



技 術 資 料

Technical Information

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Application of ORGATIX as **Silicone Curing Catalysts**



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ORGATIX is the trade name for a range of organic metal compounds developed by Matsumoto Fine Chemical. ORGATIX catalysts are recognized as being suitable for various chemical reactions, and are particularly well suited for silicone compounds. They are used in a wide range of industries as catalysts for Si-OR and Si-OH condensation reactions.

1. Advantages

- High catalytic activity
- High level of safety
- Minimum effect on finished products (catalytic activity ceases after reaction)

2. Expected applications

- Silicate curing acceleration (sol-gel coating)
 - Hard-coat coating
 - Binder for weather-resistant paint
 - Binder for photocatalysts
- Sealant curing catalyst
 - One-component RTV silicone sealant (dealcoholized)
 - Two-component RTV silicone sealant (dealcoholized)
 - Modified silicone sealant

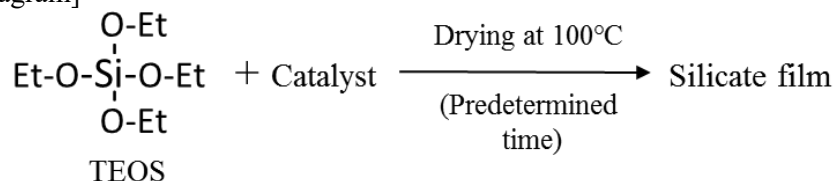
3. Recommended grades

Product name	ORGATIX TA-21	ORGATIX TA-80	ORGATIX TC-120	ORGATIX TC-750	ORGATIX ZC-200	ORGATIX AL-3100	ORGATIX AL-3215
Chemical name	Tetra n-butyltitanate (TBT)	Tetra tertiary butyltitanate (TTBT)	Titanium acetylacetonate	Ethylacetoacetate titanate	Zirconium 2-ethylhexanoate complex	Aluminium acetylacetonate	Ethylacetoacetate Alminate
Appearance	Pale yellow to yellow clear liquid	Pale yellow liquid	Reddish-brown liquid	Pale yellow to reddish-orange liquid*	Yellowish-brown liquid	White to pale yellow powder	Pale yellow solid
Content	more than 99%	more than 83%	53%	more than 95%	80%	more than 99%	more than 98%
Contained solvent	—	(TPT)	IPA and Acetylaceton	IPA	2-Ethyl-hexanoic acid	—	—
Metal content	14.1%	14.4%	7.0%	11.0%	12.4%	8.2%	6.5%
Flash point	40°C	15°C	15°C	29°C	87°C	Not available	Not available
UN No.	1993	1993	1992	1993	Not applicable	3467	?
Inventory	Japan	Registered	Registered	Registered	Registered	Registered	Registered
	USA						
	Korea						
	China						
	Taiwan						
Remarks		Make to order	Make to order	*Melt point: 28°C. May freeze during winter	Make to order	Make to order	Make to order

4. Catalyst performance for silicates (sol-gel coating)

4-1. Tetraethoxysilane monomer (TEOS):

[Reaction model diagram]



[Relation between catalyst and curing time when curing at 100°C]

Curing time (sec)	ORGATIX TA-21	ORGATIX TA-80	ORGATIX TC-120	ORGATIX TC-750	ORGATIX ZC-200	ORGATIX AL-3100	ORGATIX AL-3215
30	Good	Excellent	Bad	Bad	—	Bad	Bad
60	Excellent	Excellent	Bad	Good	—	Bad	Bad
120	Excellent	Excellent	Good	Excellent	—	Bad	Bad
300	Excellent	Excellent	Good	Excellent	—	Bad	Bad

[Test condition]

