Industry Developments:

Thermal Gap Fillers

Thermally conductive gap filler materials are in wide use for cooling hot electronics. Initially available in sheets of different thicknesses, manufacturers and converters also provided custom die cuts and molded shapes. The demands for faster, high volume applications led to automatic dispensing of gap fillers onto heat spreading components. Today's gap fillers are typically soft, ceramic-filled silicone elastomers or films. They conform to the shape and surface texture of hot components and heat spreaders, filling in often-wide air gaps with a high thermal conductive pathway.

Fujipoly provides an array of thermal gap filler materials under the Sarcon brand name. Sarcon 50G-Hm is manufactured with a special low-tack top surface, allowing the thermal pad to adhere to either the target electrical component or opposing heat sink.

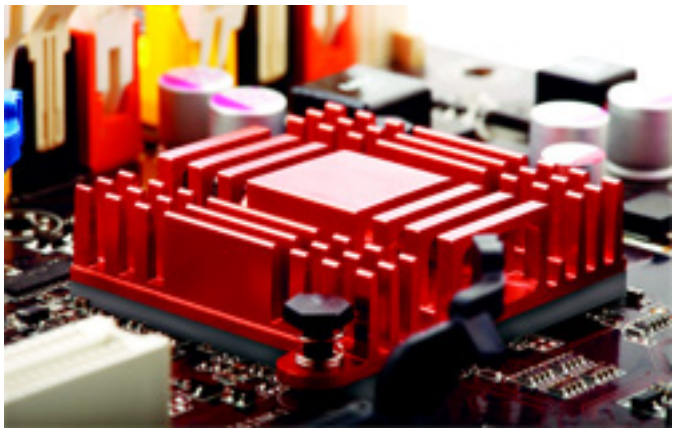

Figure 1. Thin Gap Filler Pads Can Be Used Between Hot Components and Their Heat Sinks. [1]

Sarcon's GR-SL material conforms to all gaps, peeks and air pockets, making a level, large surface area contact point in applications that include multi-band communications, GPS, video and high-speed processors. Sarcon GR-SL performs under extremely low compression, providing thermal conductivity of 2.7 W/m°K. Its thermal resistance is between 0.94 and 1.69°C-in^2/W depending on sheet thickness.

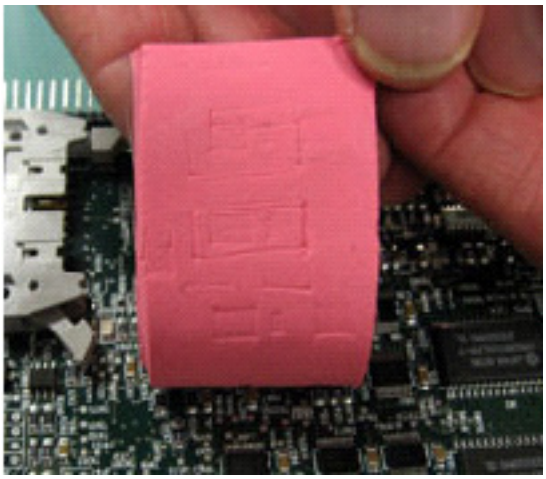

Figure 2. Ultra-Soft, Conformable Gap Fillers are Often Available with Foil or Fiberglass Backing for Added Strength. [2]

THERM-A-GAP gap-filler sheets and pads from Chomerics offer excellent thermal properties and the high conformability under low deflection forces. They have a natural high tack surface that reduces contact resistance, and for permanent attachment to the heat spreader surface. Chomerics can also add a high strength acrylic pressure sensitive adhesive.

Figure 3. Gap Filler Materials Can Provide Vibration Damping to Benefit Devices in Continuous Mobile or Mechanical Motion. [3]

Provided in the U.S. by MH&W, Kerafol 86/225 is a new single-layer fiberglass-reinforced Softtherm gap filler. It is produced in thicknesses from 0.5 to 5.0 mm and has good self-adhesive behavior on both sides. This film-based material provides very good dielectric properties. The film's Shore hardness guarantees very good compressibility and relaxation, along with vibration damping characteristics. The 86/225 gap filler is particulary suitable for heat pipes, automotive applications, control systems and control units.

Form in Place Thermal Gap Fillers

Form-in-place or cure-in-place thermal gap filler materials are applied as a liquid. This enables them to achieve an extremely thin bondline, which enhances thermal conductivity after the material cures. When the applied material first wets out, it conforms well even to rough surfaces. This enhances the elimination of tiny air pockets, improving thermal performance. This property is effective for highly miniaturized assemblies, such as automotive electronic control units (ECUs).

The optimum volume and shape of the dispensed material can be determined by experimenting with glass test components, which provide a clear view of surface coverage and bondline thickness.

