85N
PROCESSING GUIDELINES

Processing 85N Polyimide Materials

There are several areas in which the processing of polyimide multilayers differs significantly from that of handling conventional epoxy materials.

Key Differences in Processing Polyimide:

- Prepreg should be thoroughly dried before lamination, preferably in a vacuum at 29+” for at least 8-16 hours.
- Brown oxide or oxide alternative inner layer treatment followed by thorough rinsing is required for bonding. Old black oxide chemistries will not work.
- Carefully control the heatup rate during lamination for consistency of flow and thickness yields.
- High temperature cures are necessary to achieve optimum material properties.
- Plasma or permanganate etchback/ desmear. Sulfuric/chromic systems will not attack polyimides.

It has been determined that as little as 0.4% water retained in polyimide prepreg will result in slightly frothy flow and significant deterioration of the quality of inner layer bonding. Although desiccant boxes have been used with varying degrees of success for drying polyimide prepreg, we feel that 16 hours at 29” of vacuum is the best and most reliable way to dry polyimide prepreg for use. Polyimide will eventually start to compete with desiccant chemicals for water unless the desiccant is dried and changed regularly and consistently. Although 85N is slightly less moisture sensitive than older polyimides, these precautions are still valid.

PREPREG STORAGE CONDITIONS

85N prepreg should be stored in a controlled environment and protected from exposure to radiation or ultraviolet light. Prepreg properties will be maintained for three months after receipt if stored below 20ºC (<68ºF) and < 30% relative humidity. Prepreg should be allowed to equilibrate at processing conditions before use and care should be used to prevent moisture condensation. Arlon strongly recommends to vacuum desiccate prepreg for 8-12 hours prior to use.

LAYER PREPARATION

The use of brown (sometimes called red or bronze) oxide or newer oxide alternative processes are necessary for bonding polyimide inner layers. The needle like structure of the older black oxide does not survive internal shear forces caused by thermal stress and the bonds fail. Although aesthetically it is considered desirable to have a uniform dark oxide, bond strengths have been verified repeatedly to be higher when a much lighter oxide is used. This may be accomplished by reducing the concentration of oxide chemicals or through the combination of lower bath temperature and shorter times. Oxide weights of 0.1 to 0.2 mg/cm^2 are typical.

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Rinsing after brown oxide treatment is critical. Polyimides are sensitive to alkalis and will tend to hold onto excess alkali after oxiding. Alkali will also hide in the oxide's nodular structure. Hot water spray rinsing to remove the excess alkali both from the polyimide surface and from within the oxide itself is considered essential. Inadequate rinsing can be expected to cause serious inner layer bonding problems and possible delamination during subsequent thermal processing. Most of the newer oxide alternatives work well with polyimide materials. Achieving a rough copper surface at the microetch step is key to optimizing adhesion. Layers should be baked at 110 to 125°C just prior to lamination.

LAMINATION

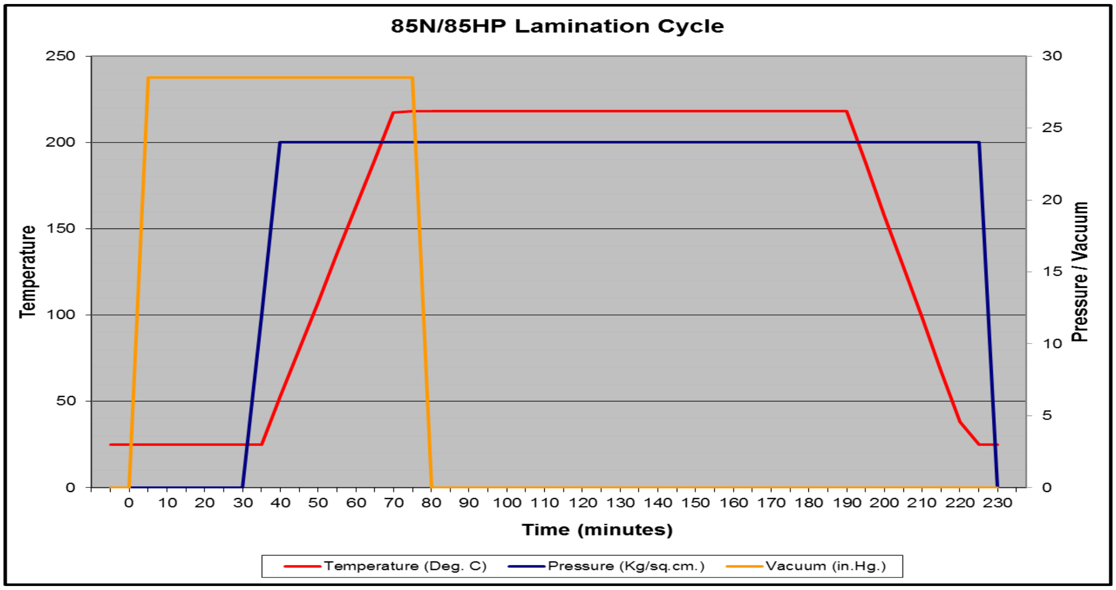
There is a wide variety of permutations of temperature, pressure and time that can be combined to make what is known as a "lamination cycle". These are varied to suit the capabilities and needs of the PWB producer. Pressure, temperature and time may vary depending on the available equipment, panel size and complexity and other factors. The following cycle is typical of what will be expected to yield good results. A heatup rate of 8-12°F/min. (4-6°C/min.) between 100°C and150°C (210°F and 300°F) is recommended. The use of vacuum assist is highly encouraged.

