Processing Guidelines for RO4450B™ and RO4450F™ Bondply

STORAGE:
Upon receipt, all bondply should be immediately moved from the receiving area into a controlled environment. Proper storage conditions would include temperatures between 10°C and 30°C (50°F and 85°F) and protection against exposure to catalytic conditions such as high radiation and ultraviolet light. The bondply should not be stored under vacuum. It is best to store the bondply in its heat sealed packaging, partially used packages should be resealed with tape.

When properly stored, bondply properties will be maintained for 6 months from the shipment date. A "first-in, first-out" inventory system is recommended.

UNPACKING:
RO4400™ bondply is packaged in a dust-free environment, but will collect dust and debris from counter tops. We recommend counter tops be cleaned prior to unpackaging the bondply. Plastic slip-sheeting has been provided to ease separation of individual plies and to shield the bondply from contamination until it is ready for use.

TOOLING:
Tooling holes can be punched, drilled, or cut. Thin entry and exit materials may be needed to support the bondply through the tooling hole formation process. The slip-sheeting should remain in place through tooling as it will shield the bondply from contamination and should eliminate the risk of individual plies fusing together as the tooling holes are formed.

MULTI-LAYER PREPARATION:
Each ply of RO4450B™ and RO4450F™ 4-mil bondply will bond to a nominal 0.004" (0.101mm) thickness, and each ply of RO4450B 3.6-mil bondply will bond to a nominal 0.0036" (0.091mm) when recommended bonding parameters are used. The actual thickness each ply will add to a multi-layer construction is dependent upon the weight and distribution of copper on the innerlayer surfaces.

Rogers recommends the use of two or more plies of bondply between metal layers, and that the proper press cycle parameters are used per our guidelines. Any deviation from these recommendations can lead to poor fill performance or electrical failures, especially in high-speed digital/high density designs. If the design requires single-ply usage between metal layers, the user must ensure the proper testing protocol is in place to evaluate fill/flow and electrical performance. Contact your local technical services representative for questions or assistance with these guidelines.

Also contact your local Technical Services Representative when bonding designs using more than six metal layers, copper layers 35 microns or thicker, having plane layers on opposing sides of the bondply, or when bonding to FR-4 cores. In some instances a high bonding pressure, such as 650-750 PSI, may be required.

Etched dielectric surfaces should not be mechanically or chemically altered prior to multilayer bonding. Innerlayer metal surfaces should be oxide treated to promote improved mechanical adhesion. Reduced black oxide, brown oxide, and additive or subtractive oxide alternatives have been successfully applied. Inner-layers should be baked for 15 to 30 minutes at 115°C (239°F) to 125°C (257°F) just prior to preparing the multi-layer package for bonding.

Core bonded constructions are preferred, but foil bonded outer-layers are an option with RO4400 bondply. Rogers' qualified and recommended copper foil is CU4000(TM) sheeted foil.

RO4450B and RO4450F bondply allow a rapid ramp to 107°C (225°F), a 2.8°C - 4.0°C/Min (5°F-7°F) ramp rate between 107°C (225°F) and 121°C (250°F), and a maximum 2.2°C/Min (4°F/min) from 121°C (250°F) to 177°C (350°F).   A minimum pressure of 400 psi should be used regardless of vacuum assistance potential and lengthy (>5 minutes) draw downs should be avoided. Pressure should be applied before package temperature exceeds 38°C (100°F). Transfer to a cooling press is allowed after a 60 minute dwell at 177°C (350°F). The temperature profile can be matched using an in-hot process. Time vs. temperature trials may be required to define requirements for lagging materials; thermocouples should be included inside the press book to verify the temperature cycle profile.

Special Bonding Note: High layer count MLB's, designs with buried metal layers thicker than ½ oz. copper, designs with opposing plane layers, and constructions using single plies of RO4450B and RO4450F bondply present a particular challenge to this no-flow adhesive system. Many challenging designs have been fabricated successfully utilizing special bonding techniques, which are detailed below.

Recommended Bonding Cycle:
The RO4450B and RO4450F prepreg resin systems are at their lowest viscosity at temperatures between 100°C (210°F) and 120°C (250°F). Fill of MLB's will benefit by spending 20 minutes in this reduced viscosity temperature window. This can be accomplished by ramping at a rate of 1°C/Min (2°F/Min) from room temperature to 175°C (350°F) or by dwelling at 115°C (240°F) for 20 minutes. Should the latter approach be chosen, the ramp rates from RT to 115°C (240°F) and from 115°C-175°C (240°F to 350°F) can be 2.8°C-4.0°C/Min (5°F-7°F/Min). Care should be taken to not exceed 120°C (250°F) during the 20 minute dwell. Time vs. temperature trials may be required to define requirements for lagging materials. Thermocouples should be included inside the press book when verifying the thermal profile.

