

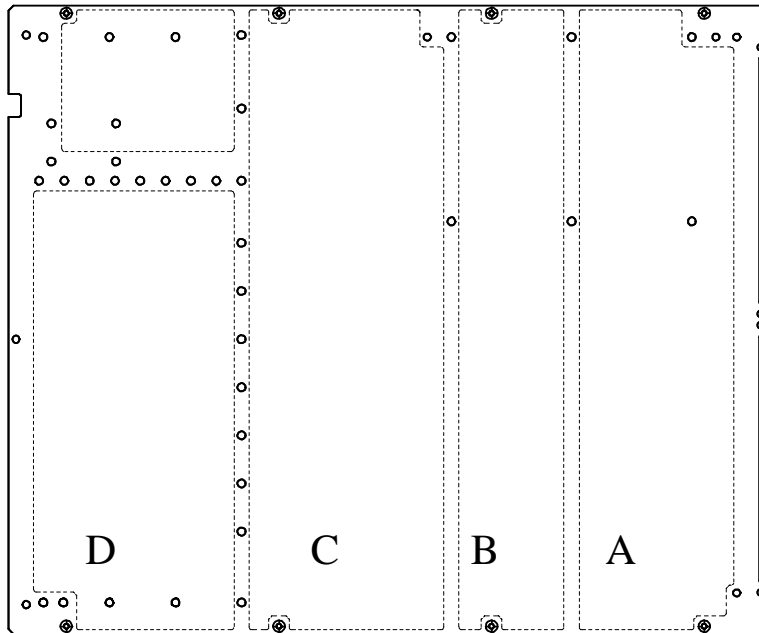
Thermal Evaluation of k-Core™ Coupons From a Flight Thermal Core

Encapsulated APG Component Produced by k Technology
Corporation (Part Number kTC/IN10238C)

WARNING INFORMATION SUBJECT TO EXPORT CONTROL LAWS

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Thermal Core



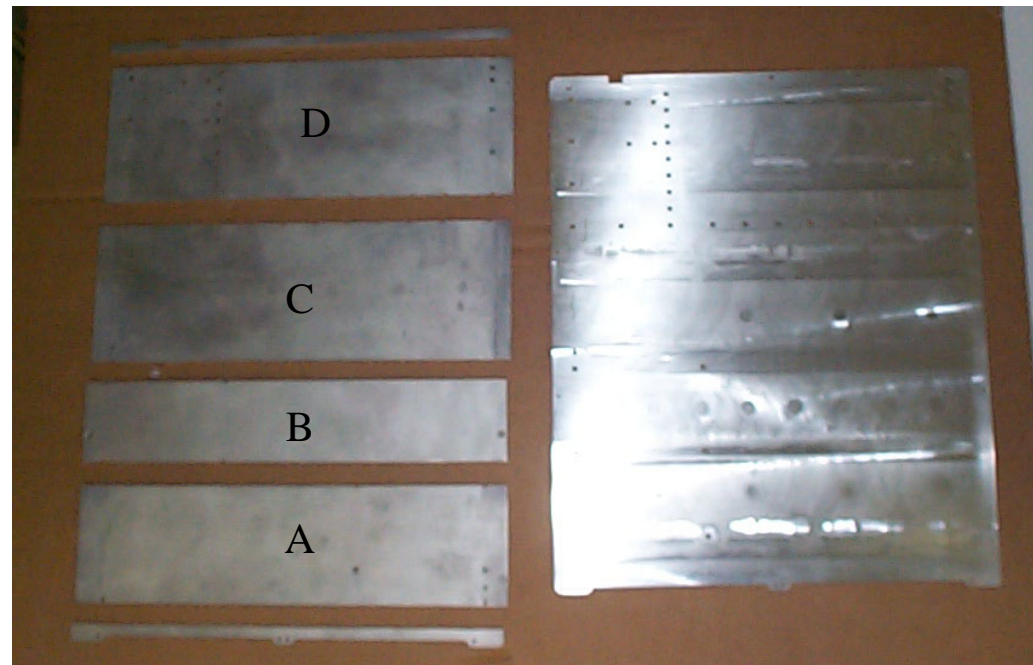
- 0.120 inch thick panel (12 x 15 inch)
- Panel is a qualified satellite thermal core
- Five .080 inch thick APG Inserts (.02 Al skins)
- Three APG inserts are “rail to rail” (A, B, and C)

