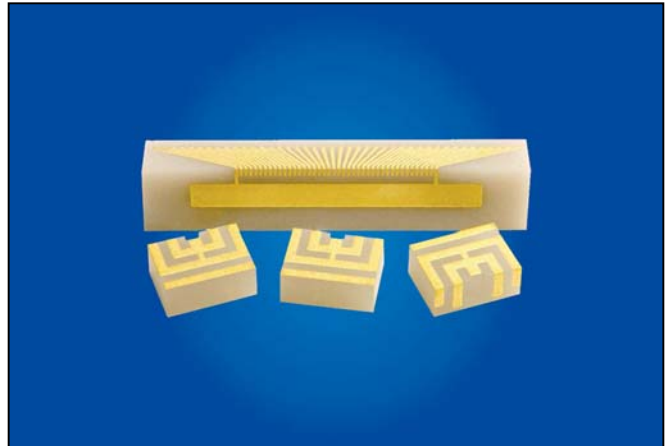


DuPont Thick Film Conductor Technology for Laser Diode / Photodetector Submounts on Aluminum Nitride

Challenge: Reliable Laser Diode and Photodetector Submounts Using High Thermal Conductivity Ceramic

Stellar Industries of Millbury, Massachusetts is a leader in the design and manufacture of precision machined and metallized submounts for laser diodes and photodetectors. Their challenge was to design high reliability submounts using substrates made from a high thermal conductivity ceramic in order to safeguard the stability of the active device, which is sensitive to changes in temperature. Stellar and their customers chose aluminum nitride (AlN) for its excellent heat dissipation (170-200 W/mK) and thermal stability. The TCE of AlN (4.5 ppm/°C) is also reasonably well matched to the TCE of semiconductor diodes, such as silicon (4.1 ppm/°C) and gallium arsenide (6.5 ppm/°C). Compared to beryllium oxide (BeO), AlN offered the additional benefits of lower cost and the elimination of potential health risks associated with machining BeO, while providing comparable thermal performance.

In order to successfully complete their metallized submount designs, Stellar needed to identify a conductor that was compatible with AlN. In addition to providing reliable adhesion, the conductor needed to be optimized for a) screen-printing, both fine-lines and edge wraps, b) soldering with gold/tin (Au/Sn) for diode



Stellar achieved excellent adhesion to the AlN substrate with the DuPont conductor, which can be vapor-deposited precisely onto the submount.

attachment to the submount and for mounting the ceramic in the fiber optic package, and c) wire bonding with gold wire.

Solution: DuPont Thick Film Materials for AlN Substrates

DuPont thick film gold conductor technology enabled Stellar to successfully fabricate their submount designs on AlN. ALN71 gold fulfilled each of Stellar's requirements for conductor adhesion, screen printing, solder wetting and wire bonding. To further enhance Au/Sn wetting, Stellar utilized DuPont's conductor technology for low-temperature brazing by applying an overprint of 5063D gold over specific areas of the ALN71.

This materials combination allowed Stellar to selectively vapor deposit Au/Sn to precise



conductor locations on the AlN submount. Vapor deposition of the brazing alloy improved both diode placement and the ability to adhere the submount to a heat sink, eliminating the need for Au/Sn preforms.

Furthermore, the ability to edge-wrap the thick film conductor enabled Stellar to offer their customers smaller and more innovative packaging, including more flexibility in final packaging and assembly. Designs in which the Au wire bonds could be attached to the metallized edge were now feasible, which made it possible, for example, for Stellar's customers to attach their submounts in a tombstone fashion inside the fiber optic package. Edge-wrapping also enabled other custom designs in which the diode could be placed on a pedestal that was machined into the AlN ceramic.

An additional benefit that Stellar has realized from DuPont's thick film technology has been their customers' ability to meet stringent Telcordia® standards for reliability. As an example, the enhanced wettability of the conductor has enabled the Au/Sn solder to form a strong mechanical bond between the diode and the submount along with good electrical contact. This and other unique design approaches have provided Stellar's customers with increased yields and reliability, while reducing their costs.

For more information, call DuPont at 1-800-284-3382, press 3, or visit the DuPont Microcircuit Materials Web Site (<http://www.dupont.com/mcm/>).

