

HYBRID DESIGN/ASSEMBLY DEVELOPMENTS

THERMAL BONDING TO CLOSEOUT

SCIPP, 3/28/00
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MOTIVATION:

- ◆ Higher than expected temp. drop down tower wall
- ◆ Minimize temp. drop from HDI to thermal boss
- ◆ Use as mechanical bond → reduce # screws
- ◆ Provide seal for eventual wire-bond encapsulation

REQUIREMENTS:

- ◆ Room temp. cure (required for any bonding involving trays)
- ◆ Repairable – low peel strength
- ◆ Low outgassing
- ◆ Fast cure for manufacturability
- ◆ Thermally conductive > 0.3 W/mK
- ◆ Operating temp. range –55 to +60 C

Thermal Conductivity of Some Low Outgassing Adhesives

Company	Type	Thermal Conductivity (W/mK)	Delta T (K) (for 2 mil bond line)	Percent of allowable 0.25 C drop
Nusil	silicone	0.84-1.5	0.0099-0.0053	2.1-4.0
Epo-Tek	epoxy	0.9-4.0	0.0092-0.0021	0.8-3.7
Tra-Con	epoxy	0.6-2.0	0.0138-0.0042	0.2-5.5
3M	tape	0.43	0.0194	7.8

- ◆ Eric Ponslet agrees that 16% of 0.25 C drop over bond line is acceptable

POTENTIAL MATERIALS:

- ◆ 2-sided tape – 3 potential space qualified materials have been found
- ◆ silicones – many space qualified materials have been found

Name	Company	Type	Thermal Conductivity (W/mK)	Peel Strength (N/m)	Cure Time	Cure Pressure (psi)
CV-2943	Nusil	Silicone	1.26	16600	7 days	NA
CV-2902	Nusil	Silicone	0.84	14000	7 days	NA
9882	3M	Transfer Tape	0.43	40-80	Short	moderate?
Thermattach T412	Chomerics	Tape w/ backing	1.4	?	15 sec.	10
Thermattach T405	Chomerics	Tape w/ backing	0.5	?	15 sec	10

TAPE:

- ◆ Desirable due to ease of manufacturing and reparability
- ◆ Generally lower thermal conductivity (probably not an issue)
- ◆ More difficult to get thermal contact – requires high planarity
- ◆ Is aging an issue? “tape bonds get stronger over time” – Chomerics data sheet
- ◆ Would possibly motivate more screws

SILICONE:

- ◆ Flexible and repairable
- ◆ Extremely long cure time at room temp. Set up time may be shorter?

OTHER OPTIONS:

- ◆ Fairly extensive search was done
- ◆ Custom formulate by adding filler ourselves – has been done and documented by NASA
- ◆ Find epoxy, or silicone with more desirable properties and add Al Nitride or Boron Nitride filler