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Sample Preparation

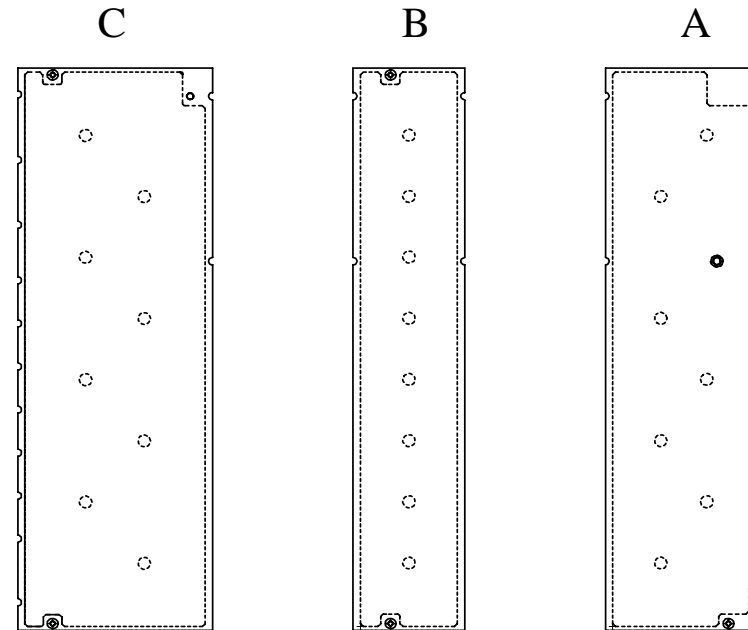
- Scrap core from production selected. Core scraped due to out of tolerance hole diameter.
- Thermal core sectioned along internal ribs producing four evaluation coupons (no exposed APG)
- Three coupons with APG insert “rail to rail” (A, B and C)
- One coupon with two APG inserts (marked D)
- Evaluation completed on coupons A, B, and C



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Coupon Details



Coupon Data

	Thickness (in)	Width (in)	T apg (in)	W apg (in)	A (in ²)	A apg (in ²)
Coupon A	0.12	3.38	0.08	3.05	0.41	0.24
Coupon B	0.12	2.28	0.08	2.07	0.27	0.17
Coupon C	0.12	4.06	0.08	3.84	0.49	0.31

k apg (W/mK) = 1637.0 TPRL Data
 k aluminum (W/mK) = 175.0 Supplier data

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Evaluation Plan

- kTC performed baseline evaluation of coupons A, B, and C and correlated results with computed data
- kTC performed thermal cycling evaluation of all coupons:
 - 10 thermal cycles from -55°C to 125°C and then measured k of all coupons
 - 50 thermal cycles from -55°C to 125°C and then measured k of all coupons
 - 100 thermal cycles from -55°C to 125°C and then measured k of all coupons
 - 250 thermal cycles from -55°C to 125°C and then measured k of all coupons
 - 500 thermal cycles from -55°C to 125°C and then measured k of all coupons
- kTC performed 2 thermal shock cycles (-25°C to 200°C) on all samples and measured k of all coupons
- kTC to provide data to team

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kTC Evaluation Apparatus

Vacuum Chamber

23" Dia x 30" Deep

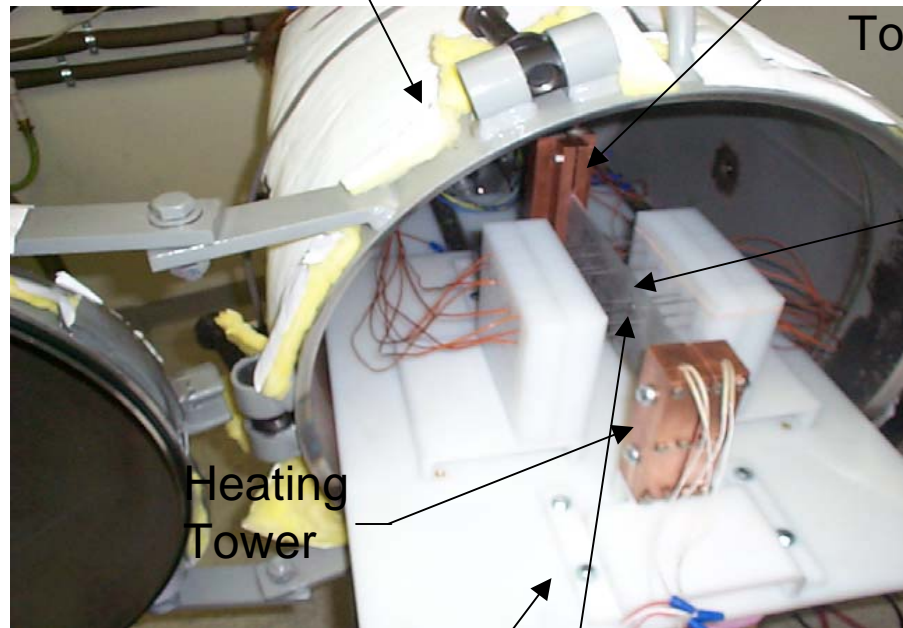
Cooling Tower

Sample, MLI shield removed

Heating Tower

Polyethelene Fixturing (low k)

Sensors (both sides of sample)



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Thermal Conductivity Measurements