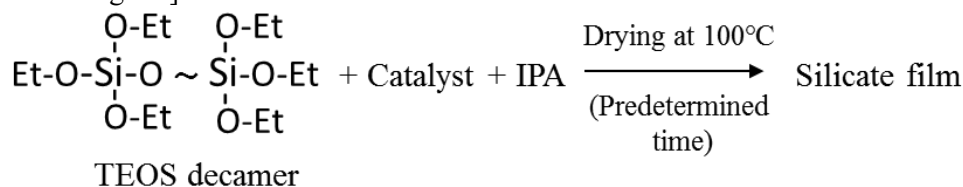
Amount added: TEOS monomer:catalyst = 100:5 (by weight)
 Substrate: Glass plate
 Coating: wire bar coater #4 (use undiluted solution)
 Drying: 100°C (circulating hot air dryer)

[Evaluation criteria]

Excellent: Good film appearance, film not stripped off after rubbing with fingers
 Good: Good film appearance, but film stripped off after rubbing with fingers
 Bad: Defective film appearance, no film formation
 —: No data

4-2. Tetraethoxysilane oligomer (TEOS decamer):

[Reaction model diagram]



[Relation between catalyst and curing time when curing at 100°C]

Curing time (sec)	ORGATIX TA-21	ORGATIX TA-80	ORGATIX TC-120	ORGATIX TC-750	ORGATIX ZC-200	ORGATIX AL-3100 *	ORGATIX AL-3215 *
30	Bad	Bad	Bad	Bad	—	Bad	Bad
60	Bad	Bad	Bad	Bad	—	Bad	Bad
120	Bad	Bad	Bad	Bad	—	Excellent	Excellent
300	Bad	Bad	Bad	Bad	—	Excellent	Excellent

*As this product is a solid, dissolve it with toluene before adding

[Test condition]

Amount added: TEOS decamer:catalyst = 100:5 (by weight)
 Substrate: Glass plate
 Coating: wire bar coater #4 (use undiluted solution)
 Drying: 100°C (circulating hot air dryer)

[Evaluation criteria]

Excellent: Good film appearance, film not stripped off after rubbing with fingers
 Good: Good film appearance, but film stripped off after rubbing with fingers
 Bad: Defective film appearance, no film formation
 —: No data

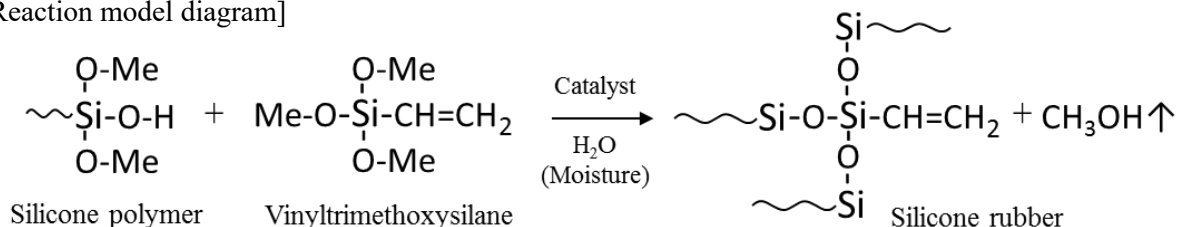
4-3. Caution

- The catalyst is susceptible to hydrolysis. Catalytic activity will be lost if you add water or solvents with a high moisture content. Adding water or inorganic acid is **not necessary** when ORGATIX is used as a silicate curing catalyst.

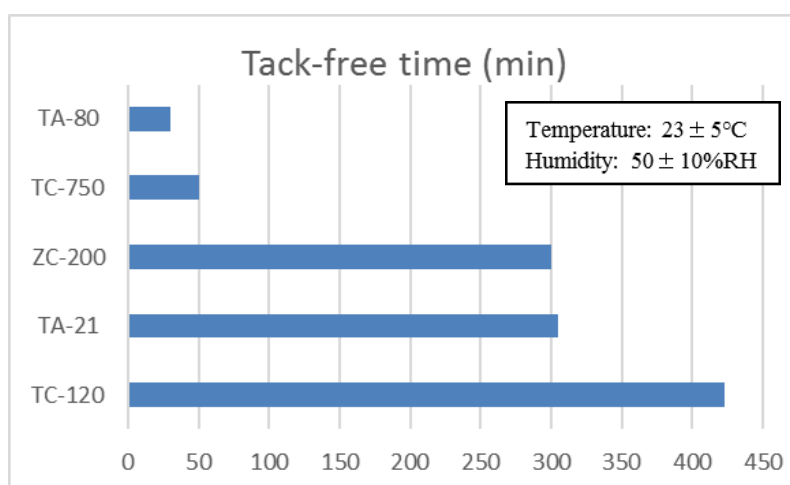
5. Catalyst performance for silicone sealants