A minimum pressure of 400 PSI should be used regardless of vacuum assistance potential. Lengthy vacuum draw downs (> 5 minutes) should be avoided. Full pressure should be applied before package temperature exceeds 38C (100F). Transfer to a cooling press is allowed after a 60 minute dwell at 177C (350F).

High layer count MLB's, designs with buried metal layers thicker than ½ oz. copper, designs with opposing plane layers, and constructions using single plies of RO4450B and RO4450F prepreg present a particular challenge to these no-flow adhesive systems. In addition to applying the preferred thermal profile described above, it may be necessary to increase lamination pressure as high as 750 PSI in order to ensure proper resin fill. In general, higher pressure is better for the prepregs, as long as there is no risk of damage to the lamination equipment. Lateral resin flow of the RO4450B and RO4450F prepreg can be achieved when using pressures above 650psi. Copper flow patterns and copper features in and around test coupons may need to be modified to optimize pressure distribution and/or minimize flow requirements. Please contact your Technical Service Engineer if you have not employed these techniques in the past, or if you have any questions about a specific design.

Outerlayer and PTH Processing: Processing guidelines for RO4003C™, RO4350B™, RO4360™ and RO4000® LoPro® double-sided circuits are applicable to RO4000 multi-layer boards. However, the multi-layer constructions will require desmear. CF4/O2 plasma and alkaline-permanganate processes used to desmear high Tg (170°C/338°F) FR-4 materials have been found to work well with RO4000 multi-layers. While desmear may be required, etchback of the resin system is not recommended.

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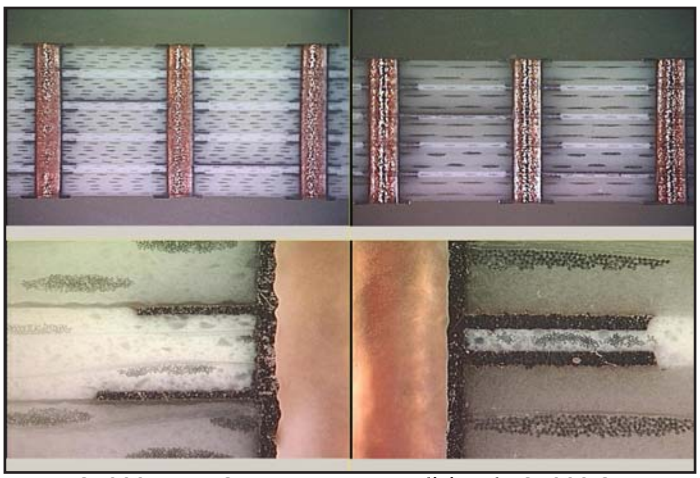
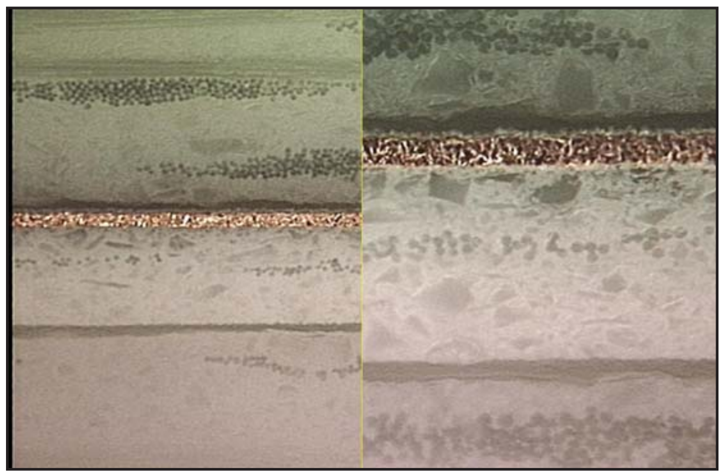
Fabrication Notes

Visual comparison of RO4000 LoPro laminates and traditional RO4000 cores in multi-layer constructions.



RO4000 LoPro Cores Traditional RO4000 Cores

Expected visual appearance in a cross section of RO4000 LoPro Laminates.



The information contained in this data sheet and processing guide is intended to assist you in designing with Rogers' circuit materials and bondply. It is not intended to and does not create any warranties, express or implied, including any warranty of merchantability or fitness for a particular purpose or that the results shown on this data sheet and processing guide will be achieved by a user for a particular purpose. The user is responsible for determining the suitability of Rogers' circuit materials and bondply for each application.

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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