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N4000-29

General Processing Guidelines

Lead Free, High Tg Multifunctional Epoxy

N4000-29 provides good performance in high-density multilayer applications while maintaining standard high-Tg FR-4 processing latitude. It is designed with superior thermal resistance for lead free assembly applications and reduced Z-axis expansion for high layer count PCB designs.

Material Handling & Storage

Store laminates flat in a dry environment. Do not bend, scratch or dent laminate.
Store prepreg flat, with a storage temperature of <72° F (<23°C) and ≤50% RH.
For extended prepreg storage, reduce storage temperature to <41° F (<5°C).
Reseal opened bags of unused prepreg.

Copper & Surface Preparation

Prepare copper surface for photo resist application according to the following options:
The type of copper surface preparation employed should relate to the foil type as specified below:

- **Reverse Treat Foil (RTFoil®)**: Chemical clean followed by a light tack clean.
- **Shiny Copper Foil**: Chemical and / or Mechanical clean followed by a light tack clean.
- **Double Treat Foil**: Chemical clean followed by a light tack clean.

Note: Chemical clean consists of a mild cleaner to remove soils followed by a mild acid to remove the passivation.

Bond Enhancing Treatments

One of the following options can be used successfully:

- Option 1: Brown oxide with DMAB (dimethylamino borane) reduction.
- Option 2: Brown oxide with controlled dissolution post-treatment.

- Option 3: Peroxysulfuric oxide alternative.

Note: The brown oxide deposit should be tested using a weight loss test. Thick oxide deposits tend to yield poor thermal resistance. The oxide deposit should not exceed 0.7 mg/cm2.

Inner Layer Drying

Inner layers should be oven dried to remove absorbed moisture. Absorbed moisture in the inner layer can affect the curing properties of the prepreg.

	Recommendations
Signal layers	225°F (110°C) in vertical racks with minimum 0.5” (12 mm) separations for 30 minutes
Plane layers and plated sub-lam layers	225°F (110°C) in vertical racks with minimum 0.5” (12 mm) separation for 60 minutes

Note: 1)Check with oxide supplier if using DMAB oxide reducer. Excessive exposure to heat may re-oxidize the reduced treatment.
2) Baking cores in stacks does not provide an effective airflow to remove entrapped moisture from the cores and should be avoided.
3) Drying temperatures below 212°F (100°C) are not effective in removing absorbed moisture from the layer.
4) If slip sheets are used to protect layers it is important that they not contain wax or silicon based materials which can transfer between cores and affect adhesion after lamination.

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Lay-up

For best results, use inner layers within 2 hours after drying. Rebake inner layers if not used within 24 hours.

Lamination

For best results, fully cure in vacuum assisted hydraulic press

	Recommendations
Vacuum Gauge Pressure	A minimum of 28.5" Hg (965 mbars) for 15 minutes before applying heat & pressure.
Heat Up Rate*	8 - 12°F (4.4 - 7 °C) per minute
Critical Range	150 – 250°F (70 – 130°C)
Pressure	200 - 300 psi (15 - 20 bar)
Cure Time, Temp	75 minutes @ 365 °F (75 minutes @ 185 °C) (If boards have a significant amount of internal copper planes then cure time may need to be extended)
Cool Down Rate	7°F (4°C) per minute or less until stack reaches 260°F (127°C)
Breakdown	After panels have cooled below 130°F (55 °C)

*Note: Heat rise is usually controlled by using an acceptable thermal lagging such as kraft paper or press pads. Alternately the heat rise can be controlled by ramping the platen temperature about 5 – 10 °F (5 °C) higher than book temperatures and controlling the heat up rate through the critical temperature range.

Drilling

Typical Drill Parameters	Recommendations	
Drill Sizes	0.012" – 0.018" (0.3 – 0.5 mm)	0.020" - 0.040" (0.5 – 1.0 mm)
Surface Speed	325 – 350 SFM (99– 106 m/min.)	350-375 SFM (106 – 114 m/min.)
Chip Load	0.7 – 1.2 mils/rev (18 – 31 µm/rev)	1.2 – 2.6 mils/rev (31 – 66 µm/rev)
Maximum Hit Count	1200	900 – 1200
Typical Stack Height	<0.180" (<4.5 mm)	<0.180" (<4.5 mm)

Drilling parameters should be adjusted depending on hole size, layer count, panel thickness, copper content and stack height. For specific feed and speed parameters, contact your drill supplier or AGC'S technical representative. Detailed typical drilling parameters are available for many products. Please contact agc-ml.info-maltimaterial@agc.com.

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Hole Cleaning (Resin Smear Removal)

Most commonly used desmear methods are compatible.

Plasma: Typical desmear conditions

Temperature	Gas mixture	Power	Time
80± 2°C	10%CF_4 , 80% O_2, 10% N_2	4000 W	20-25 min

Note: Depending on the amount of resin removal required, a preheat cycle and an oxygen burn cycle for ash removal may be necessary. Following the plasma cycle a permanganate desmear process is desirable to provide resin texturing. See your technical representative for additional information.

Note: If etch-back (3-point contact) is required, a combination of plasma, followed by a chemical desmear process, is the preferred method.

Chemical Desmear:
Most solvent swell and permanganate etch processes are suitable. Aggressive solvent swell processes and double pass chemical desmear processes should be avoided.

Type	Temp (°F /°C)	Time
Butyl / hydroxide solvent	173 ± 5 / 78 ± 2	5 - 8 min.
Cyclic Amine 50% v/v	170 ± 5 / 77 ± 2	3 - 5 min.
Cyclic Amine 100%	130 ± 5 / 54 ± 2	3 - 5 min.
Alkaline Permanganate oxidizer	175 ± 5 / 79 ± 2	10 - 15 min.

Routing

Typical Drill Parameters	Recommendations
Stack Height	0.250” (≤6.25 mm)
Tool Size	0.093” (2.4 mm)
Feed Rate	60 IPM (1.5 m/min.)
Speed	24K RPM

These guidelines can provide only basic and reference information for PCB fabricators. Because of different environment, equipment, tooling and so on, in all instances, the user shall determine suitability in any given conditions or applications. For more detailed processing information, please contact an AGC engineer or sales representative.