ARLON Materials for Electronics

High Tech News

Engineered Solutions for Advanced PWB Technology

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In This Issue:

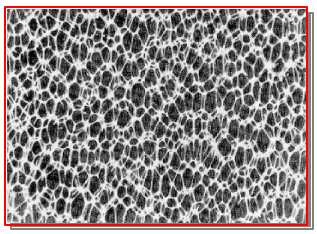
New From Arlon – "Taking Foam to the Power of R/F"

The latest in a series of new products that have been introduced by Arlon is FoamClad$^{R/F\ ™}$, a low cost, low dielectric constant copper clad laminate product designed for the cellular infrastructure antenna marketplace. Competitive in net cost with stamped and formed metal, FoamClad$^{R/F\ ™}$ provides the well-established consistency and reliability of etched printed circuit antennas.

Printed circuit antennas have always had the advantage over metal in terms of efficiency of manufacture and extraordinary repeatability in terms of performance. PTFE materials that have been traditionally used for etched antennas have the benefit of being very low in dielectric constant, and more important, dielectric loss. A plethora of attempts to offer "cheap" materials to replace PTFE have resulted in confusion, contradiction and frequent performance inadequacies. Added to that is the complication of a growing requirement that materials be able to perform in the -153 dBc range (3rd harmonic) or better in terms of Passive Intermodulation (PIM) Distortion.

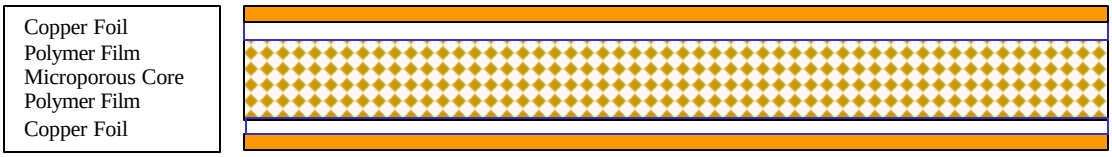
The concept of a low dielectric constant, lightweight foam core antenna has been around in theory and in very small volume with manifestations ranging from pre-etching copper foil and gluing it to foam; gluing copper on the foam and etching the antenna (risking chemistry residue staying with the foam), etc. Stand-off antennas using posts to anchor the ends of transmission lines effectively create an antenna with an air dielectric. None

of these have proved viable for high volume low cost applications for one reason or another. What was clearly needed was a ready-to-process copper clad foam core antenna material that would be impervious to surface attack by the many chemicals endemic to the PWB process.



The issues of what foam, how to make it impervious to chemical attack and how to manufacture it in volume while developing a cost effective final product that could be supplied in various lengths to 120+" for phased array antennas with long transmission lines occupied the time of our R&D people for over two years.

In the end we came up with a first generation product that has overcome all the well known process and assembly difficulties of using a foam core while enabling high volume production. The result patent pending product trademarked FoamClad$^{R/F}$ **100** ("Taking foam to the power of R/F") seems to answer all the known concerns.



Initial reactions to beta evaluations of this novel, patent-pending product have been extremely encouraging and a number of designs are going into volume production even as this is being written.

What does the product offer:

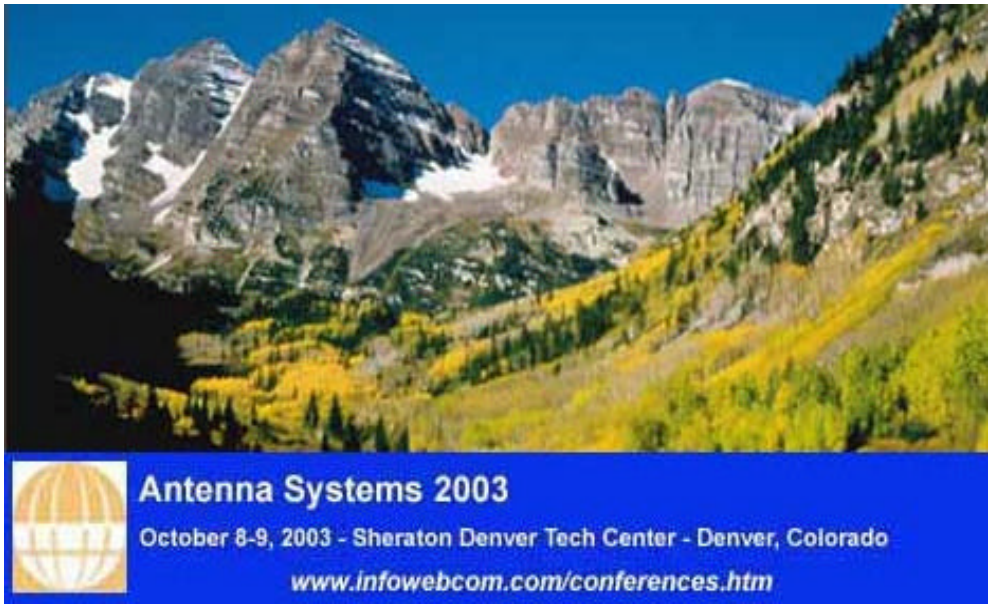
- Low Dielectric Constant: 1.2 to 1.4 (depending on foam thickness)
- Losses as low as 0.002 depending on construction and thickness
- Processable in standard PWB photo-process print and etch process with no subsequent alignment and gluing hassle
- Resistant to attack by PWB process chemistries
- Reported PIM values below –155 dBc (third harmonic)
- Available in 24" width up to 120+" in length
- Available in nominal dielectric thicknesses of 0.040", 0.072" and 0.96"
- Available clad either one side or both sides
- Lowest cost performance alternative to conventional PWB
- Lightweight – less than half the weight of conventional PTFE laminates

