

DuPont Microcircuit Materials

THICK FILM COMPOSITION

Interra™

EP310 Capacitor Dielectric Composition

Product Description

Dielectric composition EP310 is intended for making screen-printed capacitors on copper foil which are subsequently built into printed circuit boards. Properly applied and fired, this composition gives a dielectric constant of >2500. High yields of capacitors with a sheet capacitance of up to 2 nF/mm² can be obtained with controlled print thickness and optimized firing conditions.

Product Benefits

High capacitance density
Firing at 940°C - 950°C in nitrogen
High yields
Thin print layers

Processing

Substrates

Properties are based on tests on non-drum side of 1oz. Oak-Mitsui PLSP (Plain Stain Proof) electrodeposited copper foil. Tested capacitors were 100-mil x100-mil in size.

Paste Preparation

The paste should be thoroughly mixed before use. This is best achieved by slow, gentle hand stirring using a burr-free spatula (flexible plastic) for 3-5 minutes.

Composition Properties

Test	Properties
Viscosity (Pa.S) (Brookfield ½ RVT, 1rpm, SC4-14/6R, UC&SP, 25°C)	300 - 400
Solids (750°C)[%]	69.0 - 71.0
Coverage (cm ² /g) (at 1-mil wet print)	145
Thinner*	9450

*EP310 is optimized for screen printing and thinning is not normally required. Thinner may be used for slight viscosity adjustments or to replace evaporation losses.

Table 1 shows composition properties for EP310

Preprint

Print using EP320 Copper Conductor paste, dry (120°C/10 min), and fire the bottom electrode. A 325-400 stainless steel mesh or V-screen 330 mesh can be used to achieve a fired thickness of 2-4um. Fire in a 60 minute nitrogen profile, 940°C - 950°C peak temperature with 10 minutes at peak. Temperature and oxygen levels in the burnout and firing zones should be optimized and tightly controlled.

Typical Physical Properties

Test	Properties @ 20 μm Fired	Properties @ 12 μm Fired
Dielectric Constant (10KHz, 25°C)	> 2500	> 2500
Dried Dielectric Thickness, μm Fired Dielectric Thickness, μm (2 print layers with a double wet pass on each)	18 - 22 30 - 34	10 - 14 16 - 20
Capacitance Density, nF/mm ²	1.35	2.0
Dissipation Factor, % (10KHz, 25°C)	< 5	< 10
Insulation Resistance (ohms)	>1x10 ⁹	>1x10 ⁹
Breakdown Voltage, V	> 300	> 275

Table 2 shows typical physical properties for EP310

Capacitor Dielectric

Print one layer of EP310, dry at 120°C/10 min., and repeat the print and dry. For 12 μm EP310, use a double flood-print squeegee pass and a V-screen 220 mesh, 0.3-0.5 mil emulsion for each layer, and allow to level for 5 minutes before drying. Printing speeds up to 10 inches/sec. can be used. For 20 μm fired EP310, 2 prints using a 230 SS mesh is required.

Top Electrode

The top electrode (EP320) should be printed with a 325-400 mesh stainless steel screen or a V-screen 330 mesh with 0.3-0.5 emulsion. The dielectric should extend beyond the top electrode by at least 7.5 mils on each side to preclude shorting of electrodes. The top electrode should be cofired with the EP310 dielectric under optimal conditions. Temperature and oxygen levels in the burnout and firing zones should be optimized and tightly controlled. See *DuPont Embedded Capacitor Processing Guidelines* for more details.



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Storage and Shelf Life

Containers should be stored, tightly sealed, in a clean, stable environment at room temperature (<25°C). Shelf life of material in unopened containers is six months from date of shipment. Some settling of solids may occur and compositions should be thoroughly mixed prior to use.

Safety and Handling

The following precautions should be exercised when handling EP310:

- Use with adequate ventilation
- Avoid prolonged contact with skin
- If contact with skin occurs, wash affected area immediately with soap and water
- Avoid prolonged breathing of vapor
- Dangerous if swallowed - DO NOT CONSUME
- Refer to MSDS for more details

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