Micromax™ 5815

Electronic Inks and Pastes

Conductive Silver Compositions For General Purpose Air-Dry Applications

The compositions described in this bulletin are suspensions of specially prepared silver powders combined with a variety of organic binder systems. They are air-dry or low temperature-curing formulations for application on substrates which will not generally tolerate high-temperature firing. They are formulated to produce electrically conductive paths on paper, plastic, rubber, cloth, wood, etc., and may be applied by dip, spray, brush, stylus, syringe or screen print.

These highly conductive air dry/thermoset (epoxy) compositions exhibit versatility and are useful over a broad range of applications. Suggested uses are:
- Printed Electronics
- Tantalum Capacitors
- Static Shielding
- Electrical Games and Toys
- Microwave Applications
- PC Board Repair
- Electroplating Base

Choice of an air dry or thermosetting conductive silver composition for a given use is dependent upon the method of application preferred and the required properties in the end product. Trade-offs in final film properties are sometimes necessary.

Drying rate is a function of the solvent system in a composition and method of application is dictated by viscosity, a function of binder to solvent ratio.
Dry strength, flexibility, adhesion and temperature stability are functions of the binder system. No one binder system exhibits optimum capabilities of all functions. Lower metal contents are generally least expensive if cost is a primary consideration. Higher metal contents develop maximum conductivity and load carrying capabilities, and are more easily soldered.

Product information

Solvent or thinner	Micromax™ 8459

Rheological properties

Viscosity	0.8 - 0.95[1] Pa.s

[1]: Brookfield LVT, #2 spindle, 30 rpm

Application technique

Theoretical coverage	100[2] cm^2/g

[2]: Dip/Spray, at 50µm wet film thickness

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Thermal properties

Linear Coefficient of Thermal Expansion	0.00003	E-6/K

Electrical properties

Volume resistivity	30	µOhm.cm
Surface resistivity	≤100[3]	mOhm per square

[3]: Dip/Spray, at 25µm film thickness

Storage and stability

Shelf life	3[4]	months

[4]: in unopened containers, from date of shipment, at temperature between 2-4 °C (at temperatures of -18 °C or below will further prolong shelf life)

Additional information

How to use

Design & compatibility

- Design
  - Micromax™ 5815 compositions are single component, epoxy based preparations suitable for use as conductive cements in lead and discrete component attachment. They exhibit good conductivity, high adhesion and excellent resistance to abrasion. These compositions are divided into two types: anhydride-cured and amine-cured. Anhydride-cured compositions display excellent thermal stability up to 250 °C whereas amine-cured products start to degrade appreciably at temperatures above 200 °C with attendant loss of properties. Both systems, however, can withstand short excursions to higher temperatures.
  - See the CB selector guide for a selection of CB products for use in circuit board applications.
  - While not suggested for direct solder, the compositions may be electroplated to provide a solderable surface.
  - Optimum cure for Micromax™ 5815 compositions will depend on process and equipment parameters as well as the mass, heat capacity and transfer, and sensitivity of the materials involved. Cure schedules listed in table are recommended as minimal starting points with compositions Micromax™ 5504N and 5815 after applying and allowing to air-dry until tack free. The drying time can be accelerated by heating to 50 °C. Longer cure schedules may be required to optimize properties depending on end-use requirements. For example, in die-attach application, a cure schedule of 2 hours at 200 °C has been found to yield stable and reliable die-to-substrate interfaces capable of withstanding a high degree of thermal and physical stress.
  - The cure schedule show in table are also applicable to

composition Micromax™ 6838.

Processing

- Application methods
  - Micromax™ conductive silver compositions are formulated for application by screen printing, spraying, dipping, brushing, banding or stylus. In most cases the compositions are produced to a consistency suitable for use as received and require only stirring to redisperse the solids.
  - Recommended thinners for individual compositions may be added, with thorough blending, to replace solvent losses or to make slight adjustments for ease of application. Only the recommended thinner should be used. In handling and using organic solvents, the safety precautions recommended by the solvent supplier should be observed.
- Effect of curing temperatures
  - This bulletin discusses two types of compositions: air dry and thermoset (epoxy). In an air-dry system, the metal-binder film is formed when the solvent system is evap-orated or "dried". In a thermoset system, there is a drying step where the solvent is removed, followed by a chemical reaction of binder materials in the system to give a higher temperature resistant binder film for the metal. The later chemical reaction is called "curing" and is different than drying.
  - While some compositions, if given sufficient time, will adequately dry or cure at room temperature, a more effective result is achieved in much less time through low temperature thermal exposure with a moderate time/temperature drying or curing. Optimum properties in air & dry and low-temperature-cure compositions are developed only after the compositions have been properly dried or cured. The drying or curing cycle for most compositions in a function of time versus temperature up to the point of degradation of the organic system. In a system which will dry or cure in from 12 to 16 hours at room temperature (25°C) the same degree of drying or curing can be achieved in less than 2 hours at 60°C and in less than 1 hour at 100°C.
  - Elevated temperature drying or curing of these compositions can be continuous, box oven or infrared. The heat should be applied from the bottom up to permit internal gases to escape before the top surface is completely dry. "Flash drying", a momentary exposure to excessively high temperatures, is likely to from a surface skin that traps internal gases, resulting in bubbles in the dried film.

