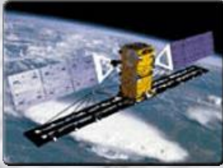
MICROCOAT TECHNOLOGIES



Prosper, Texas, Cheshire, CT, Research Triangle Park, NC USA
http://www.m-coat.com

MicroCoat Technologies, a coatings, and adhesives development company was formed in 1996 by Sam Forman a veteran of over 60 years in polymer and thick film materials. He is a Founding and Charter Member, Fellow of the Society and Life Member of IMAPS, and also the recipient of the IMAPS Lifetime Achievement and Daniel C. Hughes awards.

The Company specializes in advanced conductive, non-conductive, and UV cure adhesives and coatings formulations for the electronics, microelectronics, and semiconductor industries that supply products to the Aerospace, Defense, Medical, Opto-electronics, Telecommunications, Down-hole, and also the commercial sector of assemblies. With over 150 combined years of polymer expertise, MicroCoat has developed unquestionably the finest fine-line no-bleed conductive adhesives and "sintered' silver adhesives with a TC of >150W/mK. Our non-conductive sealing adhesives have passed ***MSL1*** testing for many companies. The Company ships several thousand syringes each month of conductive and non-conductive die attach adhesives, globtop, dam, and fill formulations for semiconductor assemblies and MCM's worldwide. MicroCoat's "B" staged conductive and non-conductive films and liquids are used extensively for both die attach and package sealing.

Epoxy Ring Bleedout Issues Solved

With substrate real estate shrinking to *"I can barely see it"* dimensions, die placement very close to active wirebond areas was a major issue as pretty much all available adhesives had epoxy ring runout of as much 300-500um. Wirebonding down from a die or to a die with lines and wire placement as close as 250um is now pretty much standard. MicroCoat Technologies has developed their MiniDot technology with <50um bleed-out for conductive and non-conductive die-attach adhesives as the adhesives of choice for very small die, micro BGA's, MCM, etc. placement/attachment.

Our library of over 3000 UV cure coatings is specifically formulated for the PCB Assembly/SMT, Medical, and Optoelectronics industries. MicroCoat UV cure or UV/Heat cure, globtops, dams, and fills are filled or unfilled. MicroCoat satisfies the most stringent of adhesives requirements.

Contact Information;

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MicroCoat Technologies, LLC

Formulating & Packaging
UV Cure Products
Cheshire, CT
6500 Sq. ft.

Employees:
~23-28
1 Ph.D/Sc.D
2 Ph.D
1 MS Chem Eng
3 Ch.E.

Formulating & Packaging
Conductive & Non-conductive
Research Triangle Park, NC
12K sq. ft.

All facilities ISO 9001/2015

R&D & Syringe Filling
Conductive & Non-Conductive
Industrial Drive McKinney, TX
4500 Sq ft

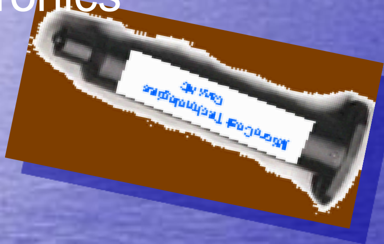
MCT closed 2021 at US$3.90M and will close 2022 at a realistic target of US$5.85M

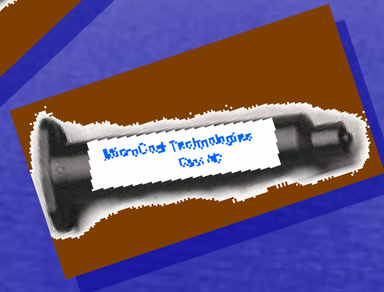
Just like an old friend, we can do it all

Military

Microelectronics

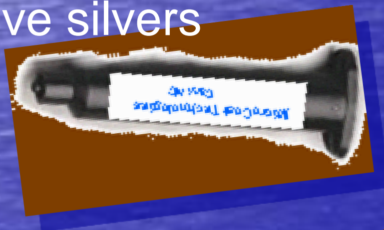
Electronics





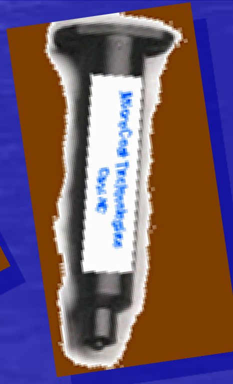
Medical

Conductive silvers



Encapsulants

Optically clear



Glass Bonders

Conformal coatings

Optically Clear Glob Tops for IC's, LED's, EPROMS, Etc.

