

# CONDUCTIMER™

## Die Attach Adhesives

Electrically conductive, polymer-based adhesives that can cut your reject rate...significantly increase throughput...and improve the reliability and performance of assembled chips and hybrids.



**M&T**<sup>™</sup>  
CHEMICALS INC.

# CONDUCTIMER™

## Die Attach Adhesives

**Innovative new adhesives that increase die-bonding speed...reduce chip stress...and improve product quality, reliability, and performance.**

If you use epoxy or polyamic-acid-based adhesives to bond your chips to lead frames, here's a product that can cut your reject rates, increase throughput, and raise your yields and profits.

Introducing Conductimer adhesives—a new line of electrically-conductive, polymer-based die-attach adhesives from M&T Chemicals.

**Conductimer adhesives can help you speed up your die-bonding operations.**

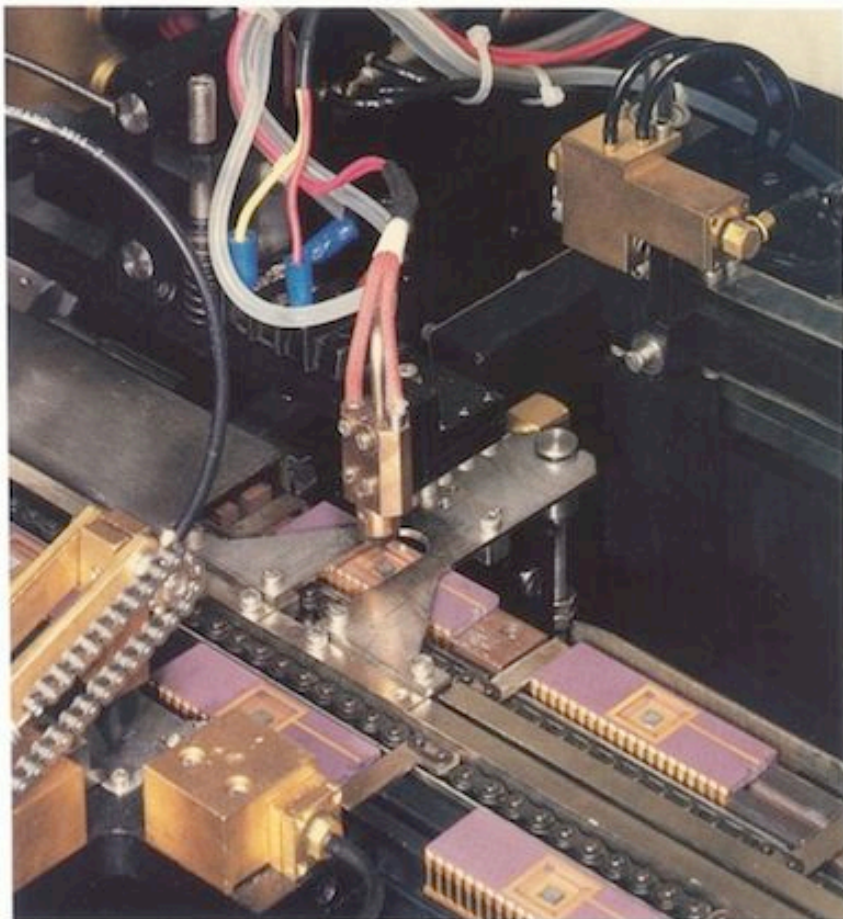
Unlike epoxy and polyamic acid, which need to be cured in an off-line oven, Conductimer adhesives require *no* curing. Just dispense the adhesive and move the lead frame to a heated in-line stage for a few seconds. Conductimer adhesives bond instantly! As a result, you can eliminate the baking cycle from your operation to dramatically increase throughput and profits.

In addition, Conductimer adhesives are based on thermoplastic resins, not thermoset resins, so they are more resilient than epoxy or polyamic acid. Which means that stress is drastically reduced, eliminating cracks, rejects, and performance problems.

Other advantages of Conductimer adhesives over epoxies and polyamic acid include:

- Lower level of extractable ions
- Stable thermal and electrical properties
- Can be stored at room temperature with no degradation
- No resin bleed-out
- Good shear strength
- Low volume resistivity
- High thermal conductivity
- And more

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If you are using high-speed production methods, you can achieve 60 to 300 times greater throughput by replacing epoxy die-attach adhesives with quick-bonding Conductimer adhesives from M&T Chemicals.

