Cure inhibition or Poisoning of silicone

In this overview we explain in simple terms what poisoning of silicone means.

Addition-hardening silicone

Additive hardening silicones are also called platinum silicones.

Poisoning of platinum silicone is also called inhibition (cure inhibition).

Addition hardening silicones harden by polymerization. The short silicone molecules form long chains and cross-links. This network eventually gives a rubber silicone.

The denser the network, the harder and stiffer the silicone.

Platinum is needed as a catalyst for this process. This platinum is an expensive metal and is therefore always added as little as possible.

Platinum also reacts with other components, if that happens it may be that there is too little platinum left to allow the silicone to harden properly. This is reinforced by the fact that platinum is put very little in the silicone anyway because of the costs.

The result is that the silicone remains sticky or even liquid and that the silicone does not have the tensile strength and firmness that one would otherwise expect, because the network is not or not sufficiently formed.

Materials that react with platinum and thus poison the addition silicone are:

Sulfur:

- Sulfides and combinations thereof.

These are found in latex gloves. Therefore, please always check your glove. Most natural rubbers are also cured using these components so be ware of any rubber product you are copying or using in the mold.

Nitrogen:

- Amines and amides
- Nitriles and cyanate and combinations and variations hereoff

These are found in epoxies, lacquers and adhesives. If an epoxy or lacquer is 100% cured, this often does not hurt, but the chance that an epoxy or lacquer is not 100% cured is quite high.

Tin:

- Tin salts and similar

These are widely used in condensation silicone. Condensation silicones come in a 2 component variant, but also in 1 component variants. A very well-known form of condensation silicone is silicone sealant (for joints etc). We therefore do not recommend using such sealant or silicone in making your molds or casings for platinum silicone formation.

Phosphorus

- Phosphorus components (phosphine and phosphite)

Among other things used in the metal industry for corrosion protection. So not all metal is safe for silicone!

Arsenic, Antimony, Selenium, Tellurium

Some solvents

- Alcohols such as ethanol and methanol
- Esters such as ethyl acetate and vinyl acetate
- Some compounds with unsaturated compounds.

Primers

- Polyethylene with any of the above additives
- Primers with additives from the list above.
- Sodium salt primers
- Polyvinyl acetate or acrylic latex lacquers
- Coatings with calcium carbonate
- Coatings with natural rubber, styrene, or polyvinyl acetate

Condensation Silicone

The above does not apply to condensation curing silicone. These are silicones in which the catalyst is often a tin compound. These types of silicones almost always harden unless there is too little moisture in the air or in the system, or if the moisture is pulled out of the silicone as with very dry river clay.

Prevention/ dissolution of inhibition of addition hardening silicone

Prevent

The easiest way to prevent inhibition is to use materials and tools that do not contain any of these products. So pay attention to the adhesives and lacquers you use, the product of which the touring model you use and even your gloves. Smoking can also poison the silicone and sanding or grinding

epoxy or polyurethane products where dust lingers in the air for a longer period of time can also poison the silicone.

Harden

If you cannot avoid using one of these materials, we recommend that these materials harden very well (if necessary, let the products harden for several days, preferably at an elevated temperature). With UV curing epoxy, we recommend curing it excessively well with UV light and possibly treating it for extra curing.

There are post curing machines to make sure your resin print is fully cured and will not cause cure inhibition.

Sealing

Finally, you can also paint the product with, for example, polyvinyl alcohol (PVA). This seals the material so that the silicone does not come into contact with it. It is important that the closure is done 100% correctly.

Extra platinum

You can also choose to provide the silicone with extra platinum, or take a silicone with a higher % platinum.

Increase temperature

You can also choose to let the silicone with mold harden at an elevated temperature, if the model and the rest of the materials can handle this. The idea here is that the silicone hardens so quickly that the platinum has less time to react with contaminants. Unfortunately, this does not work in all cases

Prevention of inhibition of condensation hardening silicone

Sufficient moisture

Make sure there is enough water in the condensation silicone. You can add one layer of water per 200 Kg. Or you use a condensation silicone accelerator (this is basically a water emulsion)

Also, you can slightly dampen the model or the materials around it. For example, make sure that river clay does not dry out completely.

Also use enough silicone, a thin layer dries out faster on a dry surface than a thick layer of silicone.

Sufficient B component

Condensation curing silicones actually always harden when B component is added. A too small amount of B component can eventually slow down the curing very much and will also give a softer and less strong silicone. Please note, a large excess is also not good, because that makes the silicone too hard and will also shorten the lifespan of the mold.

Liability

Please note that this article does not contain all possible problems and is partly based on information from third parties. We cannot make any warranties based on this document.

This list has been compiled courtesy of Dow Corning: Guarding against potential inhibitors/ poisons of platinum-catalyzed addition-cure release coatings.