Technical Data Sheet

DOWSIL™ 1-4173 Thermally Conductive Adhesive

DOWSIL™ 1-4173 Thermally Conductive Adhesive is a one-part gray, flowable thermally conductive adhesive with high tensile strength

Features & Benefits

- Flowable
- Heat cure
- Good thermal conductivity values
- No added solvents
- No mixing of separate components required
- Rapid, versatile cure processing controlled by temperature
- Able to flow, fill or self-leveling after dispensing
- Heat flow away from PCB systems components can increase reliability

Composition

- Polydimethylsiloxane
- Aluminum Oxide

Applications

Suitable for:

- Bonding integrated circuit substrates
- Adhering lids and housings
- Base plate attach
- Heat sink attach, automated or manual dispensing

Typical Properties

Specification Writers: These values are not intended for use in preparing specifications.

Property	Unit	Result
One or two-part		One
Color		Gray
Viscosity	cP	61,000
	Pa-sec	61
Thixotropy	NA	3.9
Specific gravity (cured)		2.7
Thermal conductivity	btu/hr-ft-°F	1.04
	W/m-K	1.8

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Typical Properties (Cont.)

Property	Unit	Result
Heat Cure Time at 100°C	minutes	90
Heat Cure Time at 125°C	minutes	30
Heat Cure Time at 150°C	minutes	20
Durometer Shore A		92
Unprimed Adhesion - Lap Shear (Al)	psi	650
	MPa	4.5
	N/cm^2	450
Linear CTE (by TMA)	ppm/°C	125
UL Flammability Classification	NA	UL 94-V0
Impurity (Cl-)	ppm	16
Impurity (Na+)	ppm	43

Description

The heat-cure, thermally conductive adhesives produce no by-products in the cure process, allowing their use in deep section and complete confinement. These adhesives will develop good, primerless adhesion to a variety of common substrates including metals, ceramics, epoxy laminate boards, reactive materials and filled plastics. Long-term, reliable protection of sensitive circuits and components is important in many of today's delicate and demanding PCB system applications. With the increase in processing power and the trend toward smaller, more compact PCB system modules, the need for thermal management is growing. Thermally conductive silicones function as heat transfer media, durable dielectric insulation, barriers against environmental contaminants and as stress-relieving shock and vibration absorbers over a wide temperature and humidity range. In addition to sustaining their physical and electrical properties over a broad range of operating conditions, silicones are resistant to ozone and ultraviolet degradation and have good chemical stability. Good heat transfer is dependent on a good interface between the heat producing device and the heat transfer media. Silicones have a low surface tension that enables them to wet most surfaces, which can lower the thermal contact resistance between the substrate and the material.

Substrate Testing

To ensure maximum bond strength for adhesives on a particular substrate, 100 percent cohesive failure of the adhesive in a lap shear or similar adhesive strength test is needed. This ensures compatibility of the adhesive with the substrate being considered. Also, this test can be used to determine minimum cure time or to detect the presence of surface contaminants such as mold release agents, oils, greases and oxide films.

Processing/Curing

Addition-cure silicones should be cured at 100°C (212°F) or above the cure rate is rapidly accelerated with heat (see heat-cure times in Typical Properties table). For thicker sections, a pre-cure at 70°C (158°F) may be necessary to reduce voids in the elastomer Length of pre-cure will depend on section thickness and confinement of adhesive. It is recommended that 30 minutes at 70°C (158°F) be used as a starting point for determining necessary pre-cure time. Addition-curing materials contain all the ingredients needed for cure with no by-products from the cure mechanism. Deep-section or confined cures are possible. Cure progresses evenly throughout the material. These products generally have long working times.

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Adhesion

Dow silicone adhesives are specially formulated to provide unprimed adhesion to many reactive metals, ceramics and glass, as well as to selected laminates, resins and plastics. However, good adhesion cannot be expected on non-reactive metal substrates or non-reactive plastic surfaces such as Teflon, polyethylene or polypropylene. Special surface treatments such as chemical etching or plasma treatment can sometimes provide a reactive surface and promote adhesion to these types of substrates. Dow primers can be used to increase the chemical activity on difficult substrates. For best results, the primer should be applied in a very thin, uniform coating and then wiped off after application. After application, primers should be thoroughly cured prior to application of the silicone elastomer. Poor adhesion can be experienced on plastic or rubber substrates that are highly plasticized, since the mobile plasticizers act as release agents. Small-scale laboratory evaluation of all substrates is recommended before production trials are made. In general, increasing the cure temperature and/or cure time will improve the ultimate adhesion.

Useful Temperature Ranges

For most uses, silicone adhesives should be operational over a temperature range of -45 to 200°C (-49 to 392°F) for long periods of time. However, at both the low and high temperature ends of the spectrum, behavior of the materials and performance in particular applications can become more complex and require additional considerations. For low-temperature performance, thermal cycling to conditions such as -55°C (-67°F) may be possible, for most products, but performance should be verified for your parts or assemblies. Factors that may influence performance are configuration and stress sensitivity of components, cooling rates and hold times, and prior temperature history. At the high-temperature end, the durability of the cured silicone is time and temperature dependent. As expected, the higher the temperature, the shorter the time the material will remain useable.

Solvent Exposure

Although highly filled silicones such as those discussed in this data sheet are generally more resistant to solvent or fuel exposure, standard silicones are intended only to survive splash or intermittent exposures. Testing should be done to confirm performance of the adhesives in the application and under the specified environmental conditions.

Handling Precautions

PRODUCT SAFETY INFORMATION REQUIRED FOR SAFE USE IS NOT INCLUDED IN THIS DOCUMENT. BEFORE HANDLING, READ PRODUCT AND SAFETY DATA SHEETS AND CONTAINER LABELS FOR SAFE USE, PHYSICAL AND HEALTH HAZARD INFORMATION. THE SAFETY DATA SHEET IS AVAILABLE ON THE DOW WEBSITE AT CONSUMER.DOW.COM, OR FROM YOUR DOW SALES APPLICATION ENGINEER, OR DISTRIBUTOR, OR BY CALLING DOW CUSTOMER SERVICE.

Usable Life and Storage

Shelf life is indicated by the “Use By” date found on the product label. For best results, Dow thermally conductive materials should be stored at or below the maximum specified storage temperature. Special precautions must be taken to prevent moisture from contacting these materials. Containers should be kept tightly closed and head or air space minimized. Partially filled containers should be purged with dry air or other gases, such as nitrogen. Any special storage and handling instructions will be printed on the product containers.

Limitations

This product is neither tested nor represented as suitable for medical or pharmaceutical uses.

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Health And Environmental Information

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