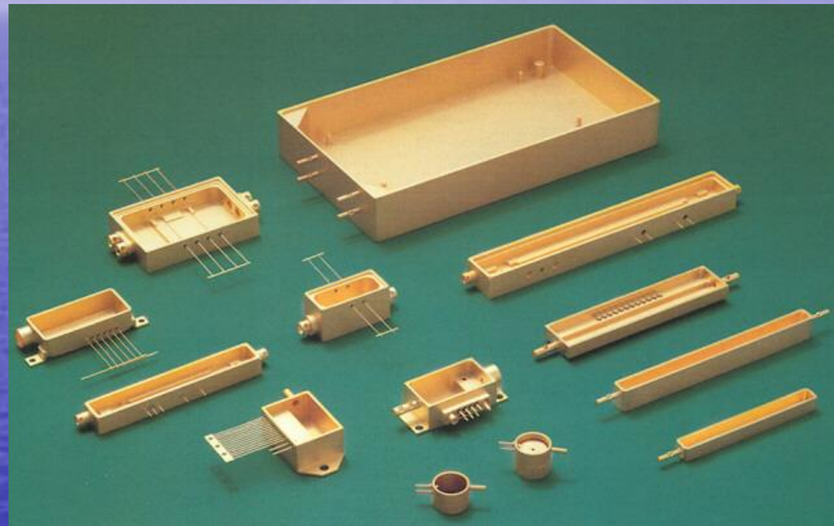
Without Silicone!!!

- Refractive Index 1.65 - 1.71!!!!!
- Transmissivity @ 990nm 99%
- R-I 1.7 @ 850 nm
- Operating Temperature Range of -55C to +150C

UV Curable in < 20 seconds !

Optically Clear UV Cured Photo-Cell & Optical Sensor Coatings

Optically Clear Coatings and Adhesives for;



Picture of Sinclair Manuf. Packages

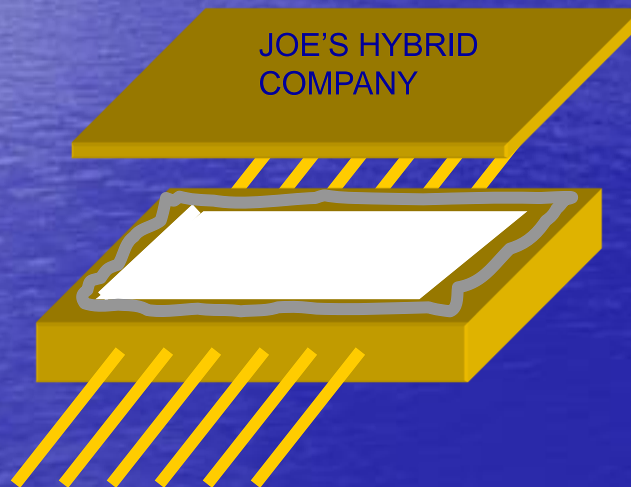
- WADM Modules
- Modulators
- Attenuators
- Pump Lasers
- Switches
- Amplifiers

Epoxy Sealing of Hybrids and Power Devices

Non-conductive adhesives for lid sealing, die attach, etc.

Passes gross leak, temp cycle, temp shock.

Withstands die attach to >340C



MCT 3417
Hi Temp Sealing
Passes 340C Die Attach 5 minutes
Passes 350 Cycles -65C- +150C
Passes 85/85
Passes Gross Leak

MicroCoat Technologies

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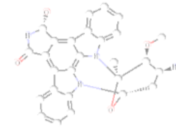
Unparalleled in Polymer Coatings and Adhesives Technology TM



Product Data Sheet

MicroCoat 3417-HT3

A Single Component, Toughened, Microelectronic Grade Package Sealant with a Service Temperature of <-65°C to Over >340°C and Meets NASA Low Outgassing Specifications

MicroCoat 3417-HT3 features a unique blend of performance properties including both high shear and peel strengths along with convenient handling and high/low temp properties. This is a one component system formulated to cure at elevated temperatures.
3417-HT3 has a number of outstanding processing advantages;

- No mixing is necessary prior to use
- This material is ***not*** "Pre-mixed and Frozen"
- The viscosity remains constant with time (i.e. it will not thicken over time)
- Working life is unlimited at room temperature, and the material is room temperature storable
- No cleanup required in-between shifts

MicroCoat 3417-HT3 forms high strength bonds for service over the remarkably wide temperature range of <-65°C to over 300°C and is used for Microelectronic Package Sealing for Kovar/Ceramic, Ceramic/Ceramic, Ceramic/Thick Film Gold, Pd/Au, Pt/Pd/Au, etc sealing. As a toughened system, 3417-HT3 offers superior resistance to impact, thermal shock, vibration and stress fatigue cracking. It is 100% reactive and does not contain any diluents or solvents. Used in several "down-the-hole" environments at >2K meters.

