Technoply

Electronic Substrates

High Reliability / High Performance Laminates

45NK
Epoxy-Kevlar®
Chip Carrier Laminates

- Tg of 175° C
- Excellent Expansion Match with Alumina – 6 x 10^{-6} in/in/°C, 6 ppm/°C

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Glass Transition Temp (°C)	Flammability	Coefficient Thermal Expansion PPM per °C	Peel Strength As Received lbs./in. (N/mm)	Peel Strength After Thermal Stress lbs./in. (N/mm)	Peel Process Solutions lbs./in. (N/mm)
IPC-TM-650; 2.4.24 (DSC)	UL94	IPC-TM-650; 2.4.41	IPC-TM-650 4.8.3.7.1	IPC-TM-650 4.8.3.7.1	IPC-TM-650 4.8.3.7.3
175°	V-O	Below 170°C X-6 Y-6	8 (1.4)	6 (1.0)	6 (1.0)

Flexural Strength As Received PSI (MPa)	Flexural Strength Elev. Temp. PSI (MPa)	Water Absorption %	Dielectric Constant @ 1 MHz	Dissipation Factor @ 1 MHz	Volume Resistivity Megohms-CM	Surface Resistivity Megohms
IPC-TM-650 4.8.3.15	IPC-TM-650 4.8.3.15	IPC-TM-650 2.6.2.1	IPC-TM-650 4.8.3.13	IPC-TM-650 4.8.3.13	IPC-TM-650 4.8.3.8	IPC-TM-650 4.8.3.8
38,700 (267)	10,000 (69)	0.8	3.9	0.016	1.3×10^7	3.2×10^7

Cladding

45NK Multifunctional Kevlar® can be supplied with a variety of copper and specialty claddings:

1/2 oz. (17.5 micron) and 10 oz. (35 micron) standard
Double treat copper available in standard copper weights
5 and 9 micron (1.8 and 1.4 oz.) foils available
Heavier copper foils available by special order

We recommend the use of HTE (Grade-III) copper on all laminates.

• Prepreg: B-Stage bonding sheets available in fabric style 120 only

Processing Information for epoxy KEVLAR® Materials

Material

Epoxy Kevlar® materials made by ARLON are constructed with an epoxy resin system (CTE 35-45 ppm/°C) reinforced with Kevlar® aramid fabric (CTE -4 ppm/°C). The resulting laminate has an in-plane (X and Y direction) CTE as low as 6 ppm/°C (style 120 fabric). The Tg of the cured material is 175°C. Given that neat resins expand isotropically (the same amount in all directions) to the extent that the reinforced resin is constrained from moving in the plane (X and Y) of the laminate, the resin will expand in the Z-direction. The resin will expand approximately 60-70 ppm below Tg and 250 ppm above Tg.

Process Recommendations

Storage Conditions

Storage conditions of 70°F(21°C) and <30 % relative humidity (humidity is a more critical storage factor than temperature) are recommended. It is crucial to follow the recommendations under- Pre-Lamination Drying Procedure. Note: Even when good storage conditions are available, vacuum drying of Kevlar® as an insurance step to protect the investment in material is strongly recommended.

Copper Etching Process

Effective water rinsing after etching and neutralization is necessary to remove etching chemical residues.

Oxide Process

An oxide process that works well with polyimide should work well with epoxy Kevlar®. Superior bonds are achieved with an adequate micro etch and a “red, brown, or bronze” oxide treatment. Thorough hot water rinsing is very important to ensure a properly clean surface.

Oven Dry Process

Drying of inner layers, after the oxide process and prior to the lamination process, is of utmost importance. A drying cycle of 250°F(121°C) for 90 minutes should be adequate to remove any moisture.

Kevlar® reinforcements and many high performance resin systems are sensitive to humidity. Water may be absorbed as a result of uncontrolled storage conditions and/or during wet process operations. Typical wet process operations where moisture may be absorbed are: copper etching, dry film resist stripping, copper oxide treatment, etc. If this absorbed moisture is not removed immediately prior to the multilayer lamination process, the multilayer composite may not survive subsequent thermal excursions of plasma etch, solder reflow, wave soldering, hot air leveling, solder mask baking or thermal stress testing. The multilayer board may exhibit blistering, delamination, and/or the electrical properties may be degraded. An oven dry operation is required prior to all high temperature processing steps. The most critical drying step for the material is immediately prior to multilayer lamination.

