Packaging of MEMS for Aerodynamic Measurements

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Abstract

Micromachined arrays of microphones and surface shear sensors have been packaged for aerodynamic flow testing applications. This application requires low surface topology for the entire package, as the boundary layer flows have a viscous sublayer thickness on the order of 25 microns. Ideally, the topology of the sensor array surface should be kept within the viscous sublayer in order to minimize the impact of the sensor on the characteristics of the flow. A variety of packaging approaches to this problem will be described. The first approach uses CPGA packages with CNC milled epoxy fill, wirebonding, and vapor- phase Parylene coating. A second approach is a chip-in-board method using a milled PCB, laser cut stencil, semiconductor processing tape and conductive ink interconnect by syringe printing. Both of these methods achieve approximately 100 microns of total surface topology. These systems have been tested in wind tunnels at the University of Toronto, NASA Ames, and Spirit Aerosystems. In recent work, aerosol jet printing has been used to provide a thin polyimide dielectric coat over the edges of the chip, reducing yield loss for wirebond shorts to the side of the die. Ongoing efforts attempt to further extend the aerosol jet printing to direct-write the interconnects between the MEMS sensor array and the package. The challenge with all three methods is identifying and reducing sources of failure during the packaging process while maintaining a low level of surface topology.