**Conductimer adhesives give you immediate process and performance improvements in both new and existing manufacturing operations.**

Here's what Conductimer adhesives can do for you:

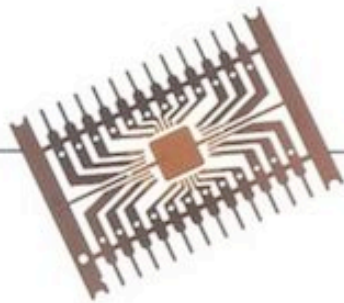
*If you run an automatic, high-speed operation, Conductimer adhesives can eliminate oven curing to increase bonding speed between 60 and 300 times faster than epoxies.*

*If you manufacture linear devices, Conductimer adhesives can drastically reduce chip stress to ensure consistent, reliable parametric performance.*

*If you manufacture large integrated circuits, Conductimer adhesives can relieve stress to cut down on cracks and other defects. You get better performance, higher yield.*

*If ionic corrosion is a problem for you, try Conductimer adhesives instead of epoxy. With an extractable ion content of less than 1.5 parts per million for each of the problem ions, Conductimer adhesives eliminate ionic contamination that can corrode aluminum bond pads.*

*If you fabricate hybrids, you'll benefit from the low ion content and quick bonding of Conductimer adhesives. Plus, as thermoplastics, Conductimer adhesives can be heated and reworked; most epoxies*



## Nine reasons why you should try Conductimer adhesives instead of epoxy or polyamic-acid-based die-attach adhesives:

can't. This allows you to save hybrids that would otherwise be destined for the scrap heap.

*If you attach chips directly to the board,* the low bonding temperature of Conductimer adhesives gives you a good bond without exposing your board to damaging heat. And their low ion content prevents moisture from causing corrosion problems.

*If you fabricate with high wire bonding temperatures,* you'll appreciate the Conductimer high temperature series adhesives which can withstand bonding temperatures of up to 300°C.

### Conductimer die attach adhesives: A technical overview

Conductimer adhesives are based on proprietary thermoplastic polyimides developed by the Specialty Polyimide Group of M&T Chemicals.

Conductimer adhesives use fully imidized, high-molecular-weight resins. So, unlike epoxy or polyamic-acid-based adhesives, Conductimer adhesives do not require curing. The only process that takes place during bonding is solvent removal, which occurs very rapidly.

Conductimer adhesives are available as thixotropic pastes or as ribbons. High silver content ensures good electrical and thermal conductivity. Because they are thermoplastic, Conductimer adhesives have built-in stress relief mechanisms (such as creep and compliancy) that eliminate the stress inherent in most thermoset materials such as epoxy and polyamic acid.

**1 No curing.** Conductimer adhesives bond in seconds; no off-line curing required. The result is a much faster die-bonding cycle time and a significant increase in throughput. Conductimer adhesives allow you to use standard automated high-speed die-bonding machines with little modification. Wire bonding can proceed immediately after die bonding, with no intermediate step.

**2 Compatible with your existing equipment.** Although Conductimer adhesives can be used with high-speed production methods to dramatically increase productivity, they also work perfectly with your existing epoxy oven set-up. Which means you can take advantage of the unique properties of Conductimer adhesives right away, with no changes in your operation. And no new equipment to buy.

**3 Less stress.** Conductimer adhesives exhibit greater resilience, which reduces residual stress on the die, eliminating die cracking and reliability problems.

**4 No refrigeration required.** Conductimer adhesives can be stored at room temperature. They come ready to use, with no mixing or special handling procedures. Available in ribbon or paste. Easy to dispense.

**5 Stability.** Conductimer adhesives have been proven stable under long-term accelerated aging conditions. Unlike many epoxies, the shear strength, volume resistivity, and thermal conductivity of Conductimer adhesives remain relatively constant over time—even under extremes of

pressure, temperature, and humidity. Which means Conductimer adhesives add longer life and reliability to your end-products.

**6 Eliminates ionic corrosion.** M&T's proprietary thermoplastic resin synthesis process eliminates ammonium and fluoride ions. Conductimer adhesives also contain less than 1.5 ppm each of sodium, potassium, iron, copper, sulfate, and chloride ions. Ionically clean, Conductimer adhesives prevent ionic corrosion that can eat away bond pads and cause an "open" circuit condition.