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- Failure to achieve rated conductivity indicates either that the applied composition is too thin with poor uniformity or that it has been incorrectly dried and/ or cured.

- **Soldering**
  - Some Micromax™ air dried and thermoset compositions are more commonly used as conductive cements in lead attachment, attachment of discrete components or in simple interconnections. For these applications, solderability is not important and is not generally recommended.
- **Electroplating/electroforming**
  - The use of Micromax™ air dry/thermoset conductive silver compositions as bases for electroplating and electroforming is wide-spread. Ease of application, broad curing ranges, high conductivity and dimensional stability mark Micromax™ 4929N, 4922N and 4817N compositions as leaders in the field.
- **Coverage**
  - Coverage of silver compositions depends on metal content and thickness of application. Screen print compositions printed with a 165 or 200-mesh screen will generally result in a cured film 12-20µm (0.48-0.8mil) thick. Brush band, dip or spray application will normally result in film thickness of 13-18µm (0.5-0.7mil). Thinner films (increases coverage) can be applied by thinning the compositions with the recommended thinner; however, this will result in a cured film with a higher sheet resistivity. Thicker films can be achieved by brushing or spraying simply by applying more material.
  - The coverage Micromax™ 5815 compositions are for typical cured thickness of 12-20µm (0.48-0.8mil) as outlined above.

Properties

Recommended Cure Schedules

Temperature (°C)	Time (hours)
200	0.7
180	1.5
160	2.5

Typical Physical Properties of Thermosetting Compositions (Cured Film)

Test	Properties
Thermal Conductivity (J/(cm•s•°C))	0.04

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Specific Heat (J/(g•°C))	0.30
Modulus of Elasticity (tensile) (Pa)	4 x 10^{10}
Poisson's Ratio	0.35

Storage and shelf life

Micromax™ 5815 materials (thermoset) should be refrigerated at 2-4°C (35-40°F). Shelf life of material in unopened containers under these storage conditions is three months from date of shipment. Shelf life can be extended considerably by storage at temperatures of -18°C (0°F) or below. Materials should be allowed to return to room temperature before opening to preclude moisture condensation in the jar, to assure that the proper viscosity has been reached, and to assure consistent results with whatever cure cycle is being used.

Safety and handling

For safety and handling information pertaining to this product, read Safety Data Sheet (SDS).

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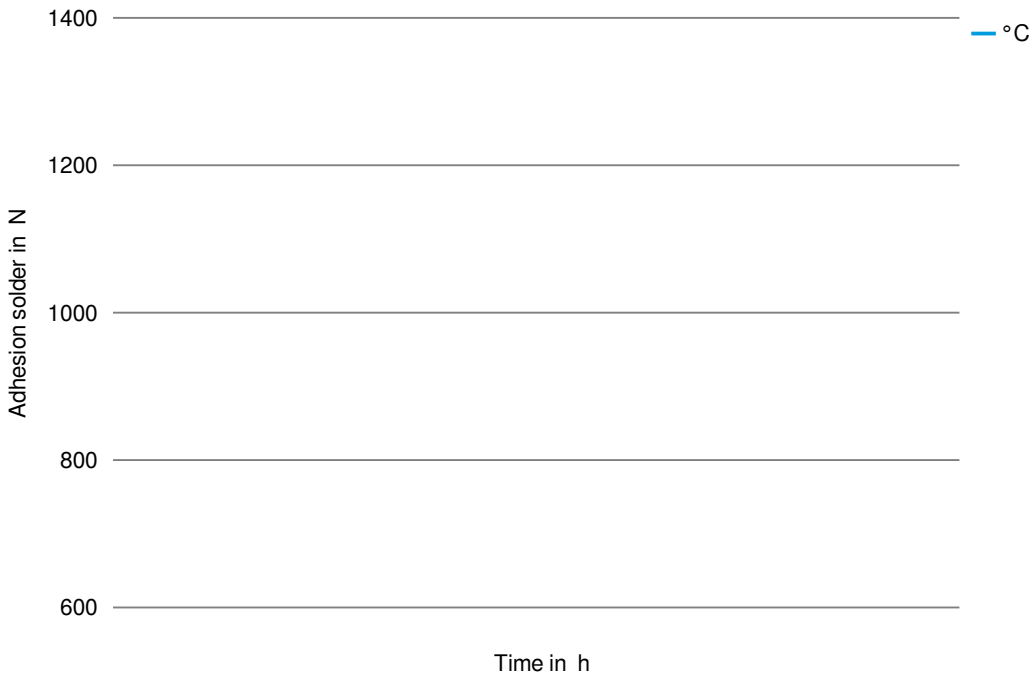
Adhesion solder after heat ageing



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