5-1. Silicone polymer + cross-linking agent + catalyst (expected to use one-component RTV silicone sealant):

[Reaction model diagram]



[Comparison of curing performance (by product)]



[Resin appearance after curing (by product)]



[Recommended products]

General purpose → **ORGATIX TC-750**

Focus on curing speed and appearance → **ORGATIX TA-80**

[Test conditions]

○Formulation for comparison of curing performance

Materials used		Formulation by weight
Silicone polymer	Dimethylpolysiloxane containing a hydroxyl group at both terminals	100
Cross-linking agent	Vinyltrimethoxysilane	4
Catalyst	ORGATIX	2

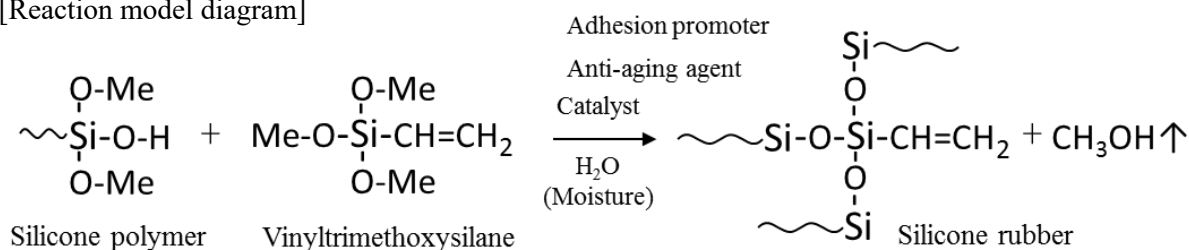
*Mixed for 15 seconds using a planetary centrifugal mixer

○Tack-free time test procedure

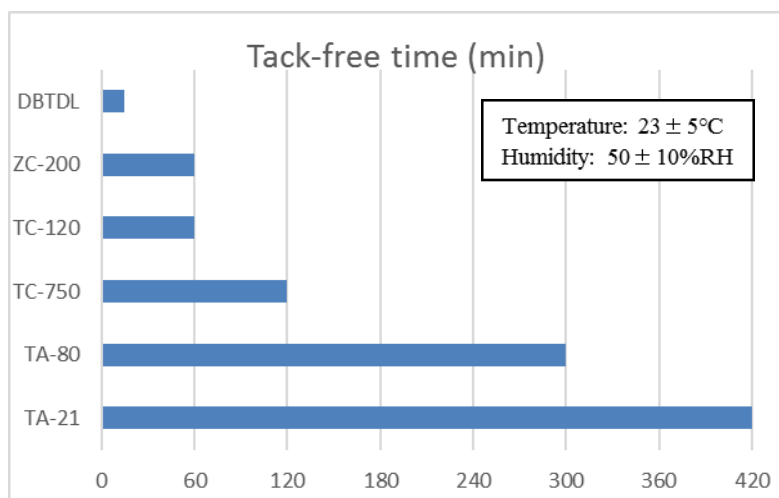
- 1) Prepare the formulation in accordance with the table above, and store it in a closed container at a temperature of 40°C for one day.
- 2) Leave the container with its lid open in an environment with a temperature of 23±5°C and a humidity of 50±10%RH.
- 3) Use a toothpick to touch the surface of the solution at specified time intervals, and note the time at which the solution ceases to stick to the tip of the toothpick as the tack-free time.