3417-HT3 is remarkably resistant to severe thermal cycling and many chemicals including water, oil, fuels and most organic solvents even upon prolonged exposures. Adhesion to metals, glass, and ceramics is excellent. The cured epoxy is a superior electrical insulator and is colored is tan. MicroCoat Polymer System 3417-HT3 high performance coupled with its convenient handling make it widely used in a variety of applications in the aerospace, electronic, microelectronics, electrical, automotive and chemical industries. MicroCoat 3417-HT3 will meet NASA low outgassing specifications.
For substrate attach to heatsink a 3 mil minimum bondline is suggested

Product Advantages

- A single component system; no mixing required prior to use, no viscosity changes over time.
- Room temperature storable; not premixed and frozen!
- Versatile cure schedules.
- High shear and peel strength to similar and dissimilar substrates over the remarkably wide temperature range of -65°C – 340°C. (Note: Color changes to slightly amber >300°C)
- Passes Gross Leak – Seal Integrity - Mil-Std-883 Method 5005 Sub Group 3 Mil-Std-883 1014 2) Gross Leak Test
- Passes Gross Leak after 500 cycles -65°C to +150°C
- Good electrical insulating properties and chemical resistance.
- Superior thermal shock, impact and stress cracking fatigue resistance,
- Will meet NASA low outgassing per ASTM E-595, NASA MSFC 1443, Mil-Std-883 5011.4 (3.8.6)
- RoHS Compliant

Conductive, Non-Conductive, and Thermally Conductive Die Attach Adhesives

In electronics, thermal management is crucial in both the design of circuit-board assemblies and in the production of semiconductor materials. For PC boards a crucial aspect can be the heating or cooling power required to keep a circuit within its specified operating temperature range.
In the manufacturing of silicon wafers it is important to maintain a very uniform temperature distribution across the wafer in order to achieve quality production processes and high yields.

Al_2O_3

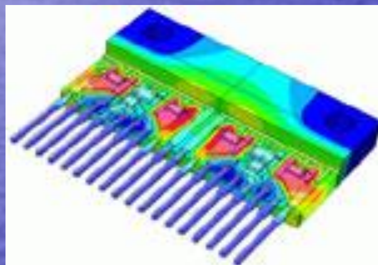
AlN

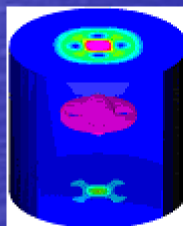
BoN

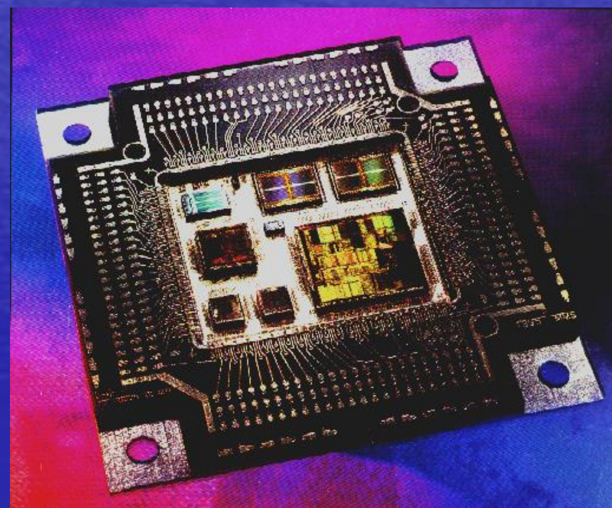
Diamond

Cu

Ag





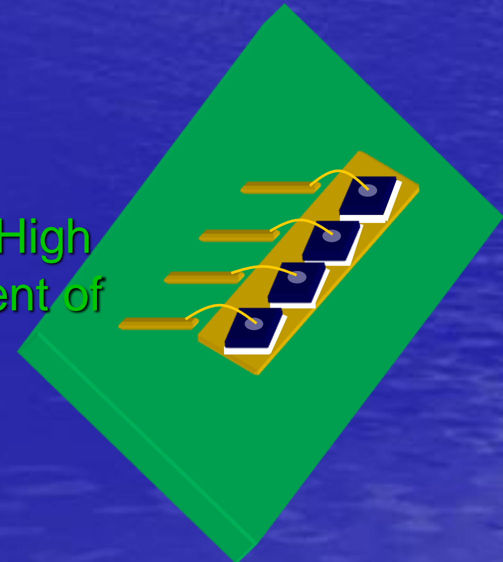


Conductive Adhesives

- SMD Attach To PCB and Ceramic
- Screen Printing Traces
- Die Attach
- Solder Replacement
- Flex Silver Traces
- Flex Carbon Traces
- Anti-Static
- Chip Component Termination
- Tantalum Capacitor Termination
- Static Discharge
- Platable For SMD Components
- Quick-Set PCB Repair
- Bio-Sensors
- Silver Spray-On

Low Outgassing Die Attach Adhesives

UV/Heat Cure for High Accuracy Placement of Opto Devices



Conductive Die Attach Adhesive MCT SD0802-31

A Military and Medical Microelectronic Devices die attach adhesive, MicroCoat 0802-31 **is** a 100% solids one part conductive thermosetting conductive epoxy designed primarily for die attaching large or very small die with mismatched thermal expansions in Military, Medical, "down-the-hole" hybrids, optoelectronics, automotive sensors, etc. A "Sister" formulation to MCT's 2-0404/33 this material is a thixotropic paste which may be applied by stencil printing or syringe. It is 100% solids, and posses' good handling and storage properties. This silver-filled conductive die attach adhesive is designed to bond ICs and components to advanced substrates such as ceramic, PBGAs, CSPs, LCP, and array packages with *virtually no bleed*. Hydrophobic and stable at high temperatures, the adhesive produces a void-free bond line with excellent interfacial adhesion strength to a wide variety of organic and metal surfaces including solder mask, BT, FR4, LCP, polyimide, gold, Kapton and Mylar. This material is formulated to provide high cohesive energy, adhesive strength, *stress absorbing for large die*, and elongation at break.

