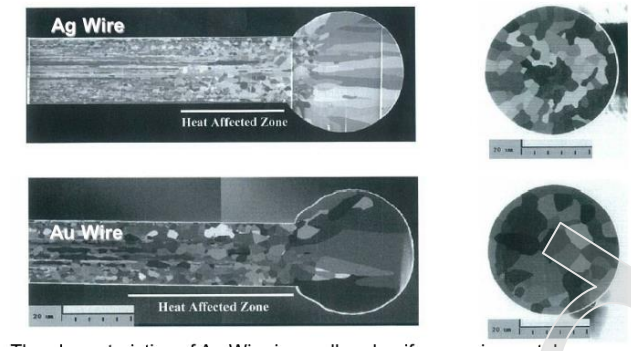
Introduction:

- SPEL started its Silver wire bonding evaluation Program in 2012
- SPEL partnered with Customers and Suppliers to develop reliable process technology for both leaded and leadless (QFN) packages
- After in-depth Material and Process evaluation, SPEL is qualified to run Volume Production in Q2 2013
- Process solutions developed using Pure Ag wire (Ag lite) on NiPdAu leadframe.
- A Comparative evaluation using diverse Equipment Models like KnS iCONN , KnS Ultra and Shinkawa UTC3000 helped to Customize Process Solutions

Ag Wire Characteristics:



- The characteristics of Ag wire is small and uniform crystals hence compared to Au stability of small balls can be expected
- HAZ of Ag wire is short hence low loop can be achieved easily
- Silver wire is Cost effective alternative to Gold wire
- Another advantage of Silver over gold is its lower tendency to form intermetallic compounds with aluminum

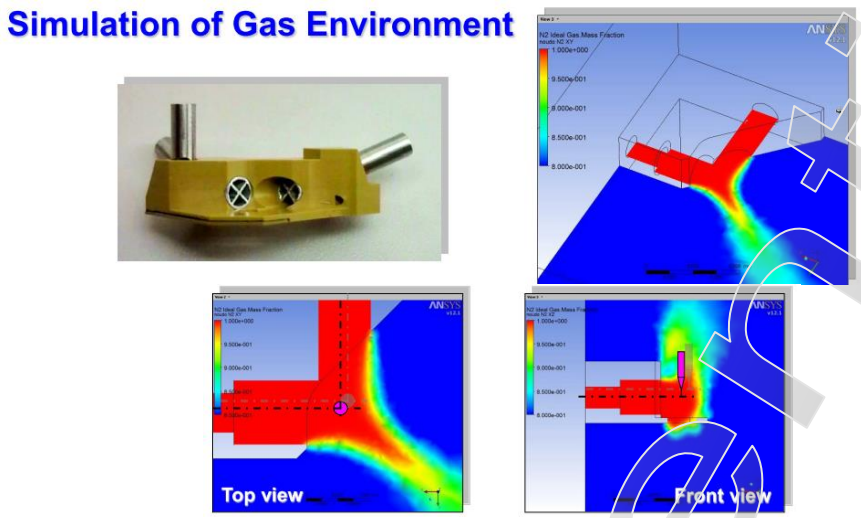
Engineering Challenges & Success

- Second bond Failures – Engineering analysis performed on Bonding Parameters with different Material Set and Equipment.
- The evaluation results helped in identifying suitable Parameter set and Bonding Tools for improved Bonding Performance
- Established Bonding Capability with 0.8 / 1.0 mil Ag Wire, including Pure Ag and Ag alloy
- Partnership with Customers and Fab, suitable Process Optimization done to reduce Cratering Failures on 0.8/0.9um Bond Pad Structures
- Reliability Performance monitored
- Successfully Qualified Customer Specific Products and Package Types for Volume Production

Process Control - Controlling pad structure damage of ultra-fine pitch cu bonding

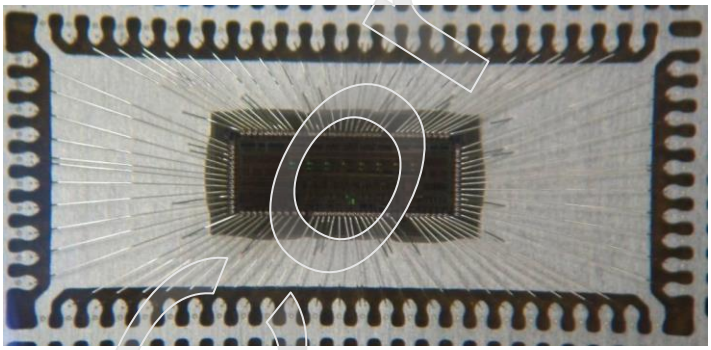
Key controls were put in to work on the following,

- Free ball oxidation by forming balls in an oxygen free environment (in all our Bonder types)



- Controlling pad damage – Thru DOE studies for process optimization.
    - Parameter effects
    - Bond tool effects
    - Wire effects
- Pad Structure design – Can be controlled and we worked with customers to improve pad structure by increasing Pad Hardness and thickness. If Pad structure cannot be modified then then Capillary and process parameter optimization should be done and controlled effectively.

Packages Qualified
Leadless – 72L QFN



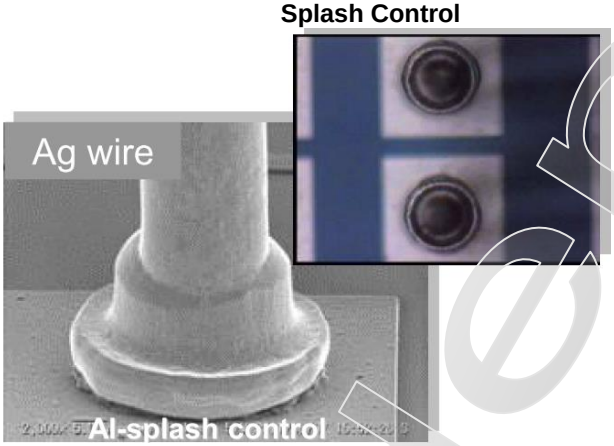
- Cratering test performed in one device and found good (Images attached)
- Excellent 2nd bond Wedge formation with good adhesion growth.

- Reduced 2nd bond assists , equivalent to Gold wire bonding – Improved system performance

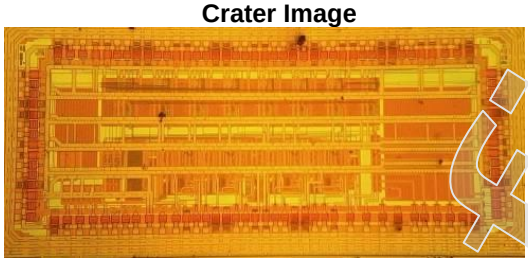
Ball

Wedge

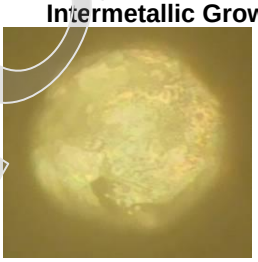
Splash Control



Crater Image



Intermetallic Growth



- SPEL is now ready for production using Silver Bond wires