Earlier we referred to FoamCladR/F **100** as a "first generation product" – and hopefully that has piqued your interest. We are looking for ways to make a good thing even better and focusing especially on the issue of how to get the lowest possible line loss from a foam clad product. An ongoing and major effort is underway to develop FoamClad$^{R/F}$ **200**

or even **300** as we find new combinations of materials and processes so you as the designers and users can have increased choices in terms of critical material parameters.

For additional details, data sheets and for samples visit Arlon's website at www.arlon-med.com or contact an Arlon sales representative or technical service person directly.

Don't Forget Antenna Systems 2003!



Plan now to register for Antenna Systems 2003 in Denver in October. Not only will you have the opportunity to hear some of the best brains in the antenna industry talking about trends and technology, but you will also get to brag for years to come that "I survived Chet's presentation at Antenna Systems 2003." We hope to see you there.

- **New Materials for Printed Circuit Antennas**
  The presentation will review existing substrate materials commonly used in etched PCB antennas and compare them to the new foam laminate approach.
  Chet Guiles, Director, New Business Development, Arlon Materials

- You can link to rest of the program at:
  http://www.antennasonline.com/ast_conf_program.htm
- You can register to attend at:
  http://www.antennasonline.com/ast_conf_registration.htm

Application Note: Moisture Pickup in Thermount® Laminates

Traditionally in the laminate industry moisture absorption is characterized by a 24 hour water immersion test (IPC TM-650 2.6.2.1) using an etched 0.062" piece of rigid laminate. Typical values of water absorption obtained by this method are:

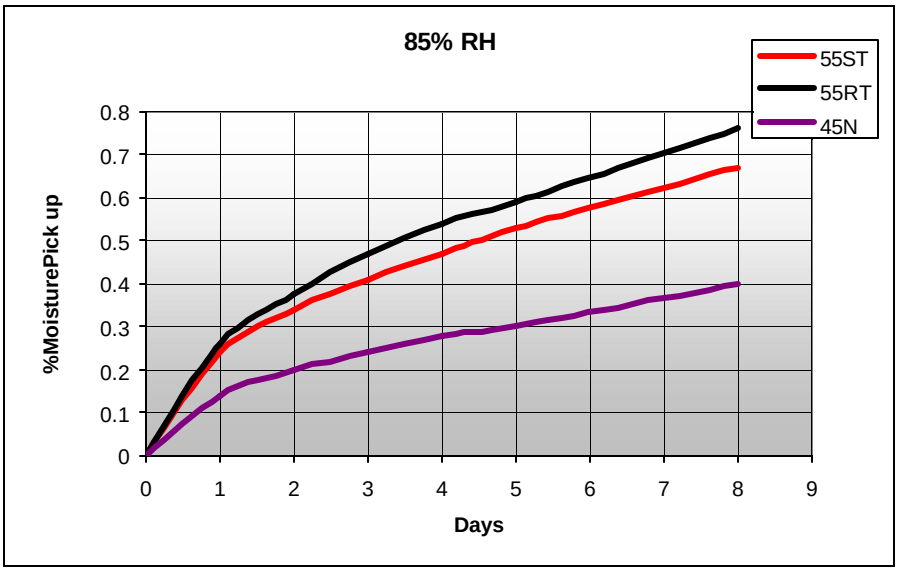
Epoxy-Glass (FR-4): 0.1%
Epoxy-Nonwoven Aramid: 0.3%
Polyimide Glass: 0.3%
Polyimide Nonwoven Aramid: 0.5 to 0.6%
PTFE-Glass (Low Dielectric Constant): 0.02%
Ceramic-Filled PTFE: 0.04 to 0.08%

