

## Advanced Materials

### HeraLock<sup>®</sup> Tape HL2000

#### Low Temperature Co-Fireable Tape

*US Patented*

#### Description:

Heraeus' new HL2000 low-temperature co-fireable tape is self-constraining, allowing near zero x-y shrinkage for the production of high performance LTCC devices with no additional processing or tooling.

HL2000 has properties appropriate for applications such as general-purpose packaging, automotive modules and RF applications requiring low-loss at high frequencies.

The main difference between HL2000 and all other LTCC tapes is its unique shrinkage properties during firing. Free-sintered HL2000 densifies by shrinking in the z-axis.

#### ● Key Benefits:

- Near zero (0.2%) x-y shrinkage with no added processing steps
- Compatible with co-fired solderable conductors
- Resists conductor show-through and camber
- Cavity structures cut into the green HeraLock<sup>®</sup> tape show no x-y shrinkage or distortion after firing
- Lead and cadmium free
- High Q

#### ● Typical Fired Electrical Properties of HL2000:

##### Dielectric Constant @ 2.5 GHz

7.3 ± 0.3

##### Dissipation Factor (loss tangent) @ 2.5 GHz

< 0.0026

##### Thermal Coefficient of Expansion (25°C to 300°C)

6.1 ppm/°C

##### DC Breakdown Voltage

450 - 600 V/mil

##### Surface Roughness

0.7 μm (Tencor surface measurement)

##### Camber

Conforms to setter

< 1 mil/inch up to 100% conductor coverage on all layers (3" x 3" tested)

##### Insulation Resistance (@ 25°C)

> 10<sup>13</sup> Ωcm

#### ● Recommended Processing Guidelines for HL2000:

##### Printing:

Blank tape, to the desired size tape, can be processed on the Mylar<sup>®</sup> carrier (for easy handling) or removed. The majority of the printing is done on the dull side with a 250 – 325 mesh screen. The shiny side can be printed on if printing is required on both sides.

##### Print Drying:

###### BOX DRYING OVEN

Temperature	80°C
Time	15 minutes

##### Preconditioning:

###### CONVECTION BOX OVEN

10 minutes at 80°C

##### Lamination:

###### ISOSTATIC

Stack each printed and dried layer on a metal registration plate. Place stack inside of a heat sealable bag, evacuate and seal. It is critical that the bag be fully evacuated.

##### Lamination Conditions – 150 static hot water

Pressure	1500 psi
Temperature	75°C
Dwell Time	90 seconds
Cycle Time	10 minutes

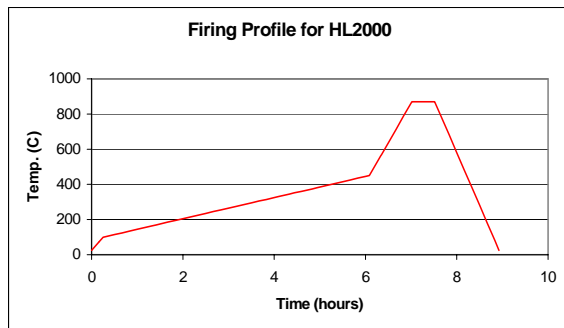
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- **Burnout and Firing Profile in a Box Oven\*:**  
Ramp at 3°C/min to 100°C for start of burnout  
Burnout: ramp at 1°C/min to 450°C (typically no holds are required during burnout)  
Ramp at 8.0 to 10°C/min to 865°C  
Firing peak: 865°C for 20 to 30 minutes  
Cool at 10°C/min to room temp



**Recommended Setter**  
Porous or Honeycombed

- **Typical Unfired Properties of HL2000:**

**Green Density**  
2.3 g/cm<sup>3</sup>

**Tensile Strength**  
240 psi

**Green Sheet Thickness**  
5.25 mils ± 0.2 mils  
3.6 mils ± 0.2 mils  
2.6 mils ± 0.2 mils

- **Typical Fired Properties of HL2000:**

**Shrinkage (free sintered)**  
x,y 0.20% +/- 0.04 %  
z 32% (5.25 mils)  
40% (3.6 mils)  
44% (2.6 mils)

**Fired Layer Thickness**  
3.6 mils ± 0.2 (5.25 mils)  
2.16 mils ± 0.2 (3.6 mils)  
1.45 mils ± 0.2 (2.6 mils)

**Fired Density**  
2.9±0.5 g/cm<sup>3</sup>

**Fracture Strength:**  
>200 MPa (ASTM # F394-78)

- **Co-Fire Conductor System for HL2000:**

	Product #
Ag Routing & Ground Plane	TC0307
Inner Layer Ag Via Fill	TC0308
Co-fire Solderable Ag	TC0306
Transition Ag/Pd Via Fill	TC0401
Top Co-fire Gold	TC8101
Co-fire solder dam	TO2002

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The descriptions and engineering data shown here have been compiled by Heraeus using commonly-accepted procedures, in conjunction with modern testing equipment, and have been compiled as according to the latest factual knowledge in our possession. The information was up-to date on the date this document was printed (latest versions can always be supplied upon request). Although the data is considered accurate, we cannot guarantee accuracy, the results obtained from its use, or any patent infringement resulting from its use (unless this is contractually and explicitly agreed in writing, in advance). The data is supplied on the condition that the user shall conduct tests to determine materials suitability for a particular application.

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