2929 Bondply
Multi-Layer Board Processing Guidelines

MATERIAL DESCRIPTION: 2929 bondply is an unreinforced, hydrocarbon based thin film adhesive system intended for use in high performance, high reliability multi-layer constructions. A low dielectric constant (2.9) and loss tangent (<0.003) at microwave frequencies makes it ideal for bonding multi-layer boards (MLB's) made using PTFE composite materials such as RT/duroid® 6000 and RO3000® series laminates, filled hydrocarbon resin composites such as RO4000® cores, and specialty thin core laminates. The proprietary cross-linking resin system makes this thin film adhesive system compatible with sequential bond processing while controlled flow characteristics offer excellent blind via fill capability and potentially predictable cutback ratios for designs requiring blind and/or buried cavities. 2929 bondply is compatible with traditional flat press and autoclave bonding.

The film is currently available in 0.0015", 0.002", and 0.003" thick sheets. Individual sheets can be stacked to yield thicker adhesive layers. The unreinforced thin film can be tack bonded to inner-layers to ease simultaneous machining of cut-outs through core and adhesive layers and to facilitate formation of vias using conductive pastes. An easy to release carrier film protects the adhesive layer from contamination during machining, screening of conductive pastes, and MLB booking.

These processing guidelines offer current "best practices" procedures and parameters for bonding MLB's using 2929 bondply. The recommendations will be updated as additional information becomes available. A Rogers' Technical Service Engineer (TSE) should be consulted for our latest information. All first-time users are urged to contact a Rogers' TSE, Sales Engineer (SE), or Applications Development Manager (ADM) for evaluation/demonstration samples and special handling instructions. A video showing the recommended technique for laying up a multilayer using 2929 Bondply can be viewed in the video section on the Rogers Technology Support Hub: www.rogerscorp.com/techub.

STORAGE: Materials should be stored between 10 to 30°C (50 to 80°F) and relative humidity less than 60%. The uncured material should be shielded from long-term exposures to UV light. 2929 bondply should be used within six months of the date of shipment.

DESIGN CONSIDERATIONS: The post-bond thickness of 2929 bondply can be predicted using the following formulation. It should be noted that copper distribution, planarity of platens and caul plates, layer count, compressible padding, etc… will effect the final thickness and uniformity thereof. The following calculation can be used as a starting point to predict post-bond core:core spacing, but fine tuning based upon actual thickness measurements is recommended.

Core: core spacing = 2929 + (Side A Cu thk X retained Cu) + (Side B Cu thk X retained Cu) where:

Core: core spacing is distance between etched core surfaces on opposing (A & B) sides of 2929 bondply. The distance is measured from the base of copper features.
2929 is pre-press thickness of 2929 adhesive.

Side A and Side B Cu thickness is the thickness of the copper layers on the A and B side of the 2929 bondply. Typically, 0.5ED would be 0.0007" while 1ED would be 0.0014".

Retained Cu is the percent of copper remaining on surface A and B after inner-layer preparation divided by 100. A solid copper plane would be 100%/100 = 1.0.

Example:
2929 thickness = 0.004"
Side A Cu thick = 0.0007" (0.5E)
Side B Cu thick = 0.0014" (1E)
Side A retained Cu = 0.25 (25%/100)
Side B retained Cu = 0.5 (50%/100)

Core: core spacing =
0.004" + (0.0007 X 0.25) + (0.0014 X 0.5) = 0.0049"

Note: Cu:Cu spacing would be
0.0049" – (0.0007" + 0.0014") = 0.0028"

FORMATION OF TOOLING HOLES: Tooling holes can be punched or drilled as single sheets or in stacks of multiple sheets. The maximum recommended stack height for punching holes is ten sheets. The maximum recommended stack height for drilling holes is 25 sheets providing a new drill and proper parameters are used.

For either hole formation technique, the 2929 sheets should be stacked between layers of pressed phenolic entry material with the PET side on top. A release sheet should be placed between the phenolic sheet and the bottom layer of 2929 to avoid welding the adhesive to the exit material during formation of the tooling holes. The white tag stock paper used to package 2929 for shipment can be used as the release layer.

Tooling holes can be punched as standard. Holes should be drilled using 200 SFM and a 0.0015"/" infeed rate. The default parameters for all drill diameters greater than 0.060" are 20 KRPM spindle speed and 25 IPM infeed.

