

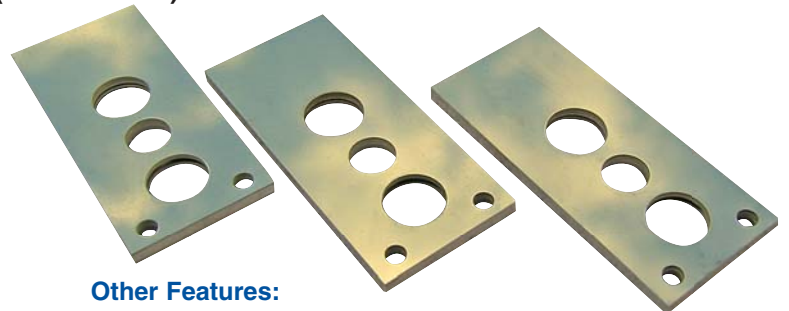
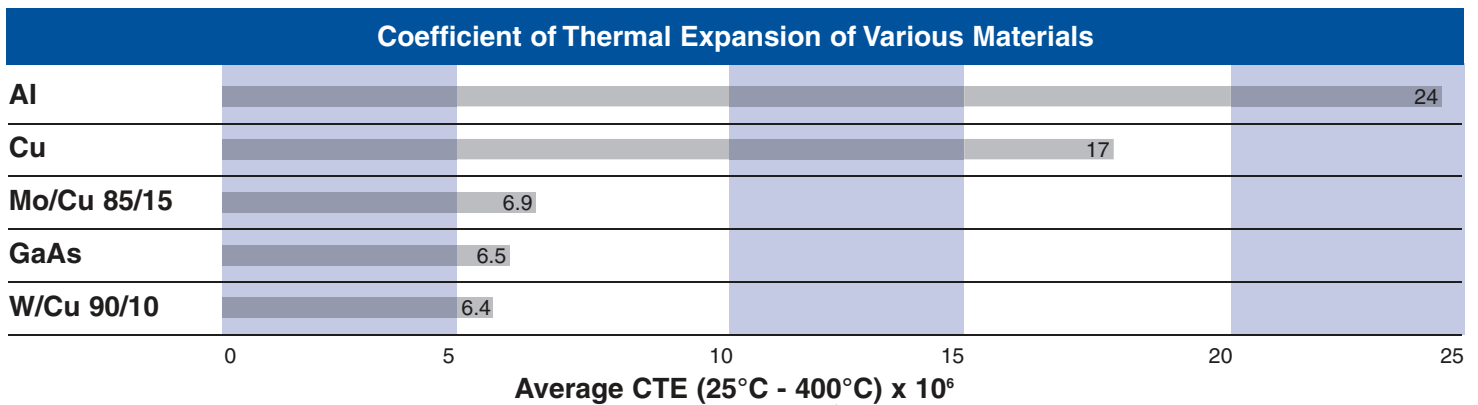
CTE-Matched Microchannel Coolers

For laser diodes and other power GaAs semiconductors

Laser diode heat dissipation can exceed 1,000 watts per square centimeter, higher than other semiconductor devices. In such cases, fluid cooling is one solution that has been implemented. “Microchannel” fluid cooling was conceived by Tuckerman and Pease at Stanford Engineering in the early 1980’s. It utilizes numerous small channels (typically less than 250 micrometers in width) and high fluid velocities to improve thermal transport beyond what is accomplished with traditional fluid or air cooling.

Microchannel Coolers (MCC’s) for laser diodes are typically made of copper or copper alloy. The disadvantage of the use of these metals is their much higher coefficient of thermal expansion (CTE) compared to the GaAs used in most laser diodes (figure below). This mismatch can result in stress on the devices even at small temperature excursions. A better solution is to fabricate the microchannel cooler (MCC) from a material that is expansion matched to GaAs.

Spectra-Mat designs, fabricates, and tests custom MCC’s of Controlled Expansion Composite (CEC) material. A wide range of dimensions are possible; we have made devices with overall thickness as low as 1.2mm (0.047”).



Advantages:

- CTE matching allows the use of higher melting “hard” solders for device attach (e.g., AuSn, AuGe) which:
 - Have better thermal conductivity than “soft” Indium based solders commonly used.
 - Exhibit less creep and void formation, both detrimental to life.
 - Allow a thinner bond line for lower thermal resistance and easier optical alignment.
- Spectra-Mat’s proprietary coating and materials can increase life in high flow applications.

Other Features:

- Thermal resistance similar to copper coolers.
- Pressure drop less than 25 PSI at 0.5 lpm.
- Cooled zone dimensions up to 10 x 4 mm.
- Custom footprints as required.
- Various plating schemes available.