Decorative	Industrial	Glass coatings	Special application	Coil coating	Wood coating
Adhesion Promoter				+	+		+	
Zinc silicate		+		+				
Curing agent	+	+						+
Resin synthesis	+	+	+			+		
Sol-gel systems						+		
Hydrophobic and oleophobic surfaces	+				+	+		+

Traditional Use of Dynasylan® Silanes

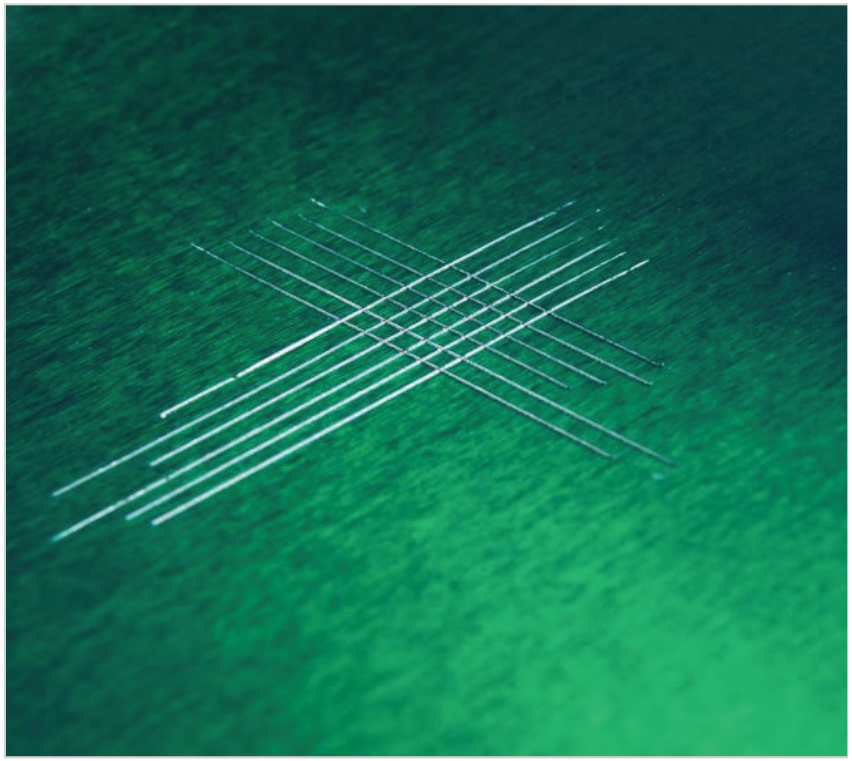
Adhesion Promoters

Main Industries:

- Industrial
- Glass coatings
- Coil coating

Main Products:

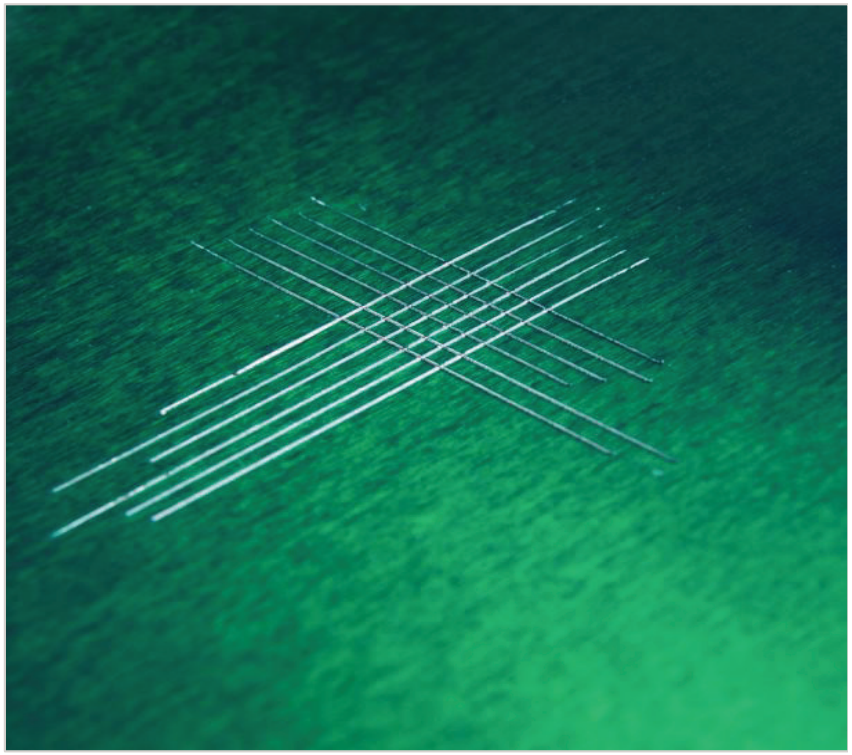
- Aminosilanes
- Epoxysilanes



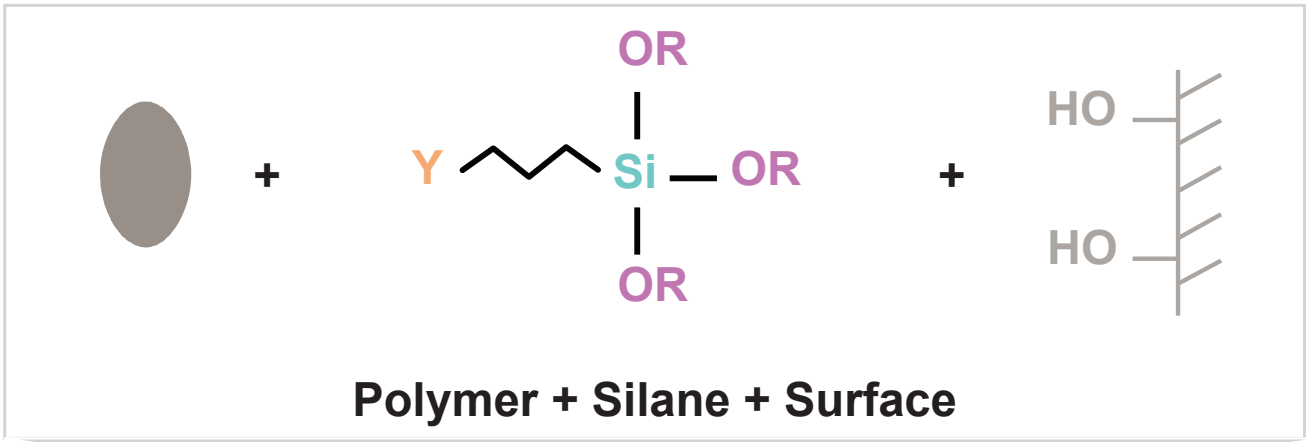
Dynasylan® as Adhesion Promoter: Suitable Substrates

Suitable substrates have active…

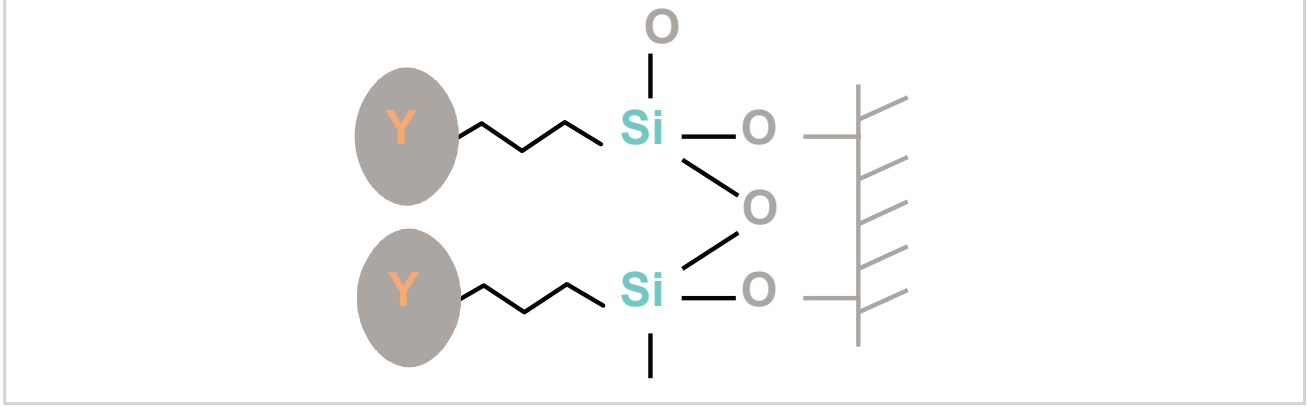
- Glass
- Ceramics
- Aluminum
- Steel
- Phosphatized steel
- Copper