Short term at >300°C (2-3 minutes for Pb free reflow) if cured at 150°C for 60 minutes

Extremely High Temp Die Attach Adhesive for Down Hole or High Power LED's

MCT 34-DH19

VERY HIGH TEMPERATURE ELECTRICALLY CONDUCTIVE ADHESIVE

Tg >300C

Down-hole geothermal instrumentation must operate over a large temperature range. The technology and capabilities of room temperature to 300°C hybrid and printed-circuit (PC) board electronics had to be developed. MicroCoat's conductive and non-conductive Polyimide adhesives meet that challenge.

DESCRIPTION: MCT 34-DH19 is an electrically conductive adhesive suitable for application by screen printing, dipping, and syringe dispensing and designed with high-temperature applications in mind.

(National Energy Tech Lab) Sensors and electronics systems are key components in measurement-while-drilling (MWD) equipment. Examples of sensors and electronics that can directly impact the efficiency of drilling guidance systems can include gamma-ray and neutron sensors, orientation modules, pressure sensors, and all of the associated signal conditioning and computational electronics. As drilling depths increase, more rigorous temperature demands are made on the electronic components in the drill string. Current sensor systems for MWD applications are limited by the temperature rating of their electronics, with a typical upper-end temperature rating of 175ºC (~350ºF). The lifetime of an electronics system at such temperatures is extremely short (600-1500 hrs). These limitations are driven by the temperature performance and reliability of the materials in the electronic components (active and passive devices) and their associated packages and interconnect methods.

Unlike conventional conductive materials, this product features a unique high continuous operation temperature and very high glass transition temperature making it especially well-suited for extreme conditions found near a furnace, heater, and for aerospace and down-hole applications. This product features excellent adhesion to a wide range of substrates such as Kapton, Mylar, ITO sputtered surfaces, glass, Al_2O_3, and a variety of other surfaces without the addition of treatment via acid or plasma etch. This product is very resistant to flexing and creasing and is suitable for very fine lines and spaces. Some applications for MCT 34-DH19 include, but are not limited to, EMI/RFI shielding of polyimide flexible circuits, polymer thick film circuitry, and membrane switches.

NASA MIL SPEC
Low Outgassing

Conductive Die Attach Adhesive MCT SD0802-31 vs 84-1

Composition Properties	**SD0802-31**	**Ablestik/Loctite 84-1**
Filler Contents:	85% Silver	80-83%
Viscosity:	25-35 K cps @ 10 RPM	30K
Thixo Ratio at above viscosity parameters	3.80	4.0
Average Particle Size:	<.70 – 1.25 microns	2.4 – 4.1 microns
Typical Cured Properties[2] at Minimum Bond Line of 32 Microns		
**Volume Resistivity:	<0.00055 Ω-cm	.0005 Ω-cm
**Thermal (Interfacial) Conductivity	2.67 W/mK	1.9-2.2
** T_g °C	190	103
CTE Below Tg ppm°C	62	55
Above Tg ppm°C	160	150
Die Shear Kg (150C 1 hour cure)	>19.7 @ RT	19
Die Shear Kg (150C 1 hour cure)	>14.46 after 200C	
Die Shear Kg (150C 1 hour cure)	>13.86 after 280C	
Shore "D" Hardness	75 – 80	80-85
**Post Cure Ionics 883/5011.3.8.7	Cl-=<6ppm, Na+=<3.3ppm, K+=<1.1ppm	Cl-<20, Na+<20K+ <10
Modulus:		
@65C =	5595 MPa	
@25C =	5510 MPa	
@150C =	925 MPa	
@250C =	310 Mpa	
**Bleedout	Never!	Many times
**Re-freeze Syringes	Yes	No
**Tends to settle in Syringe	No	Yes

MicroCoat 36190 SERIES

A Single Component, Toughened, Microelectronic Grade non-Conductive Die Attach Adhesive with a Service Temperature of <-65ºC to Over >340°C and Meets NASA Low Outgassing Specifications

The 36190 is a die attach adhesive that features a unique blend of high performance properties including both high shear and peel strengths along with convenient handling and high/low temp properties. This is a one component system formulated to cure at elevated temperatures. 36190 has a number of outstanding processing advantages;

No mixing is necessary prior to use

This material is ***not*** "Pre-mixed and Frozen"

The viscosity remains constant with time (i.e. it will not thicken over time)

Working life is unlimited at room temperature, and the material is room temperature storable

No cleanup required in-between shifts

MicroCoat 36190 forms high strength bonds for service over the remarkably wide temperature range of <-65ºC to over 300°C and is used for die attach on virtually any substrate material. As a toughened system, 36190 offers superior resistance to impact, thermal shock, vibration and stress fatigue cracking. It is 100% reactive and does not contain any diluents or solvents and may be used in "down-hole" environments at >2K meters.

