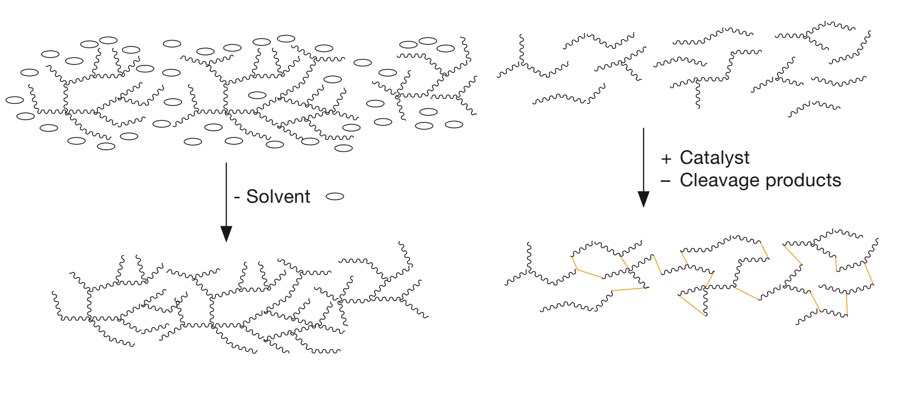
SILRES® MSE 100:

A Unique Silicone Resin that Cures at Room Temperature

Heat-resistant coatings based on conventional silicone resin solutions dry to a tack-free coating film solely due to physical evaporation of the solvent. The first time the film is heated, it initially resoftens before the onset of curing at 200 °C. Usually, undesirable smoking occurs too. With SILRES® MSE 100 binder, these problems are a thing of the past.

Figure 1: A Comparison of Drying Processes (Right: SILRES® MSE 100)



Strictly physical film formation of high-molecular binders compared with chemical film formation by forming new chemical bonds (in red)

What Distinguishes SILRES® MSE 100 from Conventional Types?

Conventional liquid silicone resin binders contain high-molecular, film-forming polymers that are typically dissolved in an aromatic solvent. Drying and film formation occur solely due to physical evaporation of the solvent.

By contrast, SILRES® MSE 100 is a liquid silicone resin (> 99% solids) that dries as a result of a chemical reaction. SILRES® MSE 100 is a blend of the methyl esters of various methyl polysilicic acids. In the presence of humidity and a catalyst, the product reacts rapidly through hydrolysis and condensation to become a solid silicone resin with great hardness. This coating will also not soften when heated anymore. As the condensation is accompanied by volume contraction, SILRES® MSE 100 is recommended as a binder for pigmented and highly filled paints and coatings. To attain the necessary adhesion to the substrate, the dry film thickness should not exceed 25 µm.

A Wide Variety of Application Possibilities

SILRES® MSE 100 is suitable as a binder for heat-resistant paints and coatings, topcoats for heat-resistant corrosion protection and flame-retardant paints and coatings.
Because no smoke is emitted during baking, it is particularly well-suited for application areas such as wood-burning stoves, where smoke development is undesirable.
With regard to their end properties – especially weathering and thermal stability, paints and coatings based on SILRES® MSE 100 are comparable to conventional coatings based on silicone resins.

Catalyst Selection

Essentially, all compounds are suitable that can catalyze the hydrolysis and condensation of SiOR or SiOH groups to Si-O-Si bonds.

This includes:
- Acids such as butylphosphate or organic sulphonic acids
- Basic compounds
- Organometallic compounds

For heat-resistant paints and coatings, titanium compounds such as alkyl titanate (e.g. titanium(IV)-n-butoxide, CAS No. [5593-70-4] or its polymer form, CAS No. [9022-96-2]), and titanium chelates (e.g. titanium ethyl acetoacetate complexes, CAS No. [27858-32-8]), have proven to be particularly suitable.
The drying rate is dependent upon the type and amount of catalyst. This enables formulators to optimally adapt to the desired drying time. Some guide values can be seen in Figure 2. Excessive amounts of catalysts usually lead to more brittle films and poorer adhesion.

Compatibility

SILRES® MSE 100 is recommended as the preferred sole binder, as it is only compatible with a few binders.

Formulation

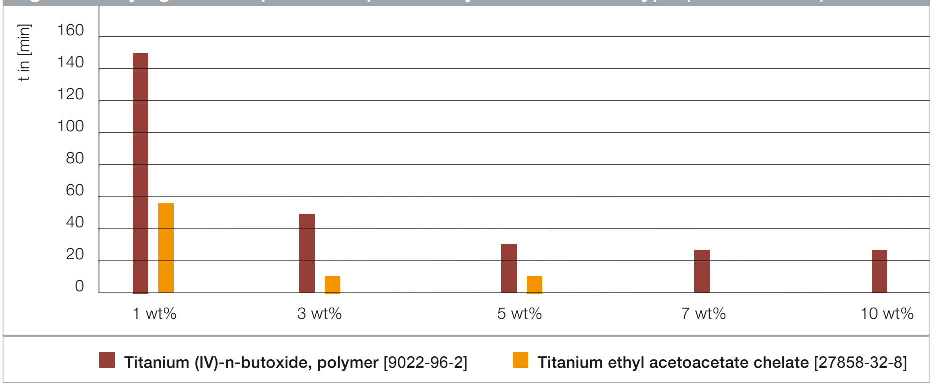
A formulation as a one-component system is possible if moisture is excluded. In this case, the storage stability of the finished formulation must be precisely examined, as the coating will contain additional constituents such as pigments and fillers.
Or, alternatively, the catalyst is mixed in just before application.
The highest resistance to heat – up to 650 °C – is provided by aluminum-pigmented coatings.
Different shades of color are also possible; an example for a black formulation can be seen on the right.

At a Glance:
The Advantages of SILRES® MSE 100

- Smoke-free baking
- Drying due to chemical reaction with humidity, with a catalyst present
- Drying speed adjustable by means of catalyst type and amount
- Low viscosity (20 – 35 mm²/s)
- Solvent-free (> 99% solids content)*
- Highly heat-resistant in pigmented formulations
- Higher inorganic content

* The solids content includes low-molecular resin constituents and condensable groups.

Figure 2: Drying Time Dependent Upon Catalyst Amount and Type (23 °C/50%rh)



Example: High-Temperature Coating, (Matt) Black	
SILRES® MSE 100	49.8 g
Talc (Extender)	26.9 g
Zinc phosphate (Anti-corrosive pigment)	3.0 g
Black pigment (Cu-Cr spinell type)	9.9 g
Thixotropic agent WACKER HDK® H13L paste (15% in xylene)	1.0 g
Disperse in a bead mill until required particle-size, then add	
SILRES® MSE 100	5.0 g
Titanium ethyl acetoacetate chelate	3.0 g
GENIOSIL® XL10	1.4 g
Immediately prior to application, thin coating with xylene to required viscosity (e.g. 6.25 g on 100 g)	

Coating Properties	
Viscosity (DIN 4 cup) [s]	23
Density [g/ml]	1.46
Tack-free after [min]	10 – 15
Pencil hardness after 7d at room temp.	9 H
Thermal stressing: from room temp. to 500 °C in 4 h, maintain at 500 °C for 2 h	OK, no damage
Cross-cut test/adhesion after thermal stressing	1 – 2
Layer thickness [µm] after thermal stressing	18
Shock test 5 x from 400 °C into cold tap water	OK

SILRES®

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