

## TECHNICAL BULLETIN 318

Made from natural graphite, eGRAF® HITHERM™ thermal interface materials are designed for use in applications requiring low contact resistance and high thermal conductivity. HITHERM material is offered in a variety of through thickness thermal conductivities, available in roll or die-cut form and can be laminated with plastics and adhesives.

An economical thermal interface material, HITHERM products will not dry out and no outgassing occurs under vacuum conditions. The conformability of HITHERM materials optimizes thermal properties and ensures excellent contact is maintained for the life of the assembly. Typical applications include thermal interfaces, chip burn-in, chip testing fixtures, DC-to-DC converters, CPU modules, microprocessors, and hot and cold plates.

### Part Designation

#### How are HITHERM products named?

Every HITHERM part is identified by a specific grade, named for its characteristics. For example, **HT-710AP** represents a HITHERM part, 700 SERIES, 0.010" thick, with Adhesive on one side, Plastic on the other side.

HT	7	10	A	P
Product Name	Series Name	Total Part Thickness (Thousands of an Inch)	Coating Side 1	Coating Side 2

### Grade, Dimension and Coating Options

#### What types of HITHERM products are available?

Grade	HT-700 SERIES			HT-1200 SERIES			HT-2500 SERIES	
<u>Thickness (in)</u>	HT-705	HT-710	HT-720	HT-1205	HT-1210	HT-1220	HT-2505	HT-2510
Thickness (mm)	0.005" (0.127mm)	0.010" (0.254 mm)	0.020" (0.508 mm)	0.005" (0.127mm)	0.010" (0.254 mm)	0.020" (0.508 mm)	0.005" (0.127mm)	0.010" (0.254 mm)
Material	Natural Graphite			Natural Graphite			Natural Graphite with Polymer Additive	
Typical <sup>1</sup> Thermal Conductivity (Through Thickness) <sup>2</sup>	6.0 W/m-K			10.0 W/m-K			16.0 W/m-K	
Typical <sup>1</sup> Thermal Conductivity (In-Plane) <sup>3</sup>	240 W/m-K			150 W/m-K			120 W/m-K	

#### Width

	24" Maximum (609 mm)	24" Maximum (609 mm)	12" Maximum (304 mm)
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#### Length

	No Maximum	No Maximum	No Maximum
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#### Coatings

Plain (No Coatings)	Yes	Yes	Yes
A1 (Adhesive on one side)	Yes	Yes	Yes
P2 (Plastic on one side)	Yes	Yes	No
AP (Adhesive on one side, Plastic on one side)	Yes	Yes	No
ES (Edge-Seal)	No	No	Yes

<sup>1</sup> Properties listed are typical and cannot be used as accept/reject specifications.

<sup>2</sup> ASTM D5470 Modified (at 110 kPa/16 psi/1.1 bar)

<sup>3</sup> Angstrom's Method

For additional information, contact the GrafTech Sales Office: +1 (800) 253-8003 (Toll-Free in USA), +1 (216) 529-3777 (International), +1 (216) 529-3922 (Fax)

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## Typical<sup>4</sup> Properties

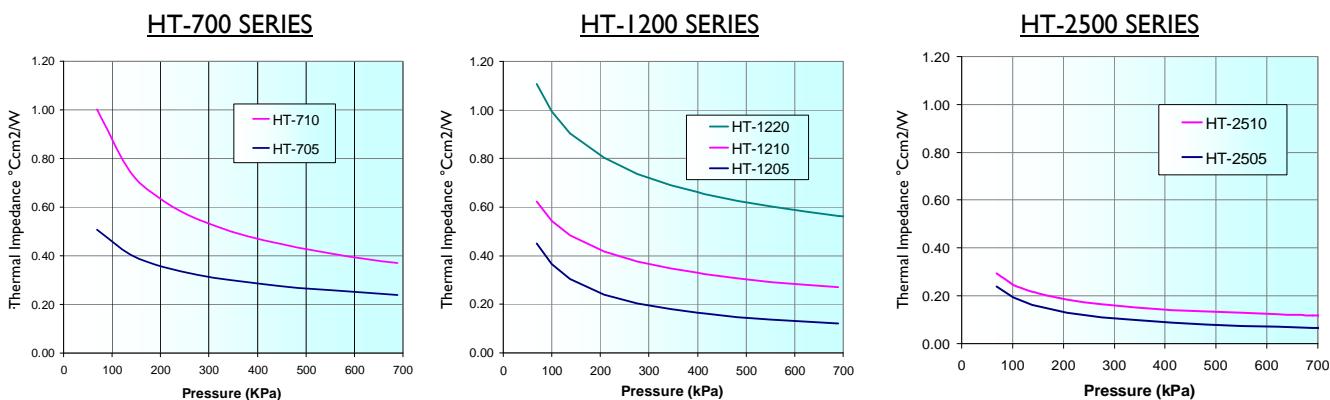
What are the performance characteristics of HITHERM thermal interface materials?

