

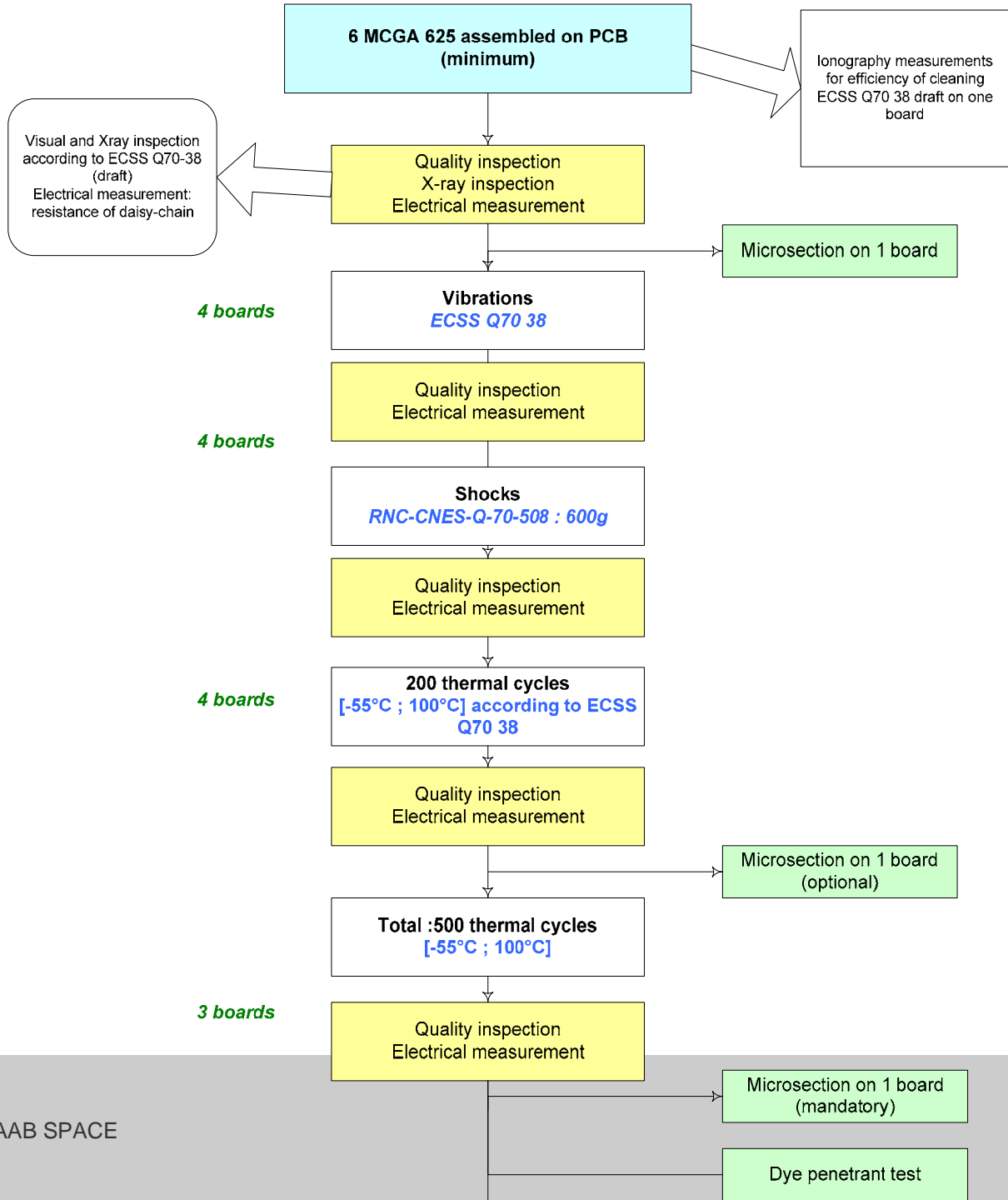
# Atmel CGA 625 Mounting Evaluation

Saab Space



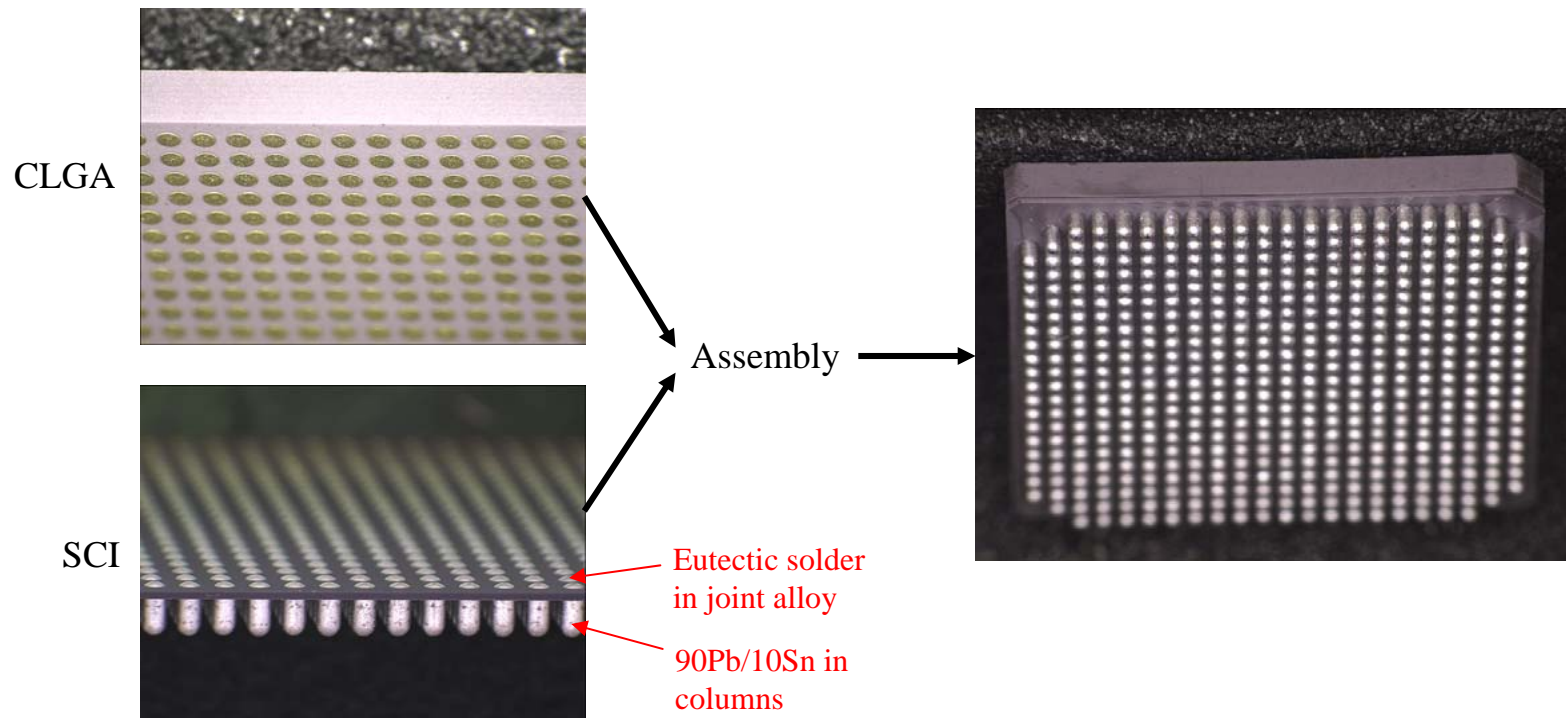
Stanley Mattsson

Estec, May 22nd, 2007

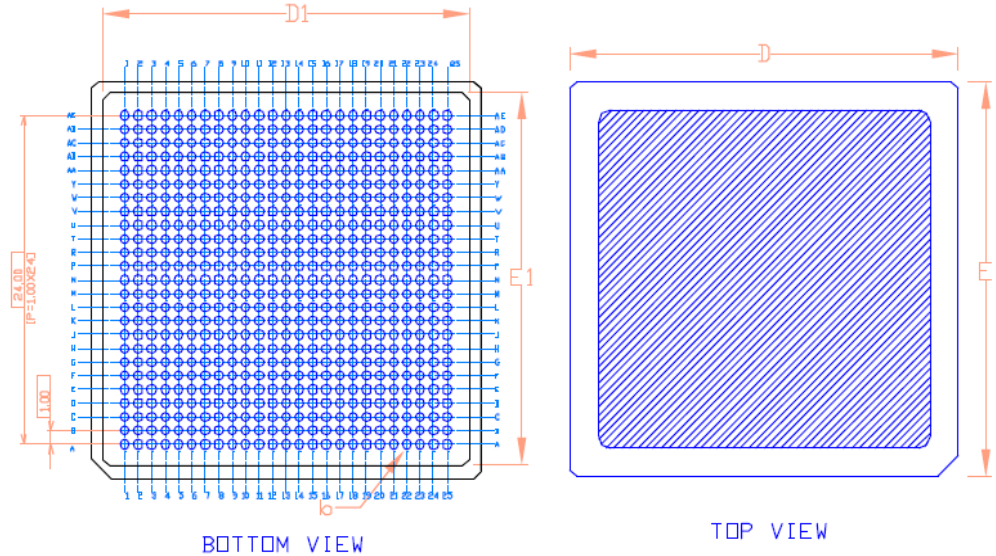


# Package Assembly

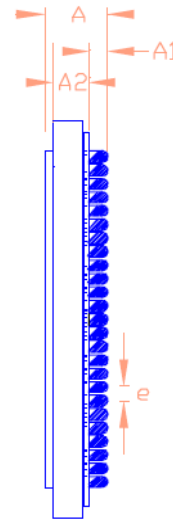
- Mounting verification of NTK 625 CLGA Package from Atmel
  - Atmel (e2v in Grenoble) mounted Solder Column Interposer on Ceramic Land Grid Array
    - ✓ Eutectic solder on flash Au, Alpha SLS65 flux and no cleaning



# Package Drawing



- ❑ Column Pitch = 1 mm
- ❑ Column width 0.62 – 0.82 mm
- ❑ co-planarity ?  $\mu\text{m}$



	MM		INCH	
	Min	Max	Min	Max
D/E	28, 85	29, 15	1. 136	1. 148
D1/E1	27, 14 TYP		1. 068 TYP	
A1		1, 80		. 071
A2		3. 45		. 136
A		5. 90		. 232
b	0, 62	0, 82	. 024	. 032
e	1, 00 REF		. 039	

# Production Processes

- ❑ Screen printing ,
- ❑ Pick&Place,
- ❑ Reflow Soldering
- ❑ Repair - hot air rework station
  - Dispensing solder paste
  - Pre-Heating complete board before replacement
  - Optimize thermal profile rigorously



# Qualification programme

## □ Environmental tests

- Shock, 600g