Conductive Flexible Adhesive 22-102-32

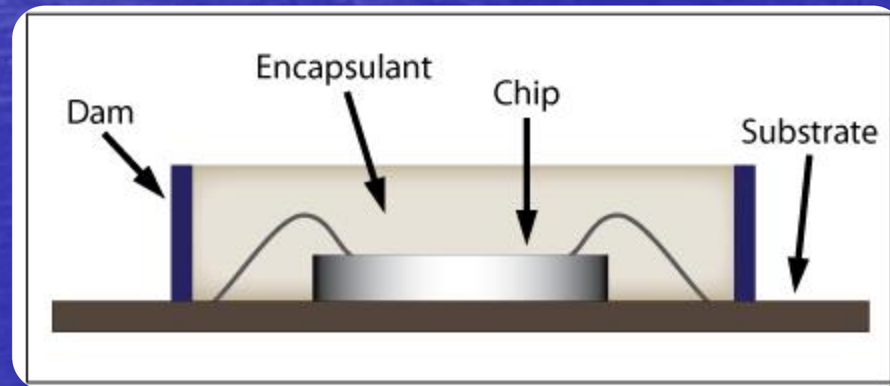
FLEXIBLE, HIGH TEMPERATURE, ELECTRICALLY CONDUCTIVE ADHESIVE

22-102-32 is a flexible, electrically conductive, silicone pressure sensitive adhesive. The overall balance of peel strength, cohesion, lap shear strength and high temperature holding power provides a versatility that makes this product useful in a wide range of fastening and bonding applications. This product is very resistant to flexing and creasing. Some applications for 22-102-32 include, but are not limited to, EMI/RFI shielding of polyimide flexible circuits, polymer thick film circuitry, gaskets, and electrical attachments for stress sensitive devices. 22-102-32 is one of the few conductive adhesives that can bond to silicone substrates and surfaces. In addition, it can be bonded to some types of Teflon® surfaces and clean aluminum and stainless steel as well.

MCT- GTH5088/94

A THERMALLY CURED, *NON-FROZEN* EPOXY GLOB TOP DAM FILL FOR SEMICONDUCTOR DEVICES

DESCRIPTION: MCT GTH5088/94 is a one component, heat cure, fast curing, low stress, glob top prepared for >45Ghz applications. The material features *exceptional* resistance to thermal cycling and is primarily used for encapsulating of dissimilar materials such as devices on ceramic substrates to LCP, metal, or ceramic packages. The glob top is designed to work from -50C to 185C and will withstand short term high temperature excursions for lead free soldering at 240°C.



- **MCT 341107P**

  A Single Component NON Solvent Bearing, NON Frozen Polyimide Glob Top with a Service Temperature of <-65ºC to Over >340°C and Meets NASA Low Outgassing Specifications

  MicroCoat MCT 341107P features a unique blend of performance properties including both high shear and peel strengths along with convenient handling and high/low temp properties. This is a one component system formulated to cure at elevated temperatures.

  341014HTGT has a number of outstanding processing advantages;
  No mixing is necessary prior to use
  NO VOC's!
  This material is ***not*** "Pre-mixed and Frozen"
  The viscosity remains constant with time (i.e. it will not thicken over time)
  Working life is unlimited at room temperature, and the material is room temperature storable
  No cleanup required in-between shifts

We ARE 3D ™

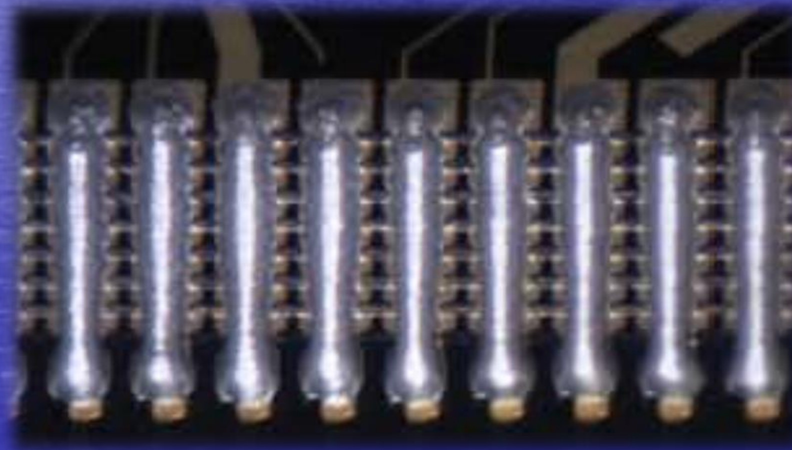


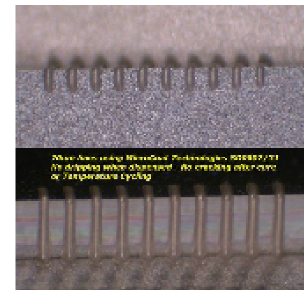
*Photo courtesy of Vertical Circuits, Inc.

