KOARTAN
MICROELECTRONIC INTERCONNECT MATERIALS
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Preliminary Technical Information

5371 Series Pb-Free Capacitor Dielectric System

The 5371 capacitor dielectric system consists of five standard blendable members. These are Pb-free versions of KOARTAN 5350 series pastes. This titanate based system is suitable for the integration of capacitors in thick film microcircuits, as well as for the manufacture of discrete components. Capacitors may be buried under or within layers of multilayer systems. Key features of the system include:

- RoHS Compliant
- Environmentally Friendly; No Pb, Cd, or highly toxic organic solvents
- Blendability Across the Full Range.
- Standard 850°C Firing Profile
- Compatibility with Silver-Palladium, Pure Silver, and Gold Electrodes.
- Laser Trimmable

TYPICAL FIRED FILM CHARACTERISTICS(1)

	5371	5372	5373	5374	5375
Dielectric Constant(2) On Ag:Pd or Gold Electrode	25 ± 15%	50 ± 15%	100± 15%	250±15%	500±15%
Dielectric Constant(3) On Silver Electrode	40 ± 20%	75 ± 20%	150± 20%	400±20%	800±20%
Dissipation Factor @ 1KHz, 25°C, On 6231DL	≤ 1.0 %	≤ 1.5 %	≤ 2.0 %	≤ 3.0 %	≤ 3.0 %
Insulation Resistance Ohms @ 50VDC	≥ 10^{11}	≥ 10^{11}	≥ 10^{11}	≥ 10^{11}	≥ 10^{11}
Fired Thickness Microns	40-50	40-50	40-50	40-50	40-50
Dielectric Strength VDC @ recommended thickness	≥ 600	≥ 600	≥ 600	≥ 600	≥ 600

(1) Typical properties are based on testing of several batches under various processing conditions. They are not intended as specification limits.

(2) The electrical results are based on 1mm x 1mm capacitors fabricated with 5371 series dielectrics and 6231DL silver-palladium electrode. Three layers of separately fired dielectric were utilized to achieve the recommended fired film thickness. The capacitors were encapsulated using 5671H and 5671 low temperature Pb-free overglaze pastes.

(3) These figures are typically obtained on Koartan 6120 silver and are provided for information only. The dielectrics are calibrated and QC tested on 6231DL silver-palladium electrodes. Results are fairly similar when Koartan 4129 Pb-free gold is used. Calibration on other electrode materials may be specified when ordering.

COMPOSITION PROPERTIES

Viscosity: 150 ± 40 Kcps, when measured with Brookfield HBT viscometer, Spindle #14, utility cup, 10 rpm, 25°C

Specific Gravity: 2.4 – 2.8 g/cm³

Recommended Thinner: KOARTAN A-1039

RECOMMENDED PROCESSING PROCEDURE

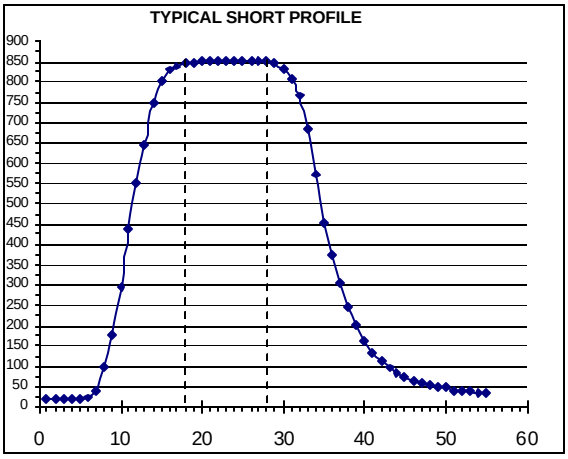
Printing: For best results, three separate print/dry/fire operations with 325 mesh stainless steel screen using 10-15 µm emulsion and 45 degree angle is recommended. Each printing operation should consist of two wet passes. Other mesh counts, 200-280, and emulsion thicknesses, 5-25 µm, may be used for special applications. A class 10,000 or better clean room should be utilized if only two layers of dielectric are printed. Depending on the print area, squeegee speeds of up to 10 inches/sec may be utilized.

Coverage is approximately 80 cm^2/g per layer, when utilizing 280 mesh screen and a wet print thickness of about 38 µm.

Drying: Wet prints should be allowed to level for 5-10 minutes prior to drying. Dry for 10-15 minutes in a convection oven or belt dryer at 125°C-150°C.

Firing: Firing in air using a belt furnace and a 36-60 minute profile, with 10 minutes at a peak temperature of 850°C, is recommended. Air flow rates must be optimized to ensure that the products of binder burn-off discharge properly and create a fully oxidizing atmosphere in the muffle.

Application Notes: Unless capacitors are sealed in a hermetic package, encapsulation with appropriate overglazes is necessary. For low temperature encapsulation, glazing



Temperature (?C) vs. Time (minutes)

with 5671H, followed by 5671 is recommended. The 5671H is a buffer layer, with a matte appearance, and should overlap the capacitor pads by at least 10 mils all around. It is fired at 525°C. The 5671 is a shinny, vitreous layer that seals the underlying structure. It is fired at 500°C.

The 850°C firing counterparts to the low temperature glazes are 5672H and 5672. There may be a capacitance reduction of up to 15% when high temperature glazes are used. All four glazes are Pb-free and green color.

The fired capacitors may also be buried under Koartan 5807 Pb-free multilayer dielectric, after which resistors or other components may be printed or placed on top. A capacitance reduction of up to 15%

may result upon firing of two layers of 5807. Additional firings may result in further capacitance reduction.

The 5371 series capacitor dielectrics may be fired up to 900°C with silver electrodes and up to 960°C with Ag:Pd or gold electrodes. Higher than 850°C firing would result in higher initial dielectric constants.

Storage and Shelf Life: Store in tightly capped containers at room temperature. Shelf life is 6 months for unopened jars.

Thorough mixing of the paste before each use is recommended. Under ordinary conditions of storage and use the product should not require thinning. However, solvent loss during extended printing runs may be corrected by incorporating up to 0.5% of Koartan A-1039 thinner.

Other System Components: Koartan offers a series of Pb-free glazes and termination electrodes for the system:

6231DL Silver-Palladium Electrode
4129 Pb-Free Gold Electrode
6120 Pb-Free Silver Electrode
5671H & 5671 Low Temperature glazes
5672H & 5672 High Temperature glazes
5807 Multilayer/Cross-Over Dielectric