Data

Item	BOL, Conductivity, Computed (W/mK)	BOL, Conductivity, Measured (W/mK)	10 Cycles, Conductivity, Measured (W/mK)*	50 Cycles, Conductivity, Measured (W/mK)*	100 Cycles, Conductivity, Measured (W/mK)*	250 Cycles, Conductivity, Measured (W/mK)*	500 Cycles, Conductivity, Measured (W/mK)*	2 Cycles, Conductivity, Measured (W/mK)**
Copper Standard	390.0	375.0	-	-	-	-	-	-
Coupon A	1054.4	978.0	993.0	897.0	975.0	929.0	923.0	925.0
Coupon B	1057.4	981.0	982.0	1027.0	946.0	1052.0	966.0	1050.0
Coupon C	1096.2	1068.0	1087.0	1022.0	944.0	1094.0	887.0	930.0

* -55 °C to 125 °C Thermal Cycle

** -25 °C to 200 °C Thermal Cycle

Computed/Measured Data

Item	BOL, Conductivity, Computed (W/mK)	EOL, Conductivity, Measured (W/mK)	Discrepancy (%)
Coupon A	1054.4	978.0	-7.8%
Coupon B	1057.4	981.0	-7.8%
Coupon C	1096.2	1068.0	-2.6%

BOL/EOL Data

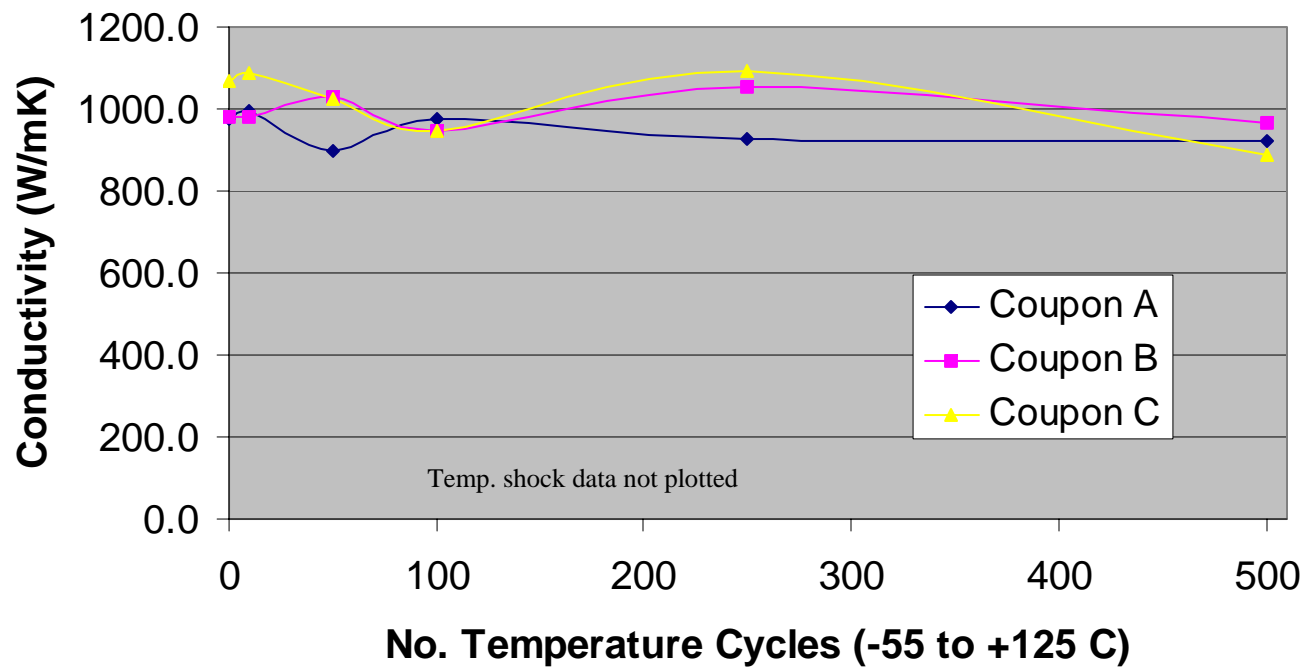
Item	BOL, Conductivity, Measured (W/mK)	EOL, Conductivity, Measured (W/mK)	Change (%)
Coupon A	978.0	925.0	-5.7%
Coupon B	981.0	1050.0	6.6%
Coupon C	1068.0	930.0	-14.8%

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Thermal Conductivity Measurements

kCore Conductivity Life Characterization



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Summary

- Computed conductivity values, using only 2D APG properties (ignoring the low through the thickness conductivity), yield results 3 to 8 percent above measured values.
- The temperature cycling had little measurable effect on coupons. Conductivity changes may be due to temperature effects or may represent the fidelity of the measuring apparatus (measurement error). kTC is checking average sample temperatures to determine if a correlation exists.

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