Application Note:

10, May 2013

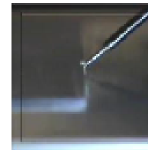
GPD Global Vertical Interconnects with MicroShot Dispensing and MicroCoat Technologies

The push for size reduction is reaching the segment of vertical interconnects. Current technology has a lower limit of approximately 0.150mm (0.006") with pump and materials being the limiting factor. GPD Global through cooperation with MicroCoat Technologies have developed a process to dispense vertical interconnects at line widths from 0.075 to 0.100 mm. A combination of fluid formulation and pump development has resulted in the ability to dispense these line widths.



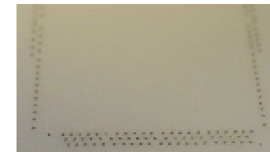
Dispensing vertically requires precise control of the dispensing tip. Angling the nozzle towards the product ensures strong tacking of the fluid to the stack. Precise alignment of the dispense tip through calibration and vision algorithms ensures consistent results. The resultant lines were 75 to 100 micron in width and were achieved with a 50micron nozzle.

MicroCoat SD0802/31 with ultra-pure formulation and particle size
Vertically dispensed lines
Silicon height –
0.5mm Line
width –
0.85mm
Line Rate – 1,900 lines per hour



Notice the uniformity of line width and uniform starts and ends. GPD Global pump technology eliminates "snake heads" that are common with other technologies.

Dot dispensing is also optimized with exceptional control of small volumes using the same MicroCoat material. Dot sizes of 75micron are achievable. The MicroDot Technologies fluid exhibits exceptional properties that allow the fluid to break cleanly from the nozzle tip. For these small volumes dot rates are in excess of 10,000 dph.



Deposits are formed by filling a metering chamber then evacuating the chamber with a piston of adjustable stroke. Because a chamber is filled and evacuated, the volumetric repeatability is exceptional. The chamber size is controlled by the size of nozzle and metering rod. These two parts are matched to achieve a dot size. Lines are formed by dispensing a series of dots close to each other that will stitch together. A wide range of dot sizes can be achieved by doing multiple shots in one location.

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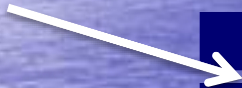
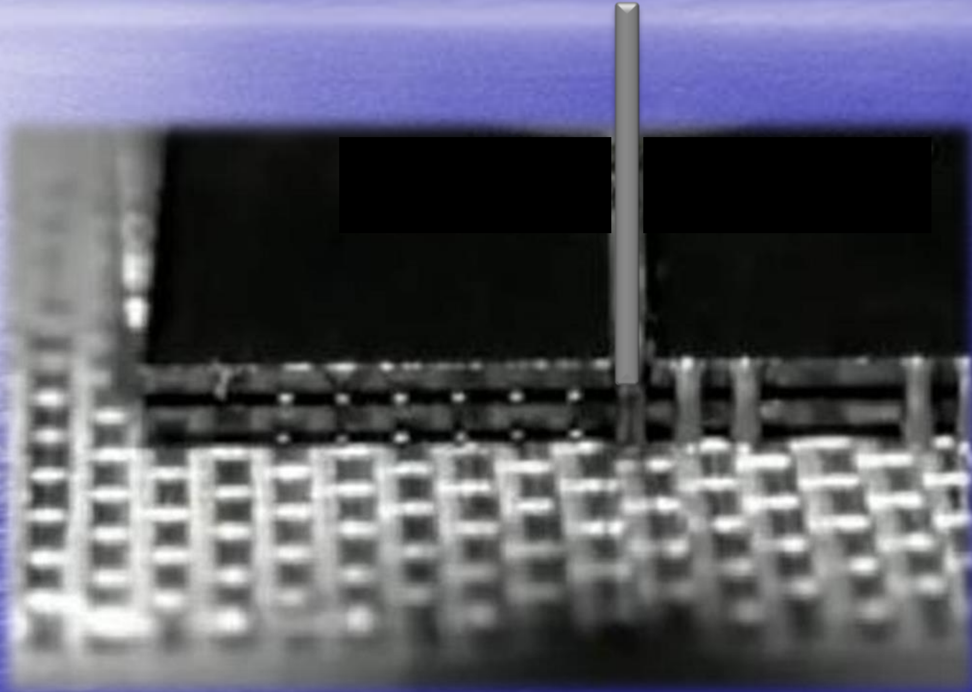
16 Layer Stacked Die With SD0802C



