## Arlon 25N / 25FR Process Overview

Arlon 25N/25FR offers the electrical performance advantages required by designers of RF, microwave, and high-speed digital devices, combined with the process cost advantages of traditional printed wiring board manufacturing methods. 25N/25FR is a true enabling technology, which allows the cost effective design, implementation, and complete integration of complex circuitry into a homogeneous dielectric package. Following are recommendations developed by our Technical Service Staff that highlight important considerations when processing this material at a typical PWB facility.

### Material Handling

25N/25FR is a soft material when compared to an epoxy or polyimide laminate. Special care should be taken when handling laminate 0.020" or less, to avoid plastic deformation of the layer. Lead frames are recommended with conveyorized develop, etch, and strip processing. Do not store prepreg under vacuum. Vacuum desiccation of prepreg is not recommended prior to lay-up.

### Layer Preparation

25N/25FR layer material should be cleaned by chemical methods only. Mechanical scrubbing will induce residual strain in the material. Standard develop, etch, and strip chemistries have been shown to be compatible with 25N/25FR. The material does show a tendency to shrink more than epoxy or polyimide after etching. Scale factors will need to be developed for specific applications based on retained copper and PWB configuration. 0.0012 inch/inch is suggested as a starting point on 0.006" core material with 1 ounce copper, signal over ground configurations.

### Oxide

We recommend the use of a brown oxide without reduction chemistry to avoid oxide breakdown at high lamination temperatures. 25N/25FR does not require extensive baking after oxide and prior to lamination due to its low moisture uptake characteristics. A bake for 30 minutes at 225-250° F in an air-circulating oven is sufficient to dry the material.

### Lamination

Foil lamination has produced variable results due to differences in bond enhancements applied by the copper supplier. Contact your Arlon Technical Service representative for recommendations. 25N/25FR prepreg requires a slow rate of heat rise during lamination to assure optimal bonding and encapsulation of circuitry. A pre-vacuum in the press for 30 minutes prior to application of heat or pressure is recommended for removal of air from the package. 300-350 psi is recommended for lamination of a typical 18"x24" panel. Full pressure should be

maintained throughout the cycle. A heat rise of 4-6F/minute from 180F to 280F is critical to the bonding mechanism of this material. Complete cure Should be accomplished in the lamination press. A dwell of 90 minutes at 375° F is necessary to fully develop the electrical and mechanical characteristics of 25N/25FR. A cool-down rate of 10F/minute or less is recommended to minimize warping. A single ply of 2112 25N/25FR prepreg will yield between 0.0057" to 0.0063", depending the configuration of the layers to be bonded.

**Drilling**

Drilling parameters used with epoxy/glass printed wiring boards have been shown to work well with 25N/25FR. Conventional rigid entry and exit materials should be used to minimize copper burrs and optimize hole quality. 25N/25FR contains a proprietary ceramic filler, so only high quality carbide tipped drills should be used for mechanical hole formation. A drill bit with maximum flute volume is recommended, as the resin system is less frangible than more conventional materials. Chip load and surface speed will vary by drill supplier, hole diameter, layer count, and hole quality considerations: chip loads can range from 0.001" to 0.004", and surface speed from 300 to 450 SFM. Tool life is reduced due to the abrasive nature of the ceramic filler. The exact number of hits should be based on an evaluation of the interaction between board design, hole wall quality, and the particular tool.

**Hole Preparation**

Hole cleaning is strongly recommended with all resin systems used on multilayer printed wiring boards to assure reliable interconnection. Both desmear as well as positive etchback have been shown to be effective on 25N/25FR multilayer PWBs. Plasma hole cleaning using a cycle suitable for polyimide that removes 0.0001" to 0.0004" of material laterally from the hole wall is effective for applications requiring etchback. Alkaline permanganate is effective for desmear and has also been used successfully to achieve etchback. Chemical parameters and dwell times appropriate for high glass transition temperature epoxy processing are sufficient for desmear; longer dwell times or higher permanganate bath temperatures may be necessary to achieve positive etchback.

**Copper Plating**

25N/25FR contains no PTFE and, therefore, requires no special hole treatment to improve wetting of the drilled hole walls. Standard plating processes and several direct metallization systems have been used with 25N/25FR. 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

A variety of metal finishes have been used on 25N/25FR PWBs 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 225-250F for 1 hour 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. We recommend that alternative finishes to hot air solder leveling (HASL), such as those mentioned above are given serious consideration when fabricating thin double sided PWBs such as LNBs or patch antennas. HASL will induce warping in most thin substrates with ground planes on one side of the board. Immersion in cool water after HASL while the PWB remains hot will cause excessive warping, particularly on thin PWBs.

## Solder Mask

Liquid photoimageable solder masks, as well as screened-on thermal cured epoxy solder masks may be used on 25N/25FR PWBs without special surface preparation.

## Profiling/Routing

Either scoring or routing may be used with 25N/25FR. A carbide twin flute "up cut" router bit is recommended for the best edge quality, however, a variety of conventional tool configurations using standard routing methods have been used with success. Chip breaker style bits do not give the best edge quality with 25N/25FR and are prone to packing with router debris. Tool wear, as well as edge quality, should be monitored due to the abrasive nature of the ceramic filler found in 25N/25FR. Rigid phenolic backer board should be used to minimize burring. Scoring, using a $30^{o}$ V -pitch blade, is a cost effective technique for many commercial applications; care must be exercised when removing boards to avoid warp. Shearing is not recommended for thin PWB products fabricated with 25N/25FR as warp and twist may be induced.

## Printed Wiring Assembly

Standard through hole and surface mount assembly processes are compatible with 25N/25FR. If pre-baking boards is part of your normal process, we recommend that a 1-2 hour bake at 225-250 F is used. Fixturing may be required for thin boards or in-panel soldering, due to the lower modulus of 25N/25FR. Assembly methodologies compatible with PTFE boards are appropriate. Special techniques may be required if extensive hand rework and repair is required to avoid pad lifting. PWAs should be removed from panels by sawing or routing; shearing will induce warp and increase the possibility of cracked ceramic components.