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Brief 67-10534

NASA TECH BRIEF

Flame Sprayed Dielectric Coatings Improve Heat Dissipation in Electronic Packaging

The problem:

Present electronic packaging applications require the transfer and dissipation of heat from heat-generating components while maintaining the components electrically isolated. The usual approach is to mount the components to an aluminum heat sink which has been coated with an electrically insulating material. The use of an anodized (aluminum oxide) coating has been found to be inadequate because of its low electrical resistance when exposed to a high humidity environment.

The solution:

Flame spray the heat sinks with coatings of alumina (Al_2O_3) or beryllia (BeO) and then finish off with an organic sealer.

How it's done:

Beryllia (BeO), and alumina (Al_2O_3) were examined for possible application as heat sink coatings. Magnesia was eliminated from consideration because it was found to be very hygroscopic. The materials applied to aluminum test panels for examination were high purity 325 mesh alumina and 200 mesh beryllium oxide. A controlled atmosphere chamber was used for the flame spraying of beryllia since it is a toxic material.

After the oxide coatings were flame sprayed onto the test panels, organic heat sealers were brushed on the coatings to inhibit moisture from penetrating into the pores of the coating. Three sealers were tested: an epoxy resin, an insulating varnish, and a phenolic sealer. The coatings exhibited the best shock resistance with the epoxy resin sealer.

Notes:

1. Flame sprayed alumina and beryllia coatings with an organic sealer brushed over them can be used from room temperature to 400°F. They have electrical resistivities of approximately 10^{15} ohm-cm at room temperature to 10^{12} ohm-cm at 400°F with no dielectric breakdown at 500 volts. The thermal conductivity of alumina is about one-sixth of that for beryllia. Both coatings (with the epoxy sealer) withstood a thermal cycle test from 400°F to −85°F with a transition period of approximately three minutes.
2. Inquiries concerning this invention may be directed to:

   Technology Utilization Officer
   Marshall Space Flight Center
   Huntsville, Alabama 35812
   Reference: B67-10534

Patent status:

Inquiries about obtaining rights for the commercial use of this invention may be made to NASA, Code GP, Washington, D.C. 20546.

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Category 01