Au Bump Technology

Tohoku-MicroTec (T-Micro)
2018 January
T-Micro Chip-to-chip, Chip-to-Wafer bonding using Au cone bump
Advantages of Au cone u-bump

- **good scalability**
  
  bump size and height are only determined by lithography process

- **No protrusion**
  
  [Image of Au cone bump and conventional bump comparison]

- **large bonding margin**
  
  NpD Au cone bump → easy to deform

- **Redundancy**
  
  Plural bump junction in a connection
  A major cause of yield loss of stacked device is Si particles generating in dicing process

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Material cost of Au bump

10^6 micro bumps

Reuse the deposited Au on photoresist
Cylinder Bump for fragile material
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CdTe surface after CdTe/Si-ROIC bonding with Au bump
Bump bonding with cylinder Au bumps

Cylinder bump

Fragile material

Thin (easy to deform)
Bump bonding with cylinder Au bumps

Bump hole patterning

Short Throw (SL) Au spatter

after photoresist lift-off
T-Micro

Au Cylinder Bump bonding for u-LED array chip

8 x 8 LED array

8 x 8 LED array for connecting test
Repair

Chip Repairing process needs
(1) Perfect electrical connection in condition of temporally bonding
(2) Easy to remove failure chip
(3) To minimize deformation of socket connection on photo chip

We propose the following structure

- Swaging
  Temporally bonding with electrical connection
  Au is best material for the switching electrode

- Failure removal
- Pass
  Thermo-compression bonding
Current Au bump Application

[2.5 mφ Au cone bump]
- SOI sensor/ Si ROIC Pixel detector for High energy Physics
  Stacked more than 150 chips with ~1M bumps without failure

[3.5 umφ Au cylinder bump]
- CdTe/Si ROIC Xray sensor
  Stacked more than 30 chips with ~10k bumps without failure

- Ge/ROIC far infra-red sensor
  Stacked more than 20 chips with ~5k bumps without failure

- u-LED Array for Intelligent head lamp
  Stacked more than 500 8x8 LED arrays without failure