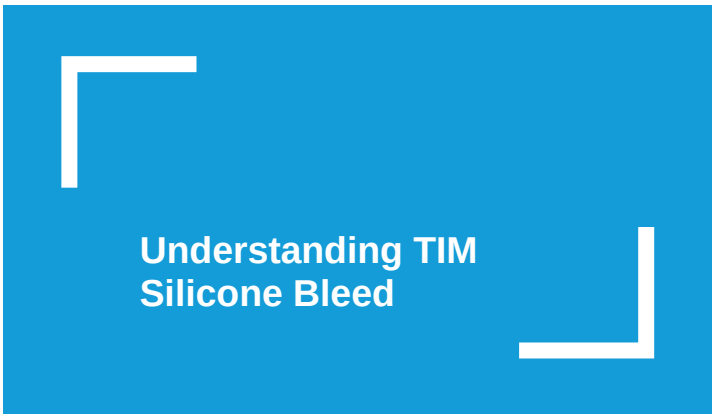
Silicone Bleed Application Note

What is silicone bleed?

The liquid residue seen under or around gap filler pads or dispensable materials is low molecular weight silicone fluid with viscosity in a range between 1,000 and 30,000 cps, with the highest concentration between 1,000 and 3,000 cps. This fluid is un-crosslinked and is therefore able to migrate within the TIM material and sometimes exit the thermal interface material (TIM). Silicone which remains in the TIM material or within the perimeter of the TIM is rarely an issue in application. This application will address silicone which migrates out of the TIM and onto other surfaces.



Is silicone bleed harmful to my components or system?

Silicone has been widely used in TIM materials for decades and is the single most common material used in TIM materials today. No other material can match silicone's softness, temperature resistance, and cost advantages. Silicone TIMs are the solutions of choice for most applications. Despite silicone's many positive attributes, designers should be aware of the following areas of concern.

- Silicone oil is non-corrosive and usually has no impact on components.
- Silicone oil is electrically isolating so it will not cause an electrical short.
- Silicone oil can prevent components such as mechanical relays or switches from making contact if it coats the contacting surfaces.
- Silicone oil will interfere with soldering during rework and should be cleaned off using a chemical solvent.
- Silicone oil will affect the adhesion of paint to surfaces and should be cleaned off prior to painting with a solvent.
- Silicone has a refractive index of 1.405 and can interfere with optics if it coats the glass.
- Silicone fluid has a dielectric constant of approximately 2.5 and can cause an impedance change on a transmission line which would slow down the signal. This is usually only an issue with data rates greater than 10 GHz.
- Silicone oil can cause aesthetic defects. The silicone oil can migrate onto a surface and cause a glossy appearance on the surface. In some cases, the oil traps dust on the surface.

- Laird Performance Materials, a DuPont business, has done extensive testing to evaluate the impact of silicone bleed on the sliding of TIMs in vertical applications. The testing has concluded that the bleeding itself is usually not the reason for sliding but may contribute in some cases.

Controlling silicone bleed

Silicone bleed is mostly a function of the TIM material and the pressure evidenced in the application. There is no standard test method for TIM bleed. However, most tests commonly used will compress the TIM material in a fixture for approximately 48 hours at an elevated temperature. The output of these tests is a weight loss of silicone oil that leaves the TIM material. Any comparison between two TIM materials should be converted to a volume percent. Weight percent can be used to compare multiple lots of the same TIM material.

- Selection of a TIM material that has a low volume percent bleed will usually minimize bleed in application.
- Avoiding uneven pressure in applications will minimize bleed. Silicone oil will migrate from high pressure to low pressure.
- Avoiding mechanical designs that result in non-uniform pressure will help reduce bleed. For example, when using the housing as the heat sink, Laird recommends avoiding holes where the TIM material will contact the case.

What does Laird Performance Materials warrantee?

Laird characterizes the bleed properties for its products and can provide data upon request. Laird maintains the highest quality standards to maintain strict compliance with values stated in its datasheets and other design parameters including bleed.

The best solution to a bleed problem is taking steps to avoid the occurrence of bleed in the first place. Laird has many years of experience across numerous applications. This experience can be tapped early. Designers can see the greatest benefit when Laird is involved at the design stage. Whenever customers are concerned about potential issues or experience them, Laird will make every effort to assist in root cause identification, aid correct the issue, and resolve it.