MicroCoat SD0802C
Dispensing Die Stacking Conductive Adhesive



MicroCoat Technologies

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Unparalleled in Polymer Coatings and Adhesives Technology TM

PRODUCT DATA SPECIFICATION

MCT SD0802C

A High Performance

Single Component, Refrigerated, High Thermal Conductivity, Very Low Resistivity

Conductive Epoxy for Inter-Connecting Silicon Stacked Die Layers

MicroCoat Technologies announces the arrival of their new low resistivity – high thermal conductivity die-stacking interconnect conductive adhesive MCT SD0802C. Many companies that are manufacturing stacked flash devices have gone to very fine line dispensed conductive adhesive instead of wirebonding to make the connections from layer to layer. MCT has developed a magnificent solution. It can be a dispensed bead or using high speed jet dispensing of conductive adhesive, the material can be applied at 50 microns wide with no sag or slump to 16+ flash layers (tested to date) with a *4 day room temperature working life*. Besides the cost and space savings compared to wirebonding the conductive paths provide an ground-breaking method for helping to cool the device(s) with the high thermal conductivity of the epoxy acting as cooling fins. *It is shown that a 32MB 3D stacked DRAM cache can reduce the cycles per memory access of a twothreaded RMS benchmark on average by 13% and as much as 55% while increasing the peak temperature by a negligible 0.08ºC. Off-die BW and power are also reduced by 66% on average. It is also shown that a 3D floorplan of a high performance microprocessor can simultaneously reduce power 15% and increase performance 15% with a small 14ºC increase in peak temperature. Voltage scaling can reach neutral thermals with a simultaneous 34% power reduction and 8% performance improvement. Bryan Black, et al, Intel Corporation.*
This adhesive is a thixotropic silver filled conductive non-frozen adhesive capable of dispensed line widths of 50 microns. It is 100% solids, and posses' good handling and storage properties. This silver-filled conductive adhesive is designed to bond from IC to IC on Silicon with either gold or aluminum pads. It also bonds ICs and components to advanced substrates such as ceramic, PBGAs, CSPs and array packages with virtually no bleed. Hydrophobic and stable at high temperatures, the adhesive produces a void-free line with excellent interfacial adhesion strength. This material is formulated to provide high cohesive energy, adhesive strength, and elongation at break. Operating temperature range -55°C – 225°C; Short term to 300°C.

Composition Properties

Filler Contents:	85% Silver
Viscosity: Thixotropic	20-35 Kcps @ 10 RPM Brookfield HBT CP51 cone and plate.
Thixo Ratio at above viscosity parameters	~1.89 – 2.30
Average Particle Size:	.70 – 1.25 microns

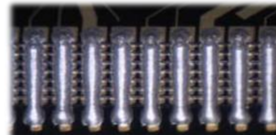
Photo Courtesy Vertical Circuits, Inc.

Typical Cured Properties

Volume Resistivity:	.00015 - .00008mohms (Dispensed)
Thermal Conductivity	7.1-7.9 W/m-K
CTE Alpha 1 ppm/°C	50
CTE Alpha 2 ppm/°C	200
Tg°C	117
Die Shear psi	>8000
Shore "D" Hardness	75 - 80
Post Cure Ionics 883/5011.3.8.7	Cl=<6ppm, Na+=<3.3ppm, K+=<1.1ppm

Teflon Flask 5 gm sample using 20-40 mesh, 50 gm DI H_2O, 100°C for 24 hours

Modulus:
@65C = 5595 MPa, @25C = 5510 MPa, @150C = 925 MPa, @250C = 310 MPa

Processing Procedures: Mixing: The material should be lightly stirred prior to use if used from a jar. Not required if in a syringe
Application: The material may be applied by screen printing or syringe dispense

Curing: Cure at 150°C for 45 minutes. Optimum conditions will vary depending upon application and will need to be determined experimentally.

Storage MicroCoat SD0802C should be stored in sealed containers away from heat or flames. It has a shelf life of 4 days at a storage temperature of 25°C, 3 months at -10°C or 6 months at -40°C. Material ***may*** be returned to refrigerator/freezer after using partial syringes or jars.

Packaging: 3cc, and 10cc syringes **Shipped Unfrozen** next day delivery only
10242011