**7 No resin-bleed out.** Bleeding and smearing of adhesive can interfere with automated wire-bonding operations and cause performance problems in assembled circuits. But, unlike epoxies, Conductimer adhesives do not bleed, because viscosity increases as the temperature rises during die bonding.

**8 Thermoplastic vs. thermoset.** Thermoplastics, unlike many thermosets, can be softened by heating and then reprocessed. Which means you can heat Conductimer adhesives to loosen them and rework the chip to save a board or hybrid from the reject pile.

**9 A superior bond.** Conductimer adhesives form a strong attachment between chip and lead frame. But unlike some epoxies, the shear strength of Conductimer adhesives remains strong over time to assure long life and reliable, trouble-free performance.

# Conductimer adhesives offer you the performance characteristics you need to speed up your processing operations and improve the reliability and quality of your products.

And our extensive test results *prove* that Conductimer die-attach adhesives can work for you....

## Proven performance

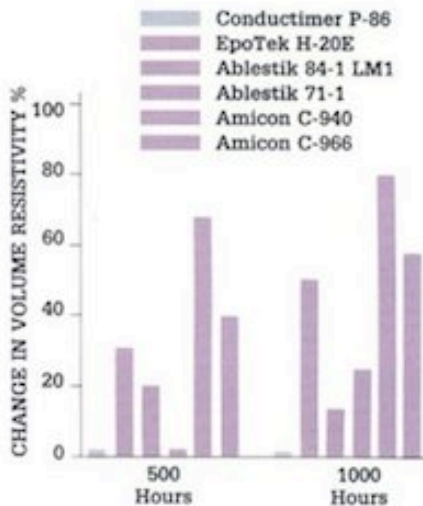
The true test of any die-attach adhesive is its ability to stand up over time. Conductimer adhesives retain their superior thermal, mechanical, and electrical properties—even under accelerated aging conditions. Extensive testing—at elevated temperatures (150°C), "85/85" (85°C at 85 percent relative humidity), and pressure pot conditions (121°C at 2 atmospheres)—prove their ability to withstand extremes of temperature, pressure, and moisture.



Here, a Conductimer adhesive is subjected to temperatures of 150°C for 2,000 continuous hours to test performance under accelerated aging conditions.

## Low volume resistivity

Many integrated circuits drain current to ground through the back of the chip, which is why the die-attach adhesive you choose should have good electrical conductivity. Conductimer adhesives have an extremely low volume resistivity: only  $9 \times 10^{-5}$  ohm-cm. And their electrical properties are the most stable of any die-attach adhesive on the market today—there is virtually *no change* in volume resistivity under accelerated aging conditions.



After 1,000 hours at 85°C and 85 percent relative humidity, the volume-resistivity of Conductimer adhesives remains unchanged, while epoxies and polyamic-acid-based adhesives undergo changes in resistance ranging from approximately 14 to 80 percent.

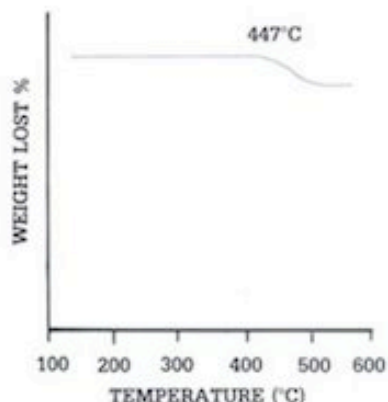


Tests prove that Conductimer adhesives have the most stable electrical properties of any die-attach adhesive on the market today.

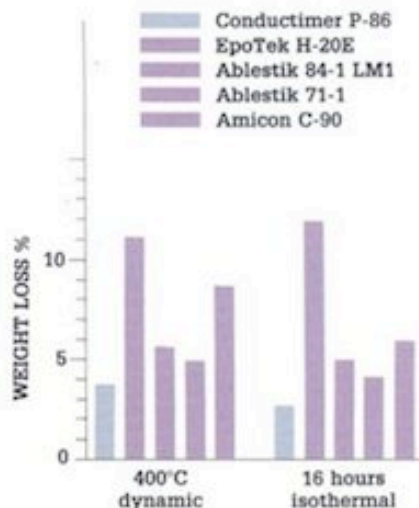
## Conductimer adhesives can take the heat!