INNER LAYER PREPARATION: Innerlayer metal surfaces should be oxide treated to promote mechanical adhesion. A wide range of oxide alternatives and some reduced black or brown oxides have been used successfully with 2929 Bondply. The thermal capabilites of a given oxide treatment must be understood in order to select the appropriate lamination temperature.

Please refer to the specific laminate manufacturers' data sheets and processing guidelines for any recommended treatment of the etched dielectric surfaces and also to insure the laminates can tolerate the lamination temperature required for 2929 Bondply.

MULTILAYER LAYUP (Reference 2929 instructional video noted on page 1): The uncured adhesive layer is fragile. The release sheet facilitates handling, serves as a protective barrier against contamination, and should not be removed until after the adhesive layer has been punched, machined (cavity designs), and positioned onto the inner-layer surface. Once positioned onto the inner-layer surface, the carrier film should be carefully peeled beginning in one corner and peeling toward the diagonal corner. The preferred method of initiating the separation process involves bending one corner of the adhesive over until the PET carrier is in contact with itself. Pressing on the bend will snap the adhesive layer. The PET carrier can be slid toward the opposing corner while maintaining a slight downward pressure. The free hand should be used to hold down the adhesive layer during removal of the release liner. Special care may be required to avoid tearing of the adhesive layer near tooling holes and cut-outs. Pre-releasing and replacing the PET layer may prove helpful before machining cut-outs or when booking very thin (0.0015") adhesive layers.

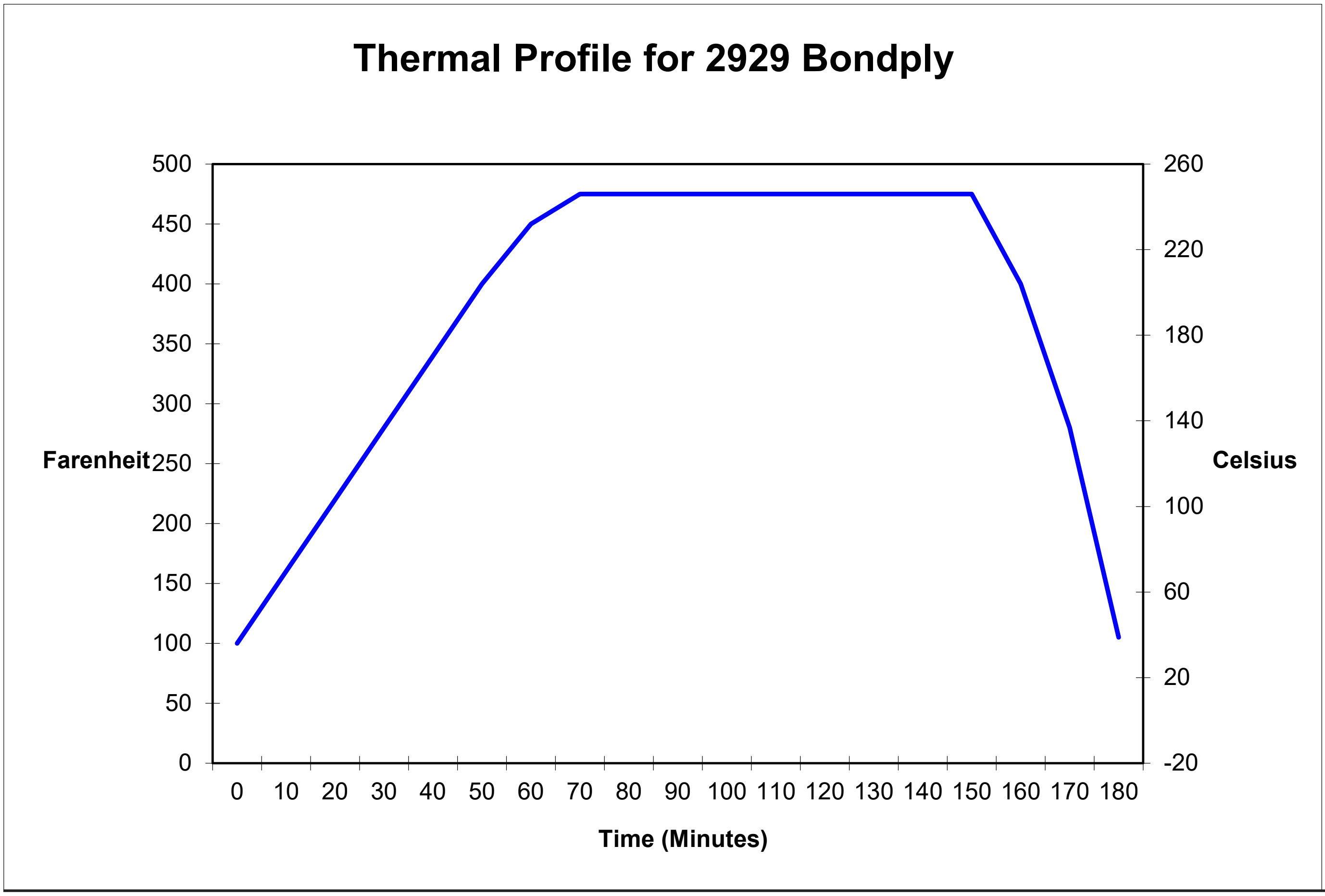
Handling, especially of thin (<0.002" thick) layers, can be facilitated through the use of tack bonding. Tack bond is possible using a hot roll laminator at 125°C (275°F), 6" per minute feed rate, and 30 PSI. Tack bonding is also possible at 110°C (230°F) providing the feed rate is slowed to 2" per minute feed rate.