Silanes Form a Molecular Bridge Between Polymers and Inorganic Surfaces



Adhesion



Y = "Organofunctional" group

OR = "Silicon-functional" group

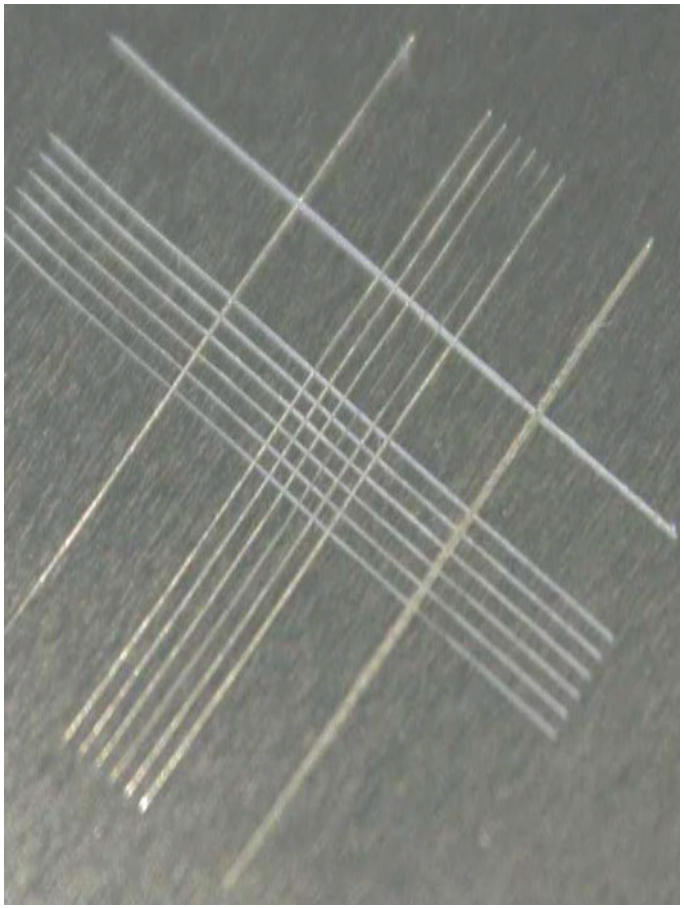
Silanes are Very Effective Adhesion Promoters on Inorganic Substrates

Substrate pre-treatment:

- Thin, invisible layer on coating surface
- Alcoholic or aqueous solution of silane: 0.1 to **3%**

Additive in resin:

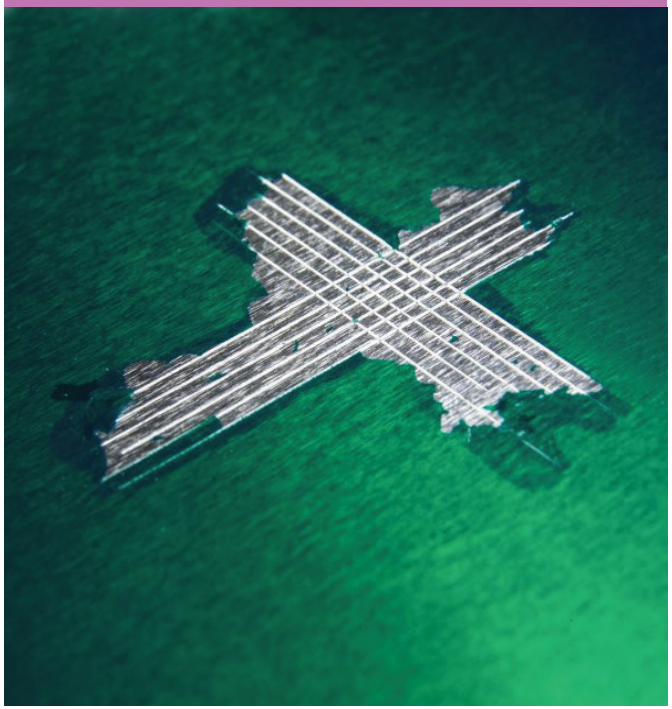
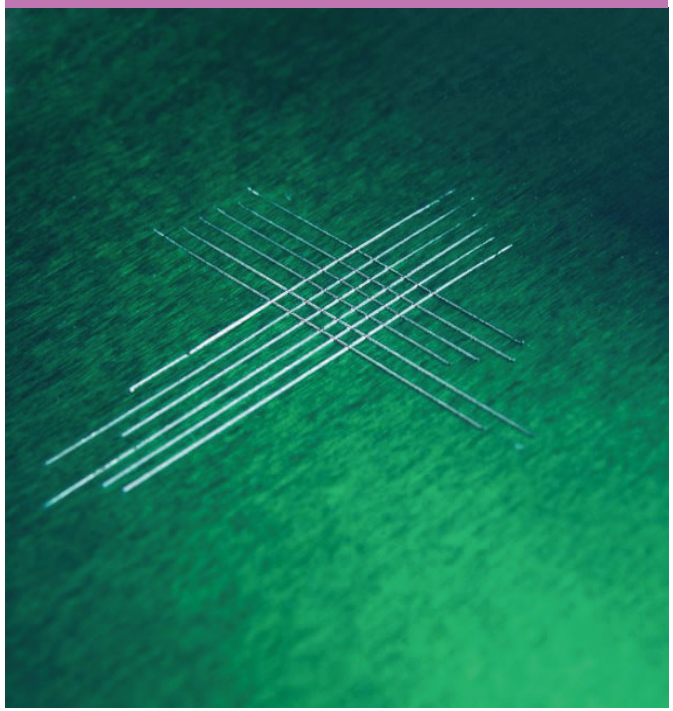
- Concentration: approx. 0.3 to 3 % (rel. to resin)
- Stability of coating system with silane must be tested
- The silane can react with most coating components
  - Inorganic fillers
  - Solvents
  - Resins
  - Pigments
  - Other additives



Silanes As Primer: Effective Adhesion After Water Storage

Adhesion after 24 hours water storage, silane-primer:

1% **Dynasylan® HYDROSIL 2909** in methoxypropanol

Coating without primer	Coating with primer
	

Dynasylan® Silanes as Primers

Solvent-borne primer

Dynasylan® SIVO 214	2.0 %
Methoxypropanol	96.0 %
Acetic Acid	1.2 %

SIVO 214 is especially suited for smooth substrates such as glass and aluminum.

Water-borne primer

Dynasylan® HYDROSIL 2776	2.0 %
Water	97.9 %
BYK 348	0.01 %

HYDROSIL 2776 is used mostly on rough surfaces such as concrete and sand blasted steels as adhesion promoter

For corrosion protection primers use:

- **Dynasylan® SIVO 110** on sand blasted steels
- **Dynasylan® SIVO 160** on Mg, Al substrates

Dynasylan® Silanes as Adhesion Promotion Additive to Coating Formulations (1/2)

Epoxy

- 2K (solvent): **GLYMO** (epoxy)
  SIVO 214 (amine hardener)
- 2K (water-borne): **GLYEO** (epoxy)
  HYDROSIL 2627 (amine hardener)

Acrylic

- UV-cured: **MEMO**
  GLYMO
- Solvent-borne: **MEMO**
  OCTEO
  6490

Addition level: about 0,3 - 3% relative to resin

Dynasylan® Silanes as Adhesion Promotion Additive to Coating Formulations (2/2)

Polyurethane

- 2K: **GLYMO** (isocyanate)
  SIVO 214 (polyol)
- Dispersion: **HYDROSIL 2926**
  HYDROSIL 2627
- 1K: **1189**
  1146

Latices (aqueous acrylic dispersions)

- Adhesion promoter
  - pH neutral: **GLYEO**
  - pH > 8.5: **HYDROSIL 2627**
  - pH < 5: **HYDROSIL 2926**
  - Thermally cured: **HYDROSIL 2926**

Addition level: about 0.3 - 3% relative to resin