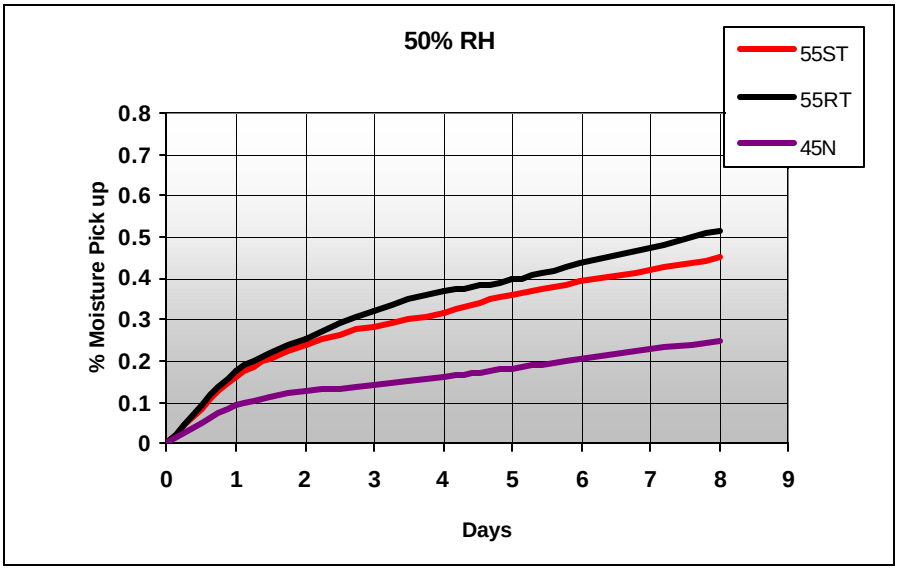
The consequences of water absorption are well known, ranging from frothy uncontrollable flow and voiding when it is present in prepreg prior to lamination, to blistering and delamination or even plated hole wall blowout in multilayer PWB's during soldering or reflow operations. Even the venerable FR-4, with relatively low water absorption, can exhibit problems if the moisture level in a PWB gets above about 0.2% when it is subjected to reflow.

To avoid the consequences of water absorption, the industry has incorporated a series of drying steps in its processes. For prepreg, either chemical desiccants such as silica gel or magnesium sulfate, or vacuum desiccation (and we prefer this because in some cases the material will compete with a chemical desiccant for the water and, frankly, many people do not dry their desiccant beds adequately or often enough) are commonly used to remove water prior to lamination. For laminate, bake cycles (the number of bakes and their duration being somewhat dependent on the material used) are employed to ensure that inner layer details are dry prior to lamination, that finished boards are dry prior to operations such as plasma desmear and hole wall prep, and, of course, to ensure that finished bare boards are dry prior to HASL or other high temp processes during final fab or assembly.

In the case of Thermount® nonwoven aramid reinforced products, the water absorption is higher because the aramid material has an inherently higher water absorption than, for example, the glass fiber used in conventional laminates. The bake recommendations are correspondingly longer and more often for these materials.

We are frequently asked about real-world data on water absorption into finished boards at room temperature at various conditions of relative humidity to simulate the kinds of situations found in different parts of the world or different times of year. The following graphs show a standard multifunctional epoxy material (Arlon's 45N) whose 24 hour water absorption is only 0.1% compared to two grades of nonwoven aramid based epoxy laminate. You can see that the absorption depends on time and RH, but eventually will significantly exceed the nominal test value.





How critical this water absorption may be in any particular set of circumstances is a matter of how long the boards have been exposed and to what level of humidity. Bare boards that are baked at the board fabricator and then sealed in moisture barrier bags with a silica gel insert can be expected to remain properly dry until the bags are unsealed. Then a moisture pickup clock starts ticking, and experience in assembly or reflow will depend on how long and how high the humidity. (Although we did not do multiple temperatures, higher moisture pickup can reasonably be expected with higher temperatures for any given RH, making hot humid climates even more susceptible.) In many cases even the relatively waterproof FR-4 (as seem clearly in these charts) can get to a point where it is over the 0.2% “danger line” and may require baking prior to assembly.

Thermount will almost always require such baking unless it can be assured by other means that the boards are dry at the time they head down the HASL line (or whatever). Even FR-4 is often baked prior to assembly, though the risk is obviously lower.

With nonwoven aramid being used in numerous HDI designs because of its excellent ability to be laser drilled using a variety of laser equipment, this little bit of extra water absorption is seen as problematic by many processing people. **In laboratory work recently completed Arlon has developed a resin system that permits nonwoven aramid product to exhibit water absorption characteristics essentially identical to those of our 45N multifunctional epoxy (see charts above).**

If such a product were made commercially available, with water pickup essentially equivalent to epoxy glass, we believe that it would broaden the applicability of nonwoven aramid materials. An obvious potential for this product would be in the area of chip carriers where in the past the moisture problem has been a real barrier both because of the post-processing involved and the use of these materials in hot, high humidity locales such as Malaysia and Singapore. **We'd be interested in your reaction to the possibility of our going forward with commercialization of this material.** If there are some markets that truly need NWA but can't tolerate the added risk of moisture absorption, please let us know.

