

Fabrication Guidelines

Microwave Materials

Arlon DiClad, CuClad, IsoClad and AD Series Laminates

Arlon's PTFE laminates are fiberglass/PTFE resin composites used as printed circuit substrates. These materials are used in high frequency applications where low loss and controlled dielectric constant are required, such as filters, couplers, low noise amplifiers, power dividers, and combiners. Using precise control of the resin to glass ratio, Arlon is able to offer a range of materials from the lowest dielectric constant and dissipation factor to more highly reinforced laminate having better dimensional stability.

PTFE materials used in stripline or microstrip applications can be processed using conventional PTFE board fabrication processes and techniques. These materials can be processed using conventional process parameters with few in-line modifications.

Processing Guidelines for DiClad, CuClad, Isoclad and AD Series Materials

Storage: Store the material flat in a cool dry area away from direct sunlight, avoiding copper oxidation and material contamination.

Bonding: Stripline or Buried Microstrip bonding can be accomplished using Arlon's 6700 or 6250 bonding films, or FR-4 prepregs. Copper oxide treatments can be used when bonding with FR-4 prepregs. It is best to bond directly after copper etching. Adhesion to the laminate surface can be improved with sodium or plasma etch prior to bonding. Adhesion to the copper surface can be improved with a micro-etch prior to bonding. Contact Arlon for process parameters for use with 6700 or 6250 bonding films.

Dimensional Stability: Dimensional stability of the laminate depends on dielectric thickness, resin to glass ratio, copper foil thickness, and the percent of retained copper specific to each product design. Designs having significant ground planes will have improved dimensional stability. The stability may be improved by using solid copper fill and borders, minimizing mechanical scrubbing, or baking for 1 hour at 300°-310°F (150°-155°C) and cooling slowly, prior to establishing a pattern for registration.

Drilling: Drill PTFE materials using highly polished carbide tools. It is not recommended to use repointed tools. Panels can be drilled in stacks based on total thickness. The use of rigid entry (.020"-.030") and exit (.060"-.093") material is recommended. The following feeds and speeds are recommended as a beginning point to develop specific process parameters.

Chip load: 0.002-0.003 inch/revolution
Surface speed: 400-450 surface feet/minute
Retract rate: 500-600 inch/minute
Tool life: 500-1000 hits (depending on stack height)

Deburring: Optimization in drilling will eliminate the need for aggressive deburring. If deburring is necessary, properly support the back side of the panel and apply light circular motion with wet 600 grit sandpaper. Use a high pressure spray to remove loose debris in the holes. Do not mechanically deburr.

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MATERIALS FOR ELECTRONICS

PTFE Fabrication Guidelines (continued)

Through Hole Preparation:

Hole wall resin activation is necessary to ensure coverage with electroless copper deposition. This can be done with plasma or sodium etchants. The following is a typical plasma cycle for PTFE materials:

Step	Gas Mixture	Time/Power
Heat-up	80% O ₂ /20% N ₂	To reach 70-90°C Material temp
Surface Etch	80% H ₂ /20% N ₂ or 80% N ₂ /20% O ₂	30 minutes @ 75% of full power
O ₂ Burn	100% O ₂	50% power / 5 min to remove residue

Hold time after plasma is limited. The plasma process should be repeated if hold time extends beyond 12 hours. For additional information on plasma process for PTFE visit www.arlon-med.com.

Commercially available sodium etchants are commonly used. Contact the following suppliers to obtain the processing guidelines for their products:

Acton Technologies, Inc.	Product: Fluoroetch®	Phone: 717-654-0512
Matheson Gas Products	Product: Poly-Etch® and Poly-Etch W®	Phone: 978-283-7700
W.L. Gore & Associates	Product: Tetra-etch® and Tetra-Prep®	Phone: 800-344-3544

Surface Prep:

Bake for 90 minutes at 110°C after sodium etch. Standard chemical cleaning techniques are recommended. It is not recommended to mechanically scrub PTFE materials, due to the dimensional change that may occur when force is applied to the surface of the copper.

Copper Plating:

Conventional electroless or direct plate technologies and electrolytic copper chemistries may be used.

Etching:

Conventional ammoniacal or cupric etchants may be used to remove unwanted copper. Rinse thoroughly with warm water after processing.

Resist Strip:

Conventional resist strippers may be used to remove unwanted resist.

Soldermask:

For SMOBC parts it is recommended that soldermask coating take place within 12 hours after copper etching for best adhesion. To improve soldermask adhesion, sodium or plasma etch will prepare the laminate surface, and a micro-etch will prepare the copper surface. If required, bake PTFE materials for one hour at 225°-250°F (110°-120°C) to remove residual moisture before soldermask processing.

Solder Leveling:

Bake PTFE materials for one to two hours at 225°-250°F (110°-120°C) prior to solder leveling. It is recommended that boards be racked to ensure proper air circulation around the parts to fully dissipate any residual moisture. Be aware that some PTFE laminates have high z-axis expansion. HAL may result in barrel cracks. Plate 2 mil minimum in thin laminates requiring HAL.

Electroless Gold:

It is important to employ adequate rinsing procedures, according to the chemical vendor processing guidelines, to ensure reliable process yields for chemical plating.

Routing:

It is recommended to use commercially available two-flute, slow spiral, micro-grain carbide, upcut endmills. Support the PTFE product with rigid entry and back-up materials. It is important for the router pressure foot to exert sufficient clamping pressure to the material stack.

Typical rout parameters for an 0.062" cutting tool are:

Spindle Speed: 15,000 rpm Table Feed Rate: 15 inches/minute

The information and data contained herein are believed reliable, but all recommendations or suggestions are made without guarantee. You should thoroughly and independently test material for any planned applications and determine satisfactory performance before commercialization. Furthermore, no suggestion for use, or material supplied shall be construed as a recommendation or inducement to violate any law or infringe any patent.

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