Storage Procedure

After drying, the oxide treated inner layers should be stored in a dry or humidity controlled environment, such as a desiccant box or a nitrogen purge dry box, to minimize the possibility of moisture pickup. The inner layers should be laminated within as short a time as possible, preferably in less than four hours.

Lamination Process

The most critical process step is that of drying of all the materials prior to placing the package into the lamination press. This drying step is necessary to remove excess of moisture from the inner layers, prepreg and lamination accessory materials.

Pre-Lamination Drying Procedure

The prepreg that is to be used for the multilayer package should be vacuum dried at >29 inches(736 mm) of Hg for 24 hours immediately prior to lay-up.

The entire multilayer package should be held at room temperature under vacuum at >29 inches (736 mm) of Hg for 60 minutes immediately prior to lamination.

Lamination Cycle

Kevlar® fabric compresses and distorts under pressure, more so than E Glass, which dictates the use of lower lamination pressures. The use of an autoclave or vacuum assist lamination makes the use of lower pressure possible. Typically the pressures used under vacuum should be about 50% of those used for standard press lamination e.g. 12" x 18" (30 cm x 45 cm) panel non-vacuum 300 PSI (21 kg/cm2) versus vacuum 150 PSI (10.5 kg/cm2). The use of a low pressure "kiss cycle" until the resin has melted will minimize stresses on the material, and should improve registration. The resin melts at 160°F (71°C) and gels at 340°F (170°C). The transition from low pressure to high pressure should occur in the lower end of this window (165 - 175°F/74 - 79°C). A cure cycle of 360°F (182°C) for 90 minutes should give a Tg of 175°C. A properly cured laminate is essential for minimizing processing problems in subsequent process operations.

Drilling

Drilling techniques that work well with laminates made with E Glass may produce snags and tears in Kevlar®. Basic parameters of 450 SFM (135m/min) and 1 mil (27 micron) chip load seem to work well. It is necessary to check for proper drill geometry and quality, as well as checking the hole quality at set-up before proceeding with drilling the complete panel.

Hole Cleaning

A vapor hone/blast with 300-350 grit Aluminum Oxide to remove debris and loose fibers is advantageous prior to plasma etch.

Prebake

A prebake process prior to plasma etch of 250°F (121°C) for 90 to 120 minutes is recommended to remove any absorbed moisture.

Plasma Etch

A plasma etch process that has worked on epoxy Kevlar® to achieve positive etch-back is as follows:

1. Prebake at 250°F (121°C) for 90 to 120 minutes.
2. Plasma treatment:
   RF Power - 2 kw.
   Gas mixture - CF4 (Freon™) 70%
   O2 (Oxygen) 30%.
   Flow rate - 750 cc / minute each.
   Electrode temperature - 250°F to 300°F (121 - 149°C).
   Duration - 20 to 30 minutes.
   Purge - O2 100%.

Prebake

A prebake process of 250°F (121°C) for 60 to 90 minutes prior to electroless copper process is recommended to remove absorbed moisture.

Electroless Copper and Copper Plating

Standard practices for electroless deposition have been used as well as a double pass to aid in the encapsulation of any protruding fibers. A heavier copper plating (possibly 2 to 2.5 mils/50 - 63 microns as opposed to 1 to 1.5 mils/25 - 38 microns) may be desirable to improve thermal management and to resist barrel cracking due to the higher Z axis expansion of laminates reinforced with Kevlar® fabric.

Routing

The use of sharp cutters is more important with Kevlar® fabric than with glass fabric. Feed rates may need to be reduced by 10 to 25% to minimize the incidence of frayed edges.

Solder Reflow

A prebake process of 250°F (121°C) for 90 to 120 minutes prior to any solder reflow process is recommended.

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MATERIALS FOR ELECTRONICS

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