Thermal stability in your adhesive is essential to chip reliability. If your adhesive oxidizes at high temperatures, device performance can be severely degraded.

Conductimer adhesives meet and exceed MIL-A-87172, showing no weight loss at 300°C. In fact, Conductimer adhesives don't begin to lose mass until over 400°C!



Under thermogravimetric analysis at a temperature rise of 10°C per minute in a nitrogen atmosphere, a Conductimer adhesive did not exhibit weight loss until the temperature reached 447°C.



Epoxy and polyamic-acid-based adhesives exhibit 20 to 73 percent more weight loss than Conductimer adhesives under identical test conditions.



### Conductimer adhesives eliminate ionic corrosion

Conductimer die-attach adhesives have the lowest extractable levels of any die-attach adhesive in the industry: less than 1.5 parts per million for each of the problem ions vs. ten times that amount for most epoxies and polyamic-acid-based adhesives. Conductimer adhesives are made from high-purity, microelectronic-grade resins—which are specially prepared by M&T—to prevent damaging ionic contamination that can eat away aluminum bond pads. The result is greater reliability and reduced risk of open circuits.

### High thermal conductivity ensures peak performance

Today the trend is toward larger chips, which generate more power and heat. And this extra energy can cause severe performance problems, unless it's dissipated. Which is why it's important for your die-attach adhesive to have high thermal conductivity—and *maintain* high conductivity as the temperature rises.

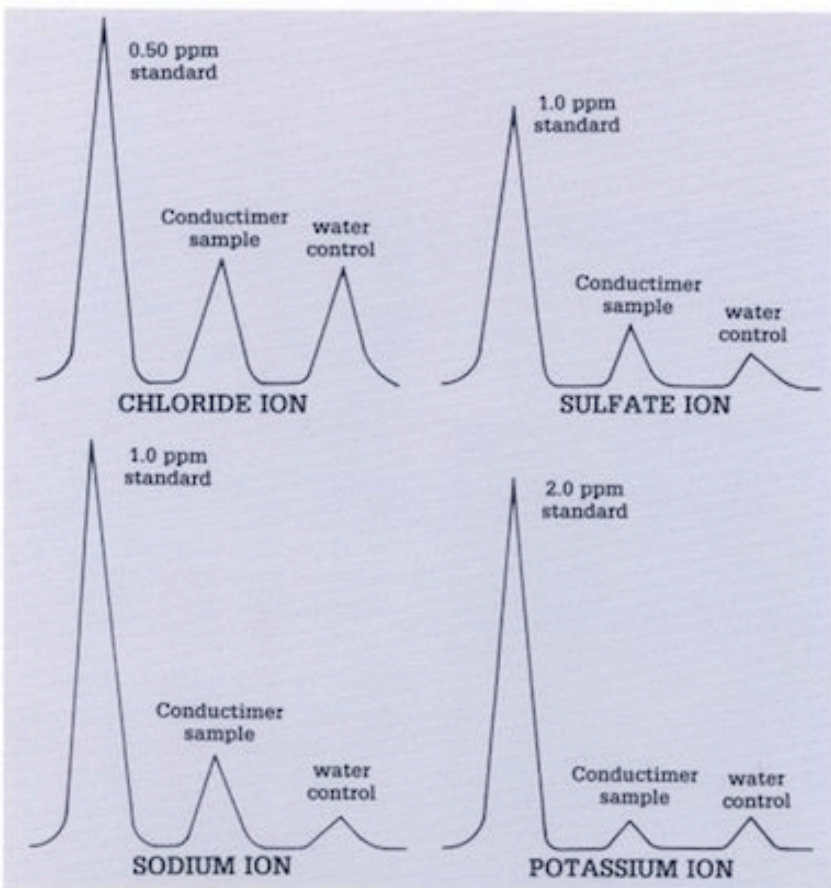
Because of their high silver content, Conductimer adhesives have among the highest thermal conductivities in the industry. This ensures consistent, reliable performance, even in larger chips.