Figure 4. An Online Video Demonstrating Thermal Gap Fillers Being Dispensed as Part of an Assembly Process with a PC Board. [4]

In practice, form-in-place gap fillers can provide better thermal performance than what is reported in material data sheets. And with form-in-place dispensing, any design changes to the position or types of components used can be accommodated quickly by changing the shape and volume of thermal material deposited. Automatic dispensing equipment can be re-programmed, avoiding any need to re-order gap-filler pads in different sizes or shapes.

The Bergquist Company now provides Gap Filler 1000SR, a two-component, room temperature cure, liquid-dispensable thermal interface material that features superior slump resistance. As dispensed, the material is designed to remain in place and maintain its shape on the target surface, allowing for ultimate flexibility in component

orientation during assembly. Gap Filler 1000SR is thixotropic and, although it will remain in place after dispensing, the material will flow easily under minimal pressure resulting in little to no stress on fragile components during assembly. As cured, this soft elastomer provides a thermal conductivity of 1.0 W/mK that is ideal for filling unique and intricate air voids and gaps.

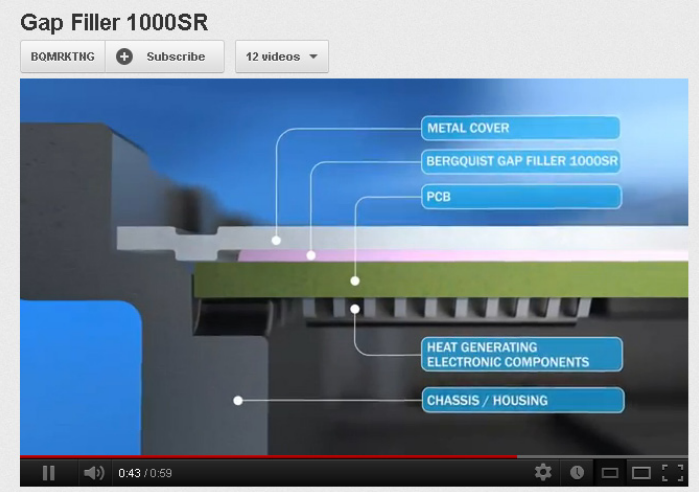

Figure 5. A Bergquist Video Showing a Typical Application for Its Gap Filler 1000SR Material. [5]

Unlike pre-cured gap filling materials, the liquid approach offers infinite thickness options and eliminates the need for specific pad thicknesses or die-cut shapes for individual applications. Gap Filler 1000SR is specifically designed with shear thinning characteristics to support optimized dispensing. It can be applied by hand or via automated dispensing. By applying precise amounts of material directly to surfaces material waste is kept to a minimum.

Putty in Your Hands

A unique gap filler material from Timtronics is referred to as thermally conductive dispensable putty. TIM-PUTTY is a 'Ultra Soft" and highly conformable paste-type gap filler. Its ultra-soft consistency helps ensure efficient heat transfer between delicate parts where minimum pressure can be tolerated. This form-in-Place gap filler can be applied at nearly any thickness. It is designed to provide a thermal solution for the recent trends of integrating higher frequency electronics into smaller devices.

Figure 6. A Thermally Conductive Putty-Type Gap Filler Material. [6]

TIM-PUTTY forms and adheres to most surfaces, shapes and sizes of components with very low compression force. It can be dispensed from cartridges or from a pail using a pneumatic dispenser. In a typical application, TIM-PUTTY is used to fill air gaps between components or PC boards and heat sinks, metal enclosures and chasses. It is ideal for applications where large gap tolerances are present due to steps, rough surfaces, and high stack-up. TIM-Putty materials allow the designer to be less concerned of CTE stresses during thermal cycling.

As will many thermal gap filler materials, non-silicone versions are also available to avoid silicone contaminations to delicate devices.

Conclusion

Many providers of thermal interface materials (TIMs) have a line of thermally conductive gap fillers. Specs can easily be compared for their stocked sheet materials, and samples are commonly made available for evaluations. Test material performance thoroughly and request references before investing in the time and tooling

for custom shapes, though these parts can provide superior cooling performance. Even eBay.com offers gap filler pads for enthusiasts, overclockers and those who want to do thermal studies before contacting a supplier's sales department.

For form-in-place gap fillers, most applicators will provide samples on your parts for evaluation. Many of these services can do multiple kinds of applications, including assembly, and application of weather sealing and EMI shielding.

References:

1. **Fujipoly.com, http://www.fujipoly.com/products/sarcon-thermal-management-components/88.html**

2. **Chomerics.com, http://www.chomerics.com/products/therm_gapfillers.htm**

3. **Mhw-intl.com, http://www.mhw-intl.com/products/thermal/**

4. **Sealant Equipment & Engineering, Inc., YouTube Video, http://www.youtube.com/watch?v=xNSwWLkMSSo**

5. **Bergquistcompany.com, YouTube Video, http://www.youtube.com watch?v=rNbAknN5vJI**

6. **Timtronics.com, http://www.timtronics.com/timputty.htm**