You can direct your inquiries to Chet Guiles at cguiles@arlon-med.com or directly by phone at 909-9897-9533.

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Meet Arlon People – The New China Team

March, 2003 -- Peter Ni Joins Arlon as Technical Service Consultant

In light of the growing importance of high tech materials in the Pacific Rim electronics marketplace, we are pleased to announce that Peter Ni of Taiwan, ROC, has joined Arlon Materials for Electronics early in 2003 as Technical Service Consultant for Arlon's products in Taiwan, China, Hong Kong, Singapore, Japan, Thailand and Malaysia. In this position, Mr. Ni will provide support for design and process groups utilizing Arlon's high performance and microwave/RF laminate products.

Peter holds a B.E/ in Chemical Engineering from Chung Yuan Christian University. Peter has had a varied career in the application of materials for electronics, having been employed with UNICAP where he held the position of Lamination Supervisor, prior to which he was responsible for new factory layout for UNICAP. More recently Peter was employed by Kinsus Interconnect Technology Corporation as Supervisor of the Manufacturing Department's Lamination Process.

In addition to his busy schedule with Arlon, Peter enjoys badminton and swimming in addition to his favorite exercise, mountain hiking on the weekends. Peter also likes to go Karaoke singing with his friends at KTV, a very popular Taiwanese pastime.

Peter makes his home in Taiwan, and can be contacted by e-mail at peterni@giga.net.tw.

May 2003 -- Helena Li Hai Joins Arlon as Technical Sales Engineer

As part of its overall strategic emphasis on the Chinese electronics marketplace, we are very pleased to announce that Helena Li Hai of Shanghai has joined Arlon Materials for Electronics as Technical Sales Engineer for Arlon's products in China. In this newly created position, Helena will report directly to Brad Foster, VP, Sales.

Helena holds the BS degree in Electronics Materials and Chemistry from the University of Science and Technology of China and an MS in Information Technology from the University of Information Engineering of PLA. Prior to joining Arlon, Helena was employed at Siemens as an Applications Manager and at American Tec Company as Marketing Manager. Prior to moving into the marketing arena, Helena was a Project and Development Director for PCB Fabrication at the Jiangnan Institute of Computing Technology.

In addition to her work a busy Helena enjoys traveling, spending time with children (she used to teach kindergarten for fun), swimming and cooking, which she says "is one of the creative things in life."

Initially, Helena will be working closely with our Asian Consultant, Mr. Don Watt, and will be focusing on OEM development and technical sales in the Northern China region. Our Chinese customers can contact Helena at helenalihai@vip.sina.com.

Some Final Notes

This has been a watershed year for Arlon MED. Despite the long and persistent economic downturn we have made a large investment in people and facilities for R&D and are currently involved in the most intensive new product development phase in the company's history. I have been around for (almost) 25 years of that history and am impressed not only with the people themselves, most of whom you have met in recent editions of the newsletter, but the output, which has been impressive. In the recent past we have introduced high peel strength nonwoven aramid product (55ST), the world's first Green (halogen and bromine free) nonwoven aramid product (65GT), a thermally conductive no-flow prepreg for heatsink bonding (99N), AD-10 thin high dielectric constant material and a low cost version of CLTE, with low thermal coefficient of dielectric constant, and now – introduced in this issue – the FoamClad$^{R/F}$ foam core product for antenna applications.

Consolidation in the domestic PWB industry and the migration of PWB manufacturing to China has also been a part of our strategic planning as well, and Arlon has announced just this past month that we will be opening a finishing facility in China this year. The SARS epidemic has temporarily delayed the implementation of that process, but the local stocking and finishing center will provide enhanced support for our customers. In addition to commitment to physical facilities, we have, as you noted in this issue, added two direct employees (in Taiwan and Shanghai) to provide additional local support to our Chinese customers. These are indeed interesting times. (There is an Ancient Chinese proverb – "May you live in interesting times!")

As always, we would like to hear from you. If you are deceased or for any other reason did not receive this copy of the newsletter, please let us know and we will forward it to wherever you are. (Non-halogen flame retardant versions are available if you are in "the other place.") Seriously, if you have comments, constructive criticisms, plaudits or complaints about this newsletter or its contents, please contact the editor, Chet Guiles, at cguiles@arlon-med.com. Look for an update in the next issue on some of our new development programs.

Enjoy your summer.

Chet Guiles
Editor, High Tech News