### Conductimer adhesives start strong—and stay strong.

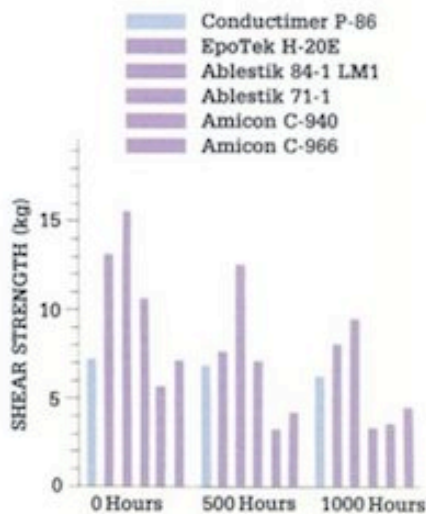
Conductimer adhesives have initial die shear strengths in excess of MIL-STD 883C. But unlike many epoxies, Conductimer adhesives *retain* their strength over time. Even under accelerated aging tests, Conductimer adhesives don't come unglued.



Using the die shear tester, it takes 8.5 kilograms of force to knock a 100 mil square chip off the lead frame, even though it was bonded with a Conductimer adhesive just seconds ago.



Ion chromatogram of a Conductimer adhesive shows extractable ion content after 24 hours at 120°C.



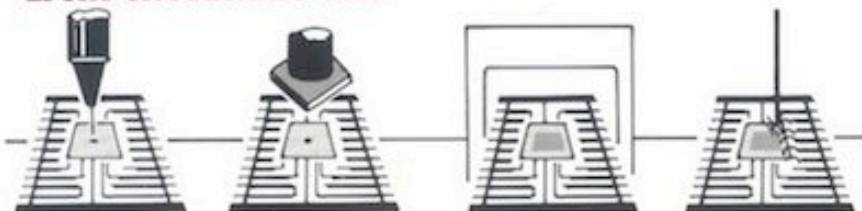
At 85°C and 85 percent relative humidity, Conductimer adhesives retain approximately 95 percent of their original shear strength after 1,000 hours, while other adhesives lose between 21 and 69 percent of their strength.

## Conductimer adhesives are clean, convenient, and work well with whatever type of die-bonding operation you're running.

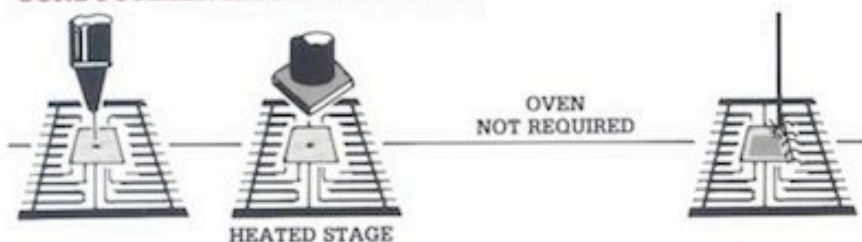
### STANDARD PROCESS SEQUENCE



### EPOXY OR POLYAMIC ACID



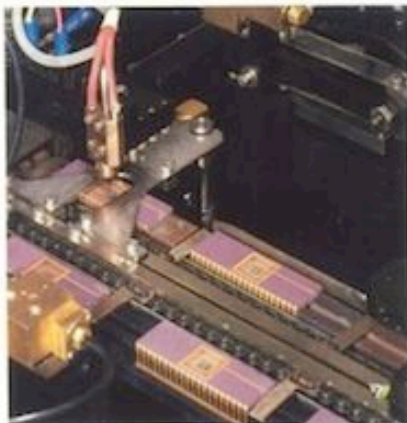
### CONDUCTIMER HIGH SPEED MODE



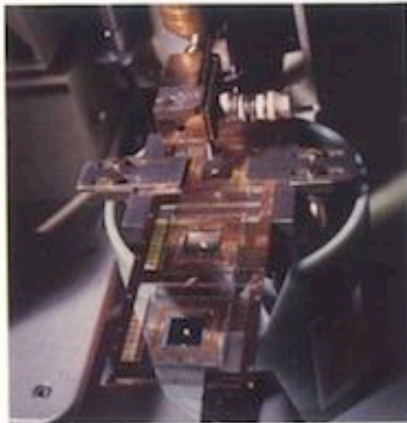
### Use Conductimer adhesives to increase throughput in a high-speed automatic die-bonding operation...