### eGRAF HITHERM Natural Graphite

- Thickness Tolerance: +/- 5% (0.010" thick material), +/- 10% (0.005" thick material)
- Flammability Rating: UL 94V-0
- Operating Temperature: -40 to 400°C (700 and 1200 SERIES), -25 to 125°C (2500 SERIES)
- Coefficient of Thermal Expansion (In-Plane):  $-0.4 \times 10^{-6}$  m/m °C
- Coefficient of Thermal Expansion (Through Thickness):  $27.0 \times 10^{-6}$  m/m °C
- Specific Heat: 711 J/kg °C
- Electrical Resistivity (In-Plane)<sup>5</sup>: 10  $\mu\Omega\text{m}$
- Electrical Resistivity (Through Thickness)<sup>5</sup>: 15000  $\mu\Omega\text{m}$

	HT-700 SERIES			HT-1200 SERIES			HT-2500 SERIES	
	HT-705	HT-710	HT-720	HT-1205	HT-1210	HT-1220	HT-2505	HT-2510
Thickness Tolerance	+/- 10%	+/- 5%	+/- 5%	+/- 10%	+/- 5%	+/- 5%	+/- 10%	+/- 5%
Tensile Strength (ASTM F-152)	715 psi (4900 kPa)	715 psi (4900 kPa)		270 psi (1800 kPa)	470 psi (3200 kPa)	470 psi (3200 kPa)	215 psi (1400 kPa)	270 psi (1800 kPa)
Thermal Impedance <sup>6</sup> @ 100 kPa (14.5 psi) (1 bar)	0.44 °C•cm <sup>2</sup> /W	0.84 °C•cm <sup>2</sup> /W		0.32 °C•cm <sup>2</sup> /W	0.54 °C•cm <sup>2</sup> /W	0.98 °C•cm <sup>2</sup> /W	0.19 °C•cm <sup>2</sup> /W	0.25 °C•cm <sup>2</sup> /W
Thermal Impedance <sup>6</sup> @ 700 kPa (100 psi) (6.9 bar)	0.24 °C•cm <sup>2</sup> /W	0.37 °C•cm <sup>2</sup> /W		0.10 °C•cm <sup>2</sup> /W	0.27 °C•cm <sup>2</sup> /W	0.56 °C•cm <sup>2</sup> /W	0.07 °C•cm <sup>2</sup> /W	0.12 °C•cm <sup>2</sup> /W

### Thermal Impedance v. Interface Pressure



### Adhesive and Plastic Coatings

#### Adhesive "A1" Coating

- Thickness: 0.00015" (0.004 mm)
- Adhesive Strength<sup>7</sup>: 700 g/cm<sup>2</sup> Typical, 450 g/cm<sup>2</sup> Minimum
- Operating Temperature: -40 to 150°C
- Thermal Impedance<sup>6</sup> per Side @ 100kPa: 0.16 cm<sup>2</sup> °C/W

#### Plastic "P2" Coating

- Thickness: 0.000056" (0.0014 mm)
- Dielectric Strength: 210 V
- Operating Temperature: -40 to 150°C
- Thermal Impedance<sup>6</sup> per Side @ 100kPa: 0.32 cm<sup>2</sup> °C/W
- Thermal Conductivity (Through Thickness): 0.155 W/m•K
- Plastic coating only available for HT-700 and HT-1200

<sup>4</sup> Properties listed are typical and cannot be used as accept/reject specifications.

<sup>5</sup> ASTM C611. 4-Point Resistivity Test

<sup>6</sup> ASTM D5470 Modified (at 110kPa/16 psi/1.1 bar). Total thermal impedance = thermal impedance of graphite + thermal impedance of coating.

<sup>7</sup> Adhesive Strength is based on a lap shear test (ASTM D3163) with material adhering to a glass plate. Note that the speed of peel from the release paper is directly related to adhesive strength. The higher the adhesive strength, the slower the peel speed from the release paper.