5-2. Silicone polymer + cross-linking agent + *adhesion promoter* + *anti-aging agent* + catalyst (expected to use two-component RTV silicone sealant and one-component modified silicone sealant):

[Reaction model diagram]

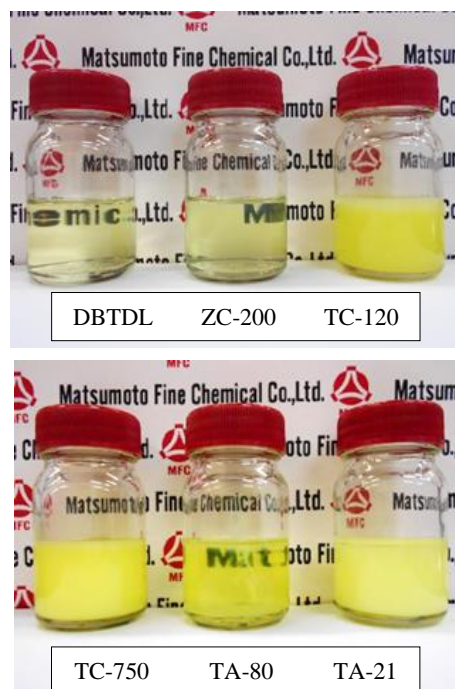


[Comparison of curing performance (by product)]



*DBTDL = Dibutyltin dilaurate

[Resin appearance after curing (by product)]



[Recommended products]

Focus on appearance and curing speed → **ORGATIX ZC-200**

Focus on price and curing speed → **ORGATIX TC-120**

[Testing conditions]

○Formulation for comparison of curing performance

Materials used		Formulation by weight
Silicone polymer	Dimethylpolysiloxane containing a hydroxyl group at both terminals	100
Anti-aging agent	2-(2-hydroxy-5-t-butylphenyl) benzotriazole	1
Cross-linking agent	Vinyltrimethoxysilane	2
Adhesion promoter	γ-aminoethyl-aminopropyl-trimethoxysilane	2
Catalyst	ORGATIX	2

*Mixed for 15 seconds using a planetary centrifugal mixer

○Tack-free time test procedure

Same as the procedures described on the previous page

5-3. Cautions when using the product as a sealant curing catalyst

○Recommended amount for addition

It is recommended to add ORGATIX at a rate of 1 to 3 wt% of the silicone polymer.

○Loss of catalytic activity

The ORGATIX product line is susceptible to hydrolysis, and loses catalytic activity when exposed to water. Using products without catalytic activity may cause insufficient curing of the sealant. Therefore, make sure dehydrated additives (such as fillers) are used as far as possible. Reducing water content within the overall product may help to extend the sealant's life (shelf life).

○Use with deoximated silicone

Combined use of deoximated silicone and ORGATIX may lead to reaction between free oximes and ORGATIX, resulting in a loss of catalytic activity and coloration. In principle, use with dealcoholized silicone is recommended.

○Use with addition curing silicone

The ORGATIX product line does not display catalytic activity for addition reaction, and is recommended for use in condensation reaction. However, ORGATIX products do not act as catalyst poisons in addition reactions, so they can be effective as adhesion promoters for addition curing silicone.

○Pseudo cross-link

Some ORGATIX products cause a rapid increase in viscosity immediately after being added to silicone polymer, and then the viscosity decreases after the silicone is left as-is for about a day. This is called the "pseudo cross-link," which is a phenomenon frequently seen when a terminal OH group is added to silicone polymer. Pseudo cross-links may be prevented by using terminal OR group polymers and limiting the types of ORGATIX used (ZC-200 and TC-120 are recommended).

6. Caution on use of ORGATIX

Make sure you read the SDS before using ORGATIX products because some of them may have corrosive or flammable properties.

The content included in this material is based on currently available data, and is for reference only. We do not provide any guarantee on the correctness of the information.

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