

Silicon /pcb assembly

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Previously

Using Sony Robot and precision dispenser

Have established acceptable glue dot parameters

Dot electrical resistances $< 0.005 \text{ Ohm}$ (Gold /dot/Gold)

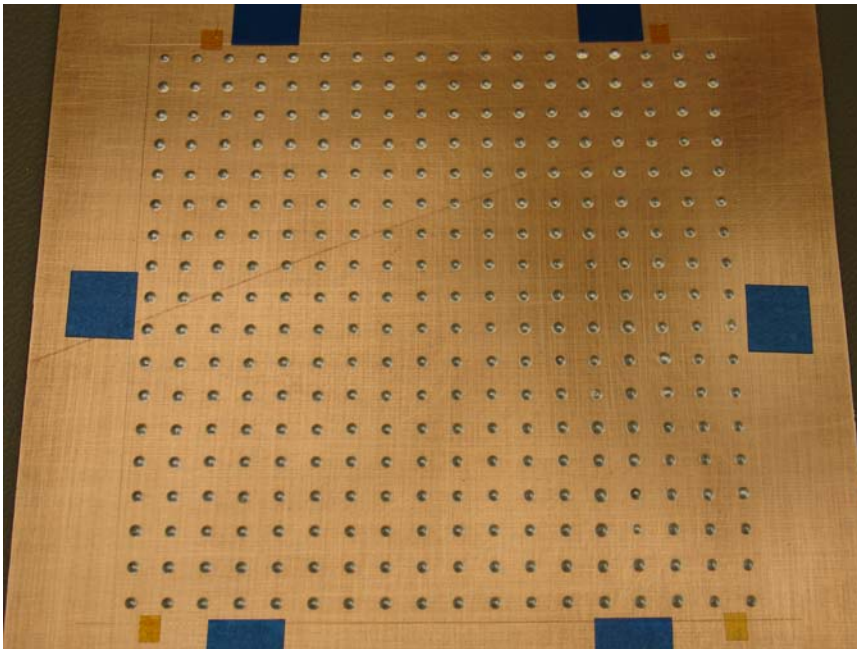
Need good control on gap thickness

Now modifying commercial BGA workstation as demonstration pick and place tool to position wafers on glued pcb.

Wafers not handled manually

Manual operation of workstation but shows automated concept

Glue Dot dispensing



Sony dispensing robot

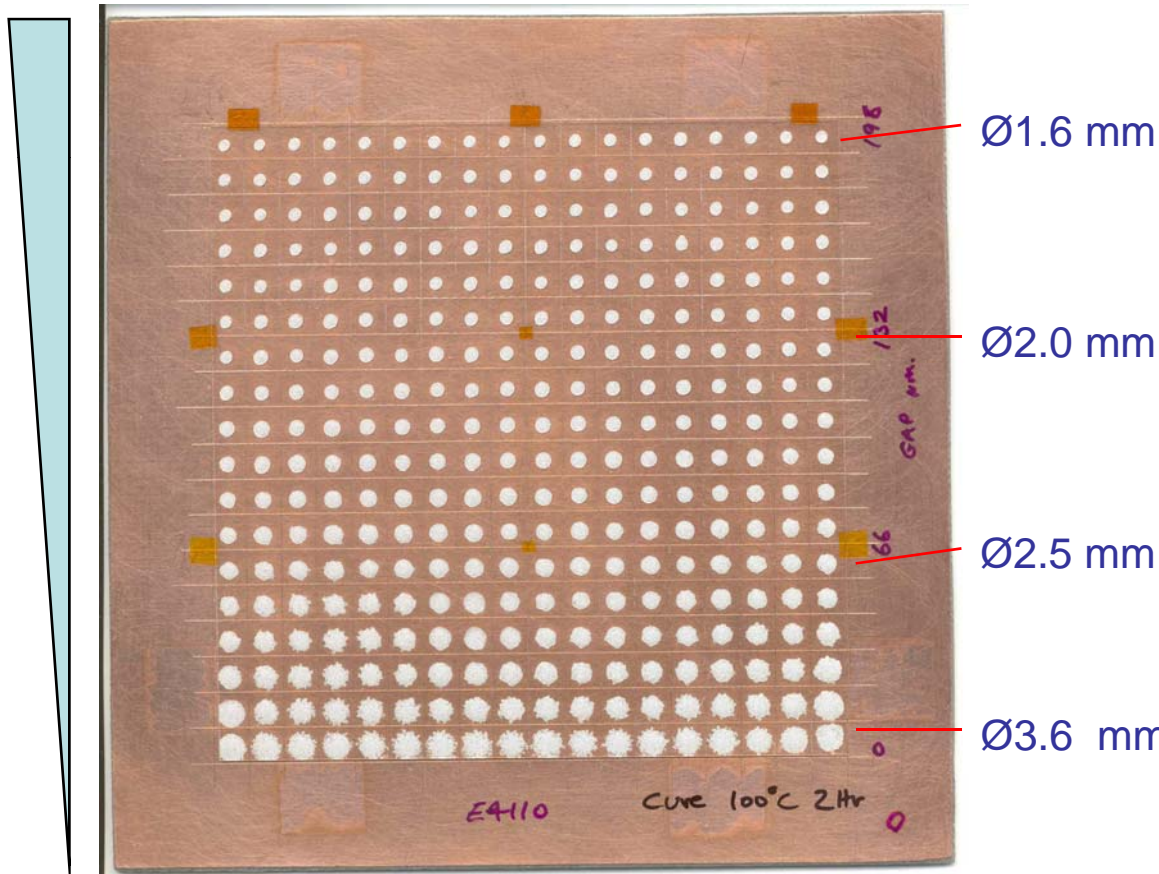
Placing glue dots
18 x 18 (324) dots on 5mm grid
(1 wafer) 0.2 sec/ dot
takes ~ 5min