Tack bonding can be accomplished using a vacuum lamination system. Parameters would include a 60-90 second dwell with bondline temperatures between 115 to 140°C (240 to 285°F). When possible, tooling holes should be formed after the tack bonding process. When properly applied, the tack bond should remain intact for 2-4 days and the adhesive layer should remain fully functional. Note: As is true with many bonding materials,the use of compressible padding placed internal to the tooling plates is recommended to improve pressure uniformity across the multilayer book. When selecting a press pad material, it is important to insure the material is properly rate for the selected bonding temperature. In addition, some designs may rquire additional conformance. In those cases, the use of skived PTFE or similar products have been used successfully between the multilayer panel and the stainless steel separators plates.

MLB BONDING CYCLE: The press cycle should include a 2.5°C - 4.0°C/min (4.5°F - 7.0°F/min) ramp rate from room temperature to 245-250°C (473 to 482°F) and a 90-120 minute dwell at 245-250°C.

NOTE: 2929 bondply can be bonded at lower temperatures if required to compensate for less thermally robust oxide treatements. However, the absolute minimum product temperature must be above 224°C (435°F). Dwell time should be 120 minutes when cure temperature is less than 245-250°C (473 to 482°F).

The recommended applied pressure for the entire cycle is 400 PSI, although pressure can be increased or decreased through evaluation to control flow of the resin/filler system. Vacuum assistance is preferred, but not required. Cooling can be accomplished in the hot press or after a transfer to a cold press for an accelerated rate of cooling. 2929 bondply is also compatible with autoclave bonding using the thermal profile described above.



POST-MLB BOND PROCESSING: With minor exceptions, bonded MLB's should be processed using procedures and parameters associated with the core layers. Thin sub-assemblies should be handled carefully after bonding to avoid excessive bending. 2929 can be desmeared chemically or using plasma. A plasma cycle is provided below. The adhesive system does not require special sodium or plasma wettability treatments prior to plating, but 2929 is compatible with these processes should they be required for the core layers.

Plasma Desmear Cycle
Frequency: 40 KHz
Voltage: 500-600V
Power: 4000-5000Watts

Pre-Heat to 60°C using:
Gases: 90% O2, 10% N2
Pressure: 250mTORR

Desmear using:
Gases: 75% O2, 15% CF4, 10% N2
Pressure 250 mTORR
Time 10-15 minutes

Prolonged exposure in an oxidative environment may cause changes to the dielectric properties of hydrocarbon based materials. The rate of change increases at higher temperatures and is highly dependent on the circuit design. Although Rogers' high frequency materials have been used successfully in innumerable applications and reports of oxidation resulting in performance problems are extremely rare, Rogers recommends that the customer evaluate each material and design combination to determine fitness for use over the entire life of the end product.

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