Pyralux ® LF Copper-Clad Laminates

Flexible Composites

Description

Pyralux® copper-clad laminated composites are constructed of DuPont Kapton® polyimide film with copper foil on one or both sides, bonded together with a proprietary C-staged modified acrylic adhesive. All copper-clad laminates are available with rolled, annealed copper or electro-deposited copper. In addition, both types are available with doubletreated copper (nodules of electro-deposited copper on both sides of the copper foil). Double-treated copper, if used, eliminates surface preparation steps prior to resist or coverlay lamination.

Pyralux® laminated composites are typically used to produce high reliability, high density circuitry of flexible, rigid-flex, and all-flexible multilayer constructions. Techniques commonly used in the manufacture of flexible circuits can be used to process Pyralux® composites.

Construction

Copper-clad laminates are available in a variety of film thicknesses and copper weights. **Tables 1** and **2** list typical constructions. The product code must be used when ordering copper-clad laminates from DuPont.

Packaging

Pyralux® copper-clad laminates are supplied in 24 in (610 mm) by 36 in (914 mm) sheets. There is a minimum of four sheets and a maximum of 25 sheets per pack.

Typical Data

Each manufactured lot, except the laminate constructions noted in **Tables 1** and **2**, is certified to IPC specifications and tested according to 1PC Test Method TM-650. See **Table 3.**

Table 1
Single-Sided Copper-Clad Product Codes

Product Code*	Copper oz/ft² (g/m²)	Adhesive Mil (µm)	Kapton Mil (µm)	IPC Cert.[1]
LF9110R	1 (305)	1 (25)	1 (25)	Yes
LF9120R	1 (305)	1 (25)	2 (51)	Yes
LF9130R	1 (305)	1 (25)	3 (76)	Yes
LF9150R	1 (305)	1 (25)	5 (127)	Yes
LF9210R	2 (610)	1 (25)	1 (25)	Yes
LF9220R	2 (610)	1 (25)	2 (51)	Yes
LF7012R	1/2 (153)	1/2 (13)	1/2 (13)	No
LF7002R	1 (305)	1/2 (13)	1/2 (13)	No
LF7062R	1/2 (153)	1/2 (13)	1 (25)	No
LF7011R	1 (305)	1/2 (13)	1 (25)	Yes
LF7008R	2 (610)	1/2 (13)	1 (25)	Yes
LF7092R	1 (305)	1/2 (13)	2 (51)	Yes
LF7004R	1/2 (153)	1 (25)	1/2 (13)	No
LF7037R	1 (305)	1 (25)	1/2 (13)	No
LF7038R	2 (610)	1 (25)	1/2 (13)	No
LF8510R	1/2 (153)	1 (25)	1 (25)	Yes
LF7031R	3/4 (229)	1 (25)	1 (25)	Yes
LF8520R	1/2 (153)	1 (25)	2 (51)	Yes
LF7019R	3/4 (229)	1 (25)	2 (51)	Yes
LF7097R	1 (305)	2 (51)	1 (25)	Yes

Add "R" to the end of the code to specify rolled-annealed copper (e.g., LF9210R). Add "E" to the end of the code to specify electro-deposited copper (e-g., LF9210E). If rolled annealed double-treated copper is specified, add the letter "D" to the end of the product code (e.g., LF9210D).

[1]Certified to IPC-4204/1: "Flexible Metal-Clad Dielectrics for use in Fabrication of Flexible Printed Wiring."

A Certificate of Analysis is available with every batch. Complete material and manufacturing records for each lot, with samples of finished laminate, are retained for reference purpose. The roll labels contain the lot number, DuPont order number, customer order number, IPC specification, customer specification, and customer part number; save these labels for reference in case of inquiries.

