MEMS-LSI Chip Lateral Interconnects (High-Density Mounting Technology with Low-Temperature Chip Stacking)

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We are conducting research aimed at developing a new mounting technology using low-temperature chip stacking for the high-density integration of heterogeneous devices and electronic parts, such as LSI chips, MEMS chips, optical devices, and passive elements. This new technology fuses IC, MEMS, mounting, and micro-optic technologies comprising 1) a technique for high-density mounting of MEMS and LSI chips on a flexible printed circuit board using self-assembly, 2) a technique for high-density formation of microbumps on a flexible printed circuit board, 3) a technique for forming crossover interconnects over chips mounted on a substrate, and 4) a technique for forming passive elements on chips, such as resistors, capacitors, inductors, and coils. Here, I will present our findings from investigations into MEMS-LSI mounting using self-assembly and the formation of crossover interconnects.

MEMS-LSI Mounting Using Self-Assembly

Numerous MEMS and LSI chips can be densely mounted together on a flexible printed circuit board using the surface tension of liquid droplets. When mounting the chips facedown on a hydrophobic flexible printed circuit board, as shown in **Fig. 1**, the underside surfaces of the multiple MEMS and LSI chips forming a plurality of microbumps are made hydrophilic and coated with an aqueous solution or liquid organic matter. At the same time, hydrophilic areas are formed on the surface of the substrate for temporarily holding the chips. These areas are also coated with an aqueous solution or liquid organic matter. The plurality of chips whose underside surfaces are coated with the aqueous solution or liquid organic matter are flipped so that their underside surfaces are facing downward and are simultaneously lowered onto the surface of the substrate so that the aqueous solution or liquid organic matter on the underside surfaces merges with that on the surface of the substrate. The chips are aligned on the substrate through self-assembly owing to the surface tension of the liquid and are bonded in place. This technique enables the chips to be positioned with an accuracy of ±1 μm within one second.

Crossover Interconnects

We are developing a technique to form high-density lateral interconnects that cross over MEMS and LSI chips mounted on a flexible printed circuit board through self-assembly. With this technique, it is important to form the copper interconnect patterns over the high chips so that the side surfaces of the chips are well coated, as shown in **Fig. 2**. To achieve this, we studied various techniques on insulating layer formation, hot lithography, and copper electroplating. We succeeded in forming crossover interconnects with widths of 5–10 μm and a pitch of 10 μm.

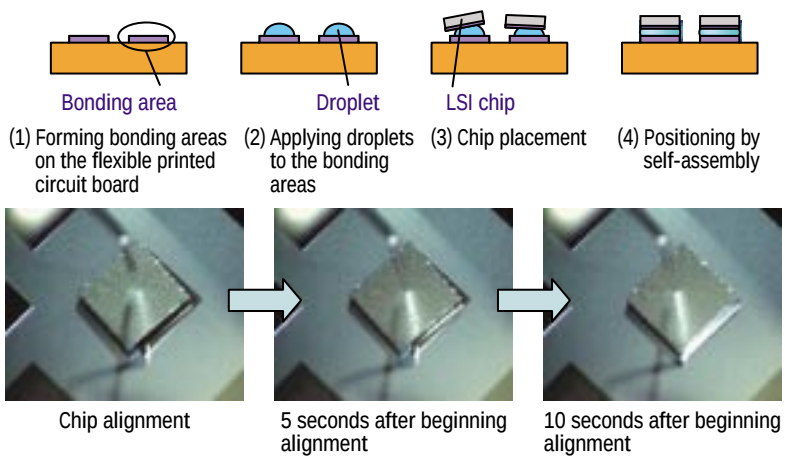

Fig. 1 MEMS-LSI mounting technology using self-assembly

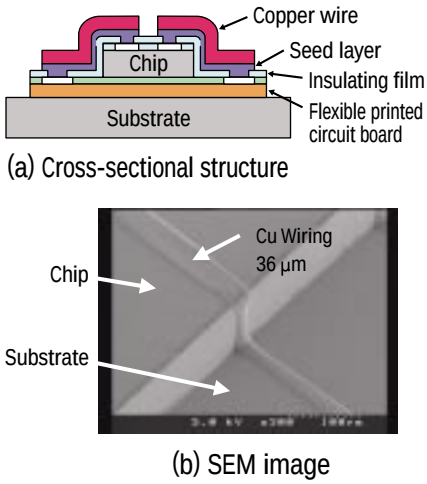

Fig. 2 Crossover interconnect