Highly reproducible

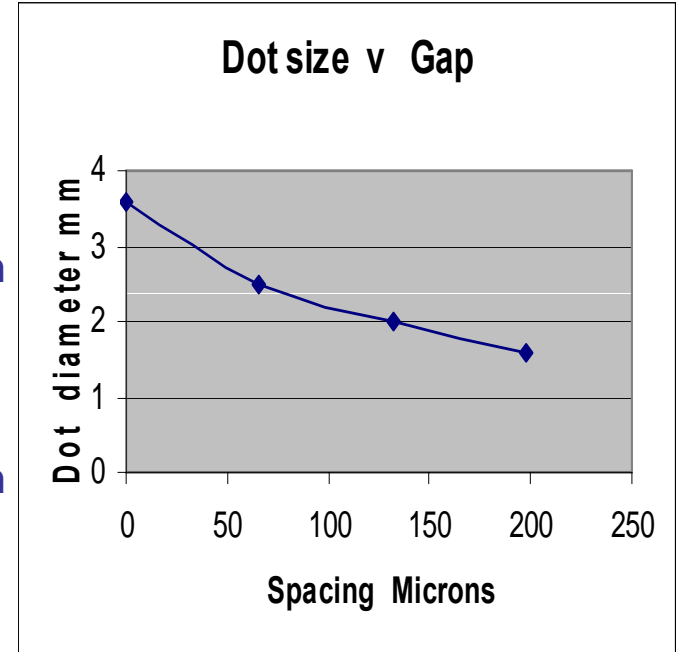
Dot size dependence on gap spacing

200μ

Glass plate wedge spacing

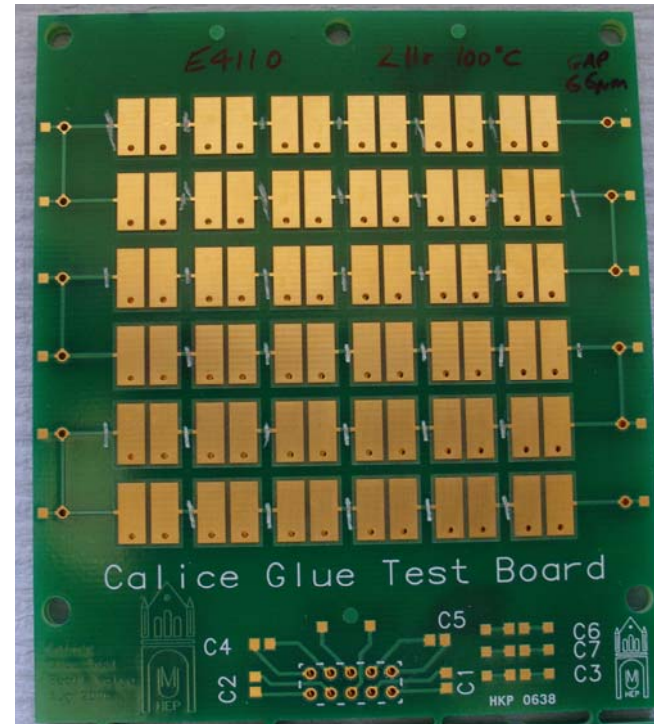
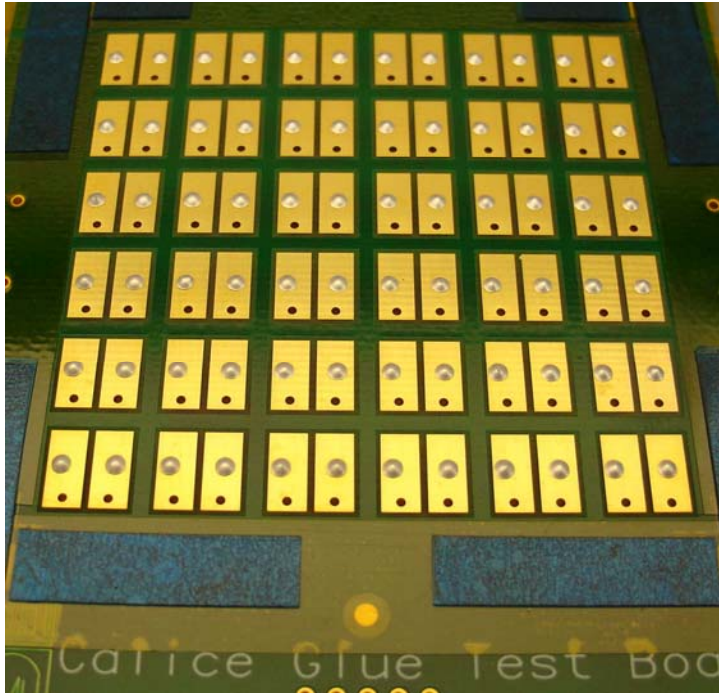