A minimum cure of 2 hours at 425-430°F is recommended to achieve full resin cure. It is preferred to complete the cure in the press although post cures has been used. The actual time required will be dependent on the laminate thickness, the number of laminates in the opening, the weight of copper in the laminate (especially true for heavy copper power or ground planes or metal core boards, etc.

There is no single correct pressure to use in laminating polyimide multilayers. It has been determined that the following are good starting points. If it is necessary to fill heavy copper, somewhat higher pressures might be of some help in addition to selection of a prepreg with adequate surface resin.

Polyimide Lamination Pressures

Panel Size	Pressure
in.	psi
12 x 18	200-250
16 x 18	250-300
18 x 24	300-350



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DRILLING

Starting point drilling recommendations for polyimide are as follows (with typical drill sizes given for reference purposes):

Drilling Parameters

	Drill Diameter (mm)		
	0.30	0.70	1.10
Chip Load (mils/rev)	0.54	2.13	2.5
Surface (ft/min) Drill	350	350	350
Speed (RPM) Feed	113,000	48000	31,000
Rate (in/min)	61	102	78
Hits/drill	750	750	750

A separate guide is available containing tables with detailed drilling parameters.

HOLE PREPARATION

Hole cleaning is strongly recommended with all resin systems used on multilayer printed wiring boards to assure reliable interconnection. A post-drill bake of 110-120ºC for 2 hours is recommended prior to desmear/etchback operations. Plasma hole cleaning is the preferred method, using a cycle suitable for polyimide. As a starting point, chemical parameters and dwell times appropriate for high glass transition temperature systems should be used for desmear and adjusted based on effectiveness. Etchback/Desmear should be optimized through careful study of hole wall quality pre & post processing.

Desmear or etchback using a 60% carbon tetrafluoride (Freon) / 40% dry oxygen plasma. Set plasma unit to 60% of power capability for 25 to 30 minutes. Time will vary depending on gas flow, temperature, hole sizes and quantity, etc. Follow as necessary by 2-3 minutes in ammonium bifluoride to remove exposed glass fibers.

Another hole preparation method is alkaline permanganate. As a preparation for plating of holes in polyimide PWBs, permanganate systems are reported to give good results and are available from several suppliers of PWB chemicals.

COPPER PLATING

Standard plating processes and several direct metallization systems have been used. To assure the highest standards of plated through reliability, copper plating thickness should be 0.0015" at the center of the plated through hole, for high layer count PWBs.

METAL FINISHING

Traditional metal finishes have been used without issue including reflowed tin-lead, hot air leveled solder, electroless and electrolytic nickel, tin-palladium, tin-silver, immersion tin, and various types of gold plating. A bake at 110-120ºC for 2 hours prior to thermal excursions, such as those encountered during hot air solder leveling, is considered prudent. Bake times and temperatures may require adjustment depending on local conditions.

SOLDER MASK

Liquid photo-imageable solder masks, as well as screened-on thermal cured epoxy solder masks may be used on 85N and 85NT based PWBs without special surface preparation.

PROFILING/ROUTING

Either scoring or routing may be used with polyimide materials. A carbide, multifluted router bit is recommended for the best edge quality. Tool wear, as well as edge quality, should be monitored to avoid cracking or fracturing the edges. High spindle speeds and reduced in-feeds may be necessary to improve router yield. Rigid phenolic backer board should be used to minimize burring. Contact your router supplier for additional recommendations. Scoring, using a 30ºV -pitch blade, is a cost effective technique for many commercial applications.

PRINTED WIRING ASSEMBLY

Standard through hole and surface mount assembly processes are compatible with 85N. Pre-baking boards is recommended for 6 hours at 110-120ºC, although longer times may be necessary depending on overall thickness or if boards have been exposed to moisture or humidity for long periods of time. Fixturing may be required for thin boards or in-panel soldering to minimize warping. PWBs should be removed from panels by sawing or routing; shearing will induce warp and increase the possibility of cracked ceramic components.

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