Table 2
Double-Sided Copper-Clad Product Codes

Product Code*	Copper oz/ft² (g/m²)		Adhesive Mil (µm)		Kapton Mil (µm)		IPC Cert.[1]
LF9111R	1	(305)	1	(25)	1	(25)	Yes
LF9121R	1	(305)	1	(25)	2	(51)	Yes
LF9131R	1	(305)	1	(25)	3	(76)	Yes
LF9151R	1	(305)	1	(25)	5	(127)	Yes
LF9212R	2	(610)	1	(25)	1	(25)	Yes
LF9222R	2	(610)	1	(25)	2	(51)	Yes
LF7022R	1/2	(153)	1/2	(13)	1/2	(13)	No
LF7014R	1/2	(153)	1/2	(13)	1	(25)	No
LF7010R	1	(305)	1/2	(13)	1	(25)	Yes
LF7041R	2	(610)	1/2	(13)	1	(25)	Yes
LF7091R	1/2	(153)	1/2	(13)	2	(51)	Yes
LF7093R	1	(305)	1/2	(13)	2	(51)	Yes
LF7058R	2	(610)	1/2	(13)	2	(51)	Yes
LF7003R	2	(610)	1/2	(13)	3	(76)	No
LF7017R	1/2	(153)	1	(25)	1/2	(13)	No
LF7039R	1	(305)	1	(25)	1/2	(13)	No
LF7040R	2	(610)	1	(25)	1/2	(13)	No
LF8515R	1/2	(153)	1	(25)	1	(25)	Yes
LF8525R	1/2	(153)	1	(25)	2	(51)	Yes
LF7090R	2	(610)	2	(51)	2	(51)	Yes
LF7071R	1	(305)	1/2	(13)	1/2	(13)	Yes

Add "R" to the end of the code to specify rolled-annealed copper (e.g., LF9210R). Add "E" to the end of the code to specify electro-deposited copper (e.g., LF9210E). If rolled annealed double-treated copper is specified, add the letter "D" to the end of the product code (e.g., LF9210ED).

[1]Certified to IPC-4204/1: "Flexible Metal-Clad Dielectrics for use in Fabrication of Flexible Printed Wiring."

Processing

Laminating conditions for Pyralux® flexible composites are typically in the following ranges:

Part Temperature:	182–199°C (360–390°F)
Pressure:	14–28 kg/cm² (200-400 psi)
Time:	1–2 hours, at temperature

For further processing information contact your DuPont representative to receive a Pyralux® Technical Manual.

Storage

Pyralux® flexible composites will retain their original properties for a minimum of one year when stored in the original packaging at temperatures of 4–29°C (40–85°F) and below 70% humidity. The products do not need refrigeration and should not be frozen. Keep the material clean and well protected.

Copper-clad laminates should not be automatically discarded if storage conditions have deviated from these limits. We recommend that material which has been stored outside of these conditions be examined in a practical test before being committed to production.

Table 3
Copper-Clad Laminate Properties vs IPC Specifications

Property	IPC Spec	Typical Clad Value
Peel Strength, min., lb/in (kg/cm)		
As received	8 (1.4)	10 (1.8)
After solder	7 (1.3)	9 (1.6)
Dimensional Stability, max., percent	0.15	0.10
Dielectric Constant, max. (at 1 MHz)	4.0	3.6
Dissipation Factor, max. (at 1 MHz)	0.03	0.02
Volume Resistivity, min., megohm-cm (ambient)	10^7	10^9
Surface Resistivity, min., megohm-cm (ambient)	10^6	10^8

Safe Handling

Pyralux® copper-clad laminated composites are supplied in sheets and are fully cured (C-staged).

DuPont is not aware of anyone developing contact dermatitis, or suffering any other medical discomforts, when using Pyralux® products. The uncured acrylic monomers in the bond ply adhesive may impart a mild odor. However, these products have been extensively tested under operating conditions (drilling and lamination conditions) and found to liberate measurable volatiles only well below[1] accepted safe limits (e.g., PEL).

To eliminate contact between the skin and exposed adhesive after etching, wear lint-free gloves or fingerpads. Anyone handling Pyralux® should wash their hands with soap before eating, smoking, or using restroom facilities. Gloves and fingerpads should be changed daily, and wash other protective clothing frequently.

Adequate ventilation and exhaust is recommended in press rooms to prevent the buildup of potentially harmful vapors, to remove disagreeable odors, and to dissipate heat. Drill rooms should be furnished with standard equipment recommended by drill vendors and required by OSHA standards.

For further information on safe handling, refer to DuPont publication H-46873, "Pyralux® LF and FR Safe Handling;" and refer to "Industrial Ventilation," 18th Edition or latest available from the American Conference of Governmental Industrial Hygienists, 6500 Glenway, Building D-5, Cincinnati, OH 45211.

[1] Values for all materials monitored were well below 10% of their accepted limits (PEL or TLV). In only one case, did the concentration reach approximately 40% of its limit. This was an oven used to dry the uncured acrylic material. This oven drying is not normally used in the process and during the exposure the oven was unventilated. Adequate ventilation is normally recommended for any heating process.

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