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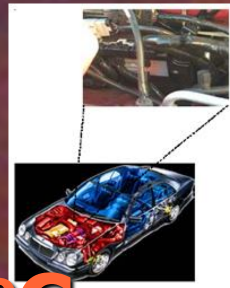
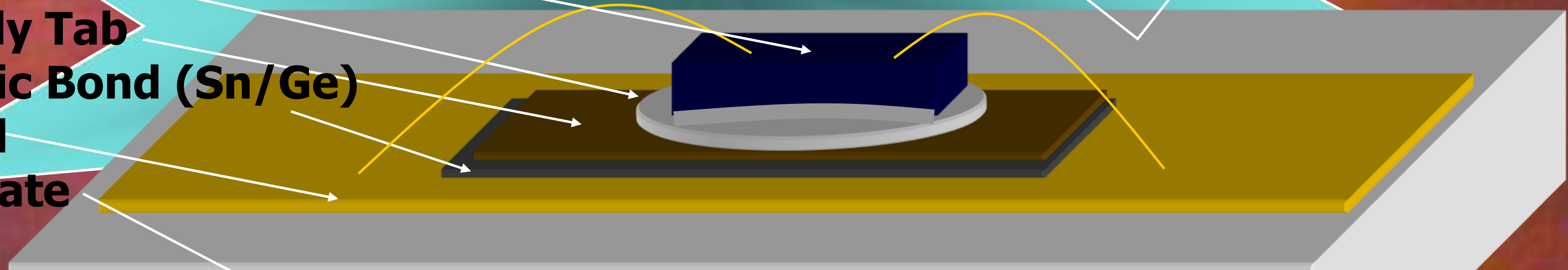


SUPER HIGH TEMPERATURE CONDUCTIVE DIE ATTACH ADHESIVE TO >650ºC

- 85% Ag – NO ORGANICS
- NO Outgassing – NONE!, NADA!, ZIPPO!, LING!, NULL!, REI!



APPROVED FOR A HARD LANDING ON VENUS!!!!!!!

MicroCoat Technologies

1316 Somerset Drive McKinney, TX 75070 www.m-coat.com Tel: 972-678-4950 Fax 214-257-8890

Unparalleled in Polymer Coatings and Adhesives Technology ™

Product Data Sheet

MCT A795-VHT

APPROVED FOR A LANDING ON VENUS AT 450°c

An Electrically and Thermally Conductive, Silver Filled, Inorganic One-Part Adhesive for Use to >550°C

**MAY NOT BE DIRECT BONDED TO GOLD

- Low Cure Temperature
- **Semiconductor Die Attach with Moly Tab for "Down the Hole Hybrids" or attach to Headers, Ag, Ni, Pd/Ag, Al, etc.
- Silicon die (no gold on back) to power headers
- Ceramic-to-Ceramic Heat Sink Bonding
- Substrate Attach to Nickel Plated Packages

Silver:	80% - 85% ~28 Micron
Viscosity:	Thixotropic Paste
Pot Life:	NA

Recommended Cure: 2 Hours Room Temperature Followed by 2 hours at 120C.

For Vacuum Sealing Applications: ALL moisture is released between 300C-400C. After that there is absolutely no outgassing. Prior to final bake at temperature there are <.01ppm H2O moisture given off. It appears from lab testing that if you cure the product for an additional 2 hours at 150C (after 1-2 hours at 120C) this will eliminate any further moisture release

Temperature Resistance:	1200°F (649°C)
CTE, in/in/°F X 10^{-6} (°C)	9.6 (17.3)
Thermal Conductivity,	
Btu-in/hr-ft^2-°F	63.1 (9.14 W/m-K)
Volume Resistivity (ohms-cm)	.0002

032406

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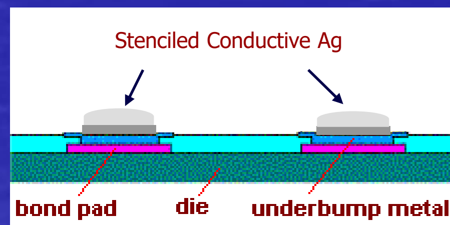
Flip Chip Bumping Using Conductive Silver

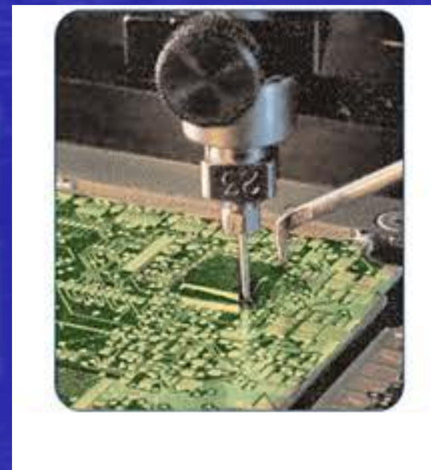
- **Adhesive bumping** is a flip-chip bumping process that stencils electrically conductive adhesive over an under-bump metallization placed over the bond pad. The stenciled adhesive serves as the bump after it has been cured. Mounting of adhesive-bumped flip-chips also uses conductive adhesives.



MCT 9116-04CUFL

Extremely Thermally Conductive Flowable Flip Chip & BGA Underfill

MCT-9116-04CUFL is a nitride filled, single component, epoxy compound for BGA and flip chip underfill applications with a TC of >2.88W/mK. This product is designed to release entrapped air rapidly during cure resulting in a smooth, pinhole free surface. The viscosity is such that this material will flow nicely under the component and around the solder or conductive epoxy balls. Adhesion to Si, GaAs, GaN, glass, epoxy molded components, is excellent.



Thanks Very Much

Questions?