Conductimer adhesives can be used with automatic die-bonders to increase throughput of quality parts. Just dispense Conductimer adhesive onto the lead frame and move to a heated platen, where solvent immediately flashes off. Then place the die in the hot adhesive. Bonding

takes place in seconds. Remove the die, cool, and proceed with wire bonding. No off-line oven baking required. The in-line heated stage removes all solvent before the die is placed, so voids are completely eliminated, resulting in a better bond.



Conductimer adhesives can be used with your current epoxy set-up (left), which requires baking in an off-line oven, as well as with automatic high-speed equipment, which needs only an in-line eutectic stage. By eliminating the oven cycle, you can achieve 60 to 300 times greater throughput with quick-bonding Conductimer adhesives.



### ...or put Conductimer adhesives to work in your current set-up.

Conductimer adhesives can also be applied with the same equipment you now use to dispense your epoxy die-attach adhesives. Dispense Conductimer adhesive onto the lead frame, and press the chip into place. Move the chip assembly into an off-line oven, then bake at 135° to 170°C (depending on die size) for 15 to 30 minutes. This ensures proper solvent removal, preventing voids. And by replacing epoxy with a Conductimer adhesive, you get a better bond, lower extractable ion content, and superior thermal stability, thermal conductivity, and volume resistivity.

### No resin bleed-out

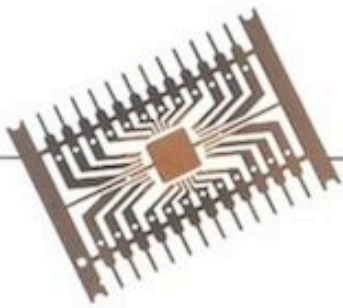
Because they're monomeric, epoxies initially lose viscosity when heated. As a result, epoxies become runny, and can flow beyond their bond lines. This reduces bond strength, adds stress, and can cause shorts in hybrids when the conductive adhesive flows onto adjacent traces. Plus, flowing epoxy can tilt the die, resulting in rejection by the pattern-recognition equipment used in automatic wire bonding machines. Hundreds of miswired rejects can pile up before someone spots the problem.

Unlike epoxy, Conductimer adhesives do not bleed. The only process that takes place during heating is solvent removal; there is no curing or chemical reaction. Viscosity goes up, never down. Resin bleed-out is completely eliminated.

### Thermoplastic, not thermoset

Epoxies and polyamic-acid-based adhesives are thermosets. So once bonded, many can never be reworked.

But Conductimer adhesives are thermoplastics, so they can be reworked. This helps cut reject rates in hybrid fabrication.



### Less stress

Because Conductimer adhesives are thermoplastics, they can creep and deform to relieve residual stress that can cause reliability and performance problems in many chip assemblies. Epoxy can't.

In addition, the epoxy curing process produces a cross-linked chemical bond, causing volume shrinkage which passes stress on to the chip. Conductimer adhesives form no such bond, eliminating a source of stress inherent in epoxy die-attach adhesives.

### Available in paste and ribbon

M&T Chemicals is developing a broad line of Conductimer adhesives, available for a wide range of wire-bonding temperatures in both paste and ribbon.



Conductimer adhesives are available in whatever form or package you need—paste or ribbon, jar or syringe.

Paste comes packed in polypropylene jars or syringes. Available in gram and kilogram quantities. Viscosity remains constant when Conductimer adhesives are kept in sealed containers. Conductimer adhesives are not reactive and should be stored at room temperature (refrigeration is

not recommended). Toxicity is negligible.

Unlike some epoxies, Conductimer paste adhesives come ready to use; no mixing required. Paste flows easily for screen printing, syringe dispensing, and stamping processes. In high-speed operations, bonding temperatures range from 180° to 200°C.

Conductimer ribbon adhesive is easy to use and eliminates the handling problems associated with paste adhesives. Bonding temperature is 300°C without scrubbing. Ribbon is clean—no mess, no curing. Conductimer adhesives are the only fully cured, heat-activated die-attach adhesive ribbons on the market today.

Conductimer ribbon adhesives are available on standard 4-inch reels and are fully compatible with existing eutectic die-bonding operations. Now, all your die bond requirements can be met with only one piece of equipment.

