MULTICLAD™ HF PROCESSING GUIDE

HALOGEN-FREE LOW-LOSS LAMINATE & PREPREG SYSTEM

Introductory Process Overview

ARLON's MultiClad HF Low-Loss product is a novel thermoset laminate and prepreg system that offers a significant improvement in electrical performance of a traditional High Tg FR4, but with a halogen-free flame retardant to meet the design needs of tomorrow. This product is a true enabling technology, offering low CTE, high Tg reliability, but with the signal integrity of a low-loss, high frequency material for high speed designs. The following are recommendations developed by our Technical Service Staff that highlight important considerations when processing this material at a typical PWB facility. These are only starting points and will require optimization specific to the design and to the fabrication process and equipment used.

Prepreg Storage & Handling:
MultiClad HF prepreg is significantly different from earlier generation of low-loss thermoset materials in that they are not tacky, brittle or dusty. 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 68ºF (<20ºF) 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
MultiClad HF layer material should be cleaned by mild chemical clean followed by light tack clean. Mechanical scrubbing is discouraged as it could induce strain in the material. Use of reverse treat (RT) copper foils are recommended for easier surface preparation and better signal integrity. Standard develop, etch, and strip chemistries have been shown to be compatible with MultiClad laminates. Arlon recommends that prototype builds be inspected for alignment and to determine scaling factors prior to production runs.

Oxide
All commercial oxides are compatible with MultiClad HF. It is recommended that inner layers be dried to remove moisture prior to lamination. A bake for 30-60 minutes at 225-250° F in an air-circulating oven is sufficient to dry the material.

Lamination
Inner cores should be baked at 225-250ºF for 60 minutes to remove moisture prior to lamination to ensure good bond. 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 psi is recommended for lamination of a typical 18"x24" panel. Full pressure should be maintained throughout the cycle. A heat rise of 8-12ºF/minute from 200ºF to 300ºF is critical to the bonding mechanism of this material. A dwell of 90 minutes with a material temperature at 360ºF (182ºC) is necessary to fully develop the electrical and mechanical properties. A cool-down rate of 10ºF/minute (6ºC/minute) or less is recommended to minimize warping. Two plies prepreg may be necessary with heavy copper foils to minimize voiding and to insure circuit filling. Direct foil lamination for outer layers

are possible, but results will vary depending on the specific copper foil used. The glass transition temperature (Tg) of the material should be verified when establishing lamination parameters to insure adequate curing prior to drilling/plating. Higher temperatures & longer cure times might be needed for thicker boards to insure full cure. Contact your Arlon Technical Service representative for specific recommendations.

LAMINATION SUMMARY	
Prebake:	225-250ºF for 60 minutes, use inner layers within 2 hours
Pre-Vacuum:	Apply vacuum 29" Hg for 15 – 30 minutes
Heat-Up Rate:	8– 12ºF per minute
Pressure:	250 – 300 psi, depending on panel size
Cure Conditions:	90 minutes at 360ºF
Cool Down:	≤10ºF per minute

Drilling

Drilling parameters used with ceramic filled printed wiring boards have generally worked well with the MultiClad system. Conventional rigid entry and exit materials should be used to minimize copper burrs and optimize hole quality. High quality carbide tipped, under-cut drill bits are recommended for mechanical hole formation. 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 0.003", and surface speed from 300 to 450 SFM. Aluminum or lubricated back-up/entry materials are recommended. Tool life should be evaluated based on an evaluation of the interaction between board design, hole wall quality, and the particular tool. Consult your drill supplier for more information in optimizing drilling for this material.

DRILLING OVERVIEW		
Drill Bits:	0.010" – 0.018"	0.020" - 0.040"
Surface Speed:	300 – 350 SFM	350-450 SFM
Chip Load:	1.0 – 1.5 mils/rev	1.25 – 2.5 mils/rev
Maximum Hit Count:	300 – 500	400 – 700

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 or other High Tg resin systems, but is not required. As a starting point, chemical parameters and dwell times appropriate for high glass transition temperature epoxy systems should be used for desmear and adjusted based on effectiveness. NMP (n-methyl pyrolidone) and cyclic amine solvents used for solvent swell are **not** recommended with this product. Etchback/Desmear should be optimized through careful study of hole wall quality pre & post processing.

Copper Plating

The MultiClad system 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. 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 225-250F 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 MultiClad based PWBs without special surface preparation.

Profiling/Routing

Either scoring or routing may be used with MultiClad. A carbide, multifluted router bit or diamond cut routers are recommended for the best edge quality. Chip breaker style bits do not give the best edge quality with MultiClad 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 the MultiClad system. 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 MultiClad. Pre-baking boards is recommended for 1-2 hour bake at 225-250 F, although longer times may be necessary depending on overall thickness or if boards have been exposed to moisture or humidity for any length 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.

For additional information, please contact your local Arlon representative.

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