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+/- 50 micron gap =
+/- 0.5 mm diameter

Dot resistance tests



12 x 6 dots @0.2 sec on CALICE test board
Each pad probe able from rear
Two boards sandwiched together, 66µm gap
Interpad links cut on top board
4 Terminal resistances between overlapping pads measured –

<0.005Ω per pad



Needs repeating with silicon wafer

Wafer Pick and place demonstrator

Modifying existing commercial BGA placement station to pick and place wafers on to glued pcb held on vacuum jig.

Alignment via split prism viewing system.

Align images of wafer pixels and PCB pixels. Manual operation could be automated with pattern recognition

- rebuild pick up vac chuck for 90 mm wafer
- base vac chuck to hold PCB
- Investigate spacing control ideas
 - vacuum transfer chuck



Assistance from Scott Kolya

Spacing Control

Spacing control is critical to dot diameter and also module thickness

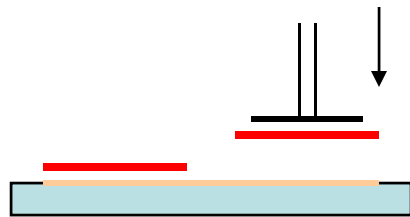
It is known that silicon wafers are usually bowed
-typically 50 -100 microns - single sided etch – uneven stress

Solutions

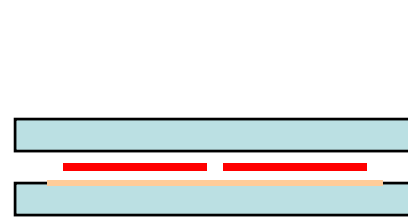
1. Removable spacers such as nylon line – c.f calice prototype
- difficult at this dot size - very manual - not automatable **✗ reject this**
2. Make few small (100 micron?) glue dots on PCB in a previous step to act as minimum gap defining spacers . Dispense glue on pcb
Carefully tune height of top jig - weight flattens wafers.
3. Use a top vacuum jig to control height – vacuum straightens wafers
More complex handling – align 4 wafers with BGA tool then pick up using a vacuum transfer jig . Transfer to separate jig with glued pcb as bottom plate.
Maintain vacuum during cure

Preferred solution - Wafers held flat and defined in x,y,z during glue cure

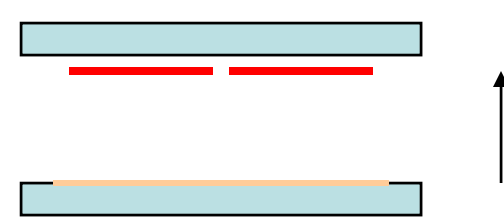
Schematic of wafer assembly steps



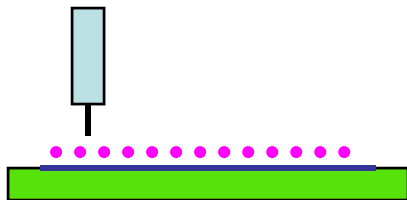
1. 4 wafers (red) picked and aligned on BGA station relative to pcb pattern (orange) . Held in position by vacuum.



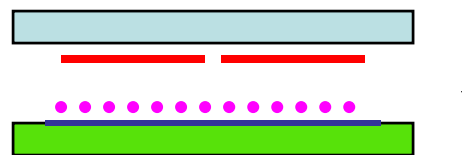
2. Transfer chuck lowered on top. Vacuum top on, bottom off. Wafers now held on transfer chuck



3. Remove transfer chuck from BGA workstation maintaining vacuum



4. Pcb (blue) held flat in bottom vac jig . Glue robot dispenses dots



5. Transfer chuck with wafers placed on bottom jig. Alignment dowels/touch bearings
Fine tune height. Maintain vac during cure



6. Remove assembled board

Vacuum Transfer Jig controls

Portable vacuum Jig Control Trolley with reservoir for moving transfer jigs from glue robot to alignment workstation
Panel controls vacuum on/off to the various jigs.



Summary

- Glue dot parameters understood
- Working on wafer pick and place
 - building jigs/ vacuum transfer system to control flatness/spacing
- Timescales - influenced by :
 - STFC cut backs reduced effort to
2 months technical
1 month engineer
 - Manchester priorities
 - attempting to get electronics help with placement - Scott Kolya
 - components PCB, Wafers.