### Complete solvent removal

Diglyme, the solvent used in Conductimer adhesives, has a lower boiling point than epoxy solvents. As a result, you are ensured easy and complete solvent removal. This eliminates voids under the die, improves bond strength, and prevents residual solvent from getting into your package.

### All this—and economical, too

When you consider its low price, the increase in throughput and yield Conductimer adhesives can provide, and the fact that no capital investment is required (if you use Conductimer with your existing die-bonding equipment), you'll find that switching from epoxy to Conductimer adhesives is an economical move that will save you money and boost your profits.

## Compare Conductimer adhesives with epoxy—and see the difference:

### Epoxy

Slow die-bonding due to off-line curing

High residual and locked-in stress cause chip cracking and performance problems  
High extractable ion content

Mechanical and thermal properties degrade with age

Unstable at room temperature; requires refrigeration or mixing

Low thermal stability

Poor thermal conductivity

Resin bleed-out weakens bonds, creates shorts, raises reject rates

Die strength deteriorates with time

Thermosets cannot be reworked

Unstable electrical properties

### Conductimer Adhesives

60 to 300 times faster die-bonding with automatic operation

Stress virtually eliminated

10 times lower ion content for increased reliability

Mechanical and thermal properties remain stable—even under accelerated aging conditions

Can be stored at room temperature; comes ready to use

High thermal stability

Good thermal conductivity

No resin-bleed out

Good initial die shear strength; remains stable over time

Adhesive can be heated and reworked, if desired

Good electrical conductivity that does not degrade

## M&T Chemicals: a major supplier to the microelectronics marketplace

For over three decades M&T Chemicals has been a major supplier of specialty chemicals to the electronics industry.

Thirty years ago, we invented the pyrophosphate plating process—the first reliable process for producing two-sided circuit boards. Today, this process is still used in the manufacture of high-reliability boards.

Other M&T innovations include a high-speed electroless copper process; new ultraviolet-cured, screen-applied plating and etching resists; cleaners; conditioners; strippers; plus the new Photomet™ solder-masking system that cuts the cost of producing high-resolution circuit boards.

Today, we manufacture just about every chemical required to produce top-quality printed circuit boards. And Conductimer adhesives now join passivation coatings to become part of our growing family of microelectronic-grade specialty chemicals that improve products, processes, productivity, and cost-effectiveness.

### About M&T Chemicals

M&T Chemicals is a 75-year-old producer of specialty chemicals. Our sales exceed \$300 million, and we have more than 50 plants, laboratories, and offices on 5 continents. M&T Chemicals is a subsidiary of Elf Aquitaine, a \$20 billion international firm.



M&T Chemicals is a leader in developing specialty-chemical technology and systems to solve problems and achieve performance improvements in a wide variety of industries. We provide technical assistance and support to key customers worldwide from M&T Technical Centers in Australia, Canada, West Germany, Brazil, Mexico, New Zealand, Hong Kong, Japan, England, France, the Netherlands, and the United States. Conductimer adhesives and other products can be delivered to you from warehouses strategically located in major markets.



### The next step...

If you have an *existing* operation, Conductimer adhesives can cut reject rates, increase yield, and improve product quality and reliability—with *no* extra equipment to buy.

If you are planning a *new* product, consider using Conductimer adhesives instead of epoxy. You can eliminate the time-wasting off-line curing cycle, dramatically raising throughput and production of high-quality parts.

If you want to evaluate a Conductimer adhesive and compare it with other die-attach adhesives, we'd be glad to help. To receive data sheets, technical assistance, and *free* samples of Conductimer adhesives, call or write us today.

### Important Notice Regarding This Information

The statements, technical information and recommendations contained in this document are based on tests that are believed to be reliable. However, this document is not contractual, and NOTHING IN IT CONSTITUTES A WARRANTY THAT THE GOODS DESCRIBED ARE FIT FOR A PARTICULAR PURPOSE OF CUSTOMER or that their use does not conflict with any existing patent rights. The exclusive source of any warranty and of any other customer rights whatsoever is the written acknowledgment of a customer's order.

**M&T**  
CHEMICALS INC.

Specialty Polyimide Group  
Woodbridge Road  
Rahway, NJ 07065  
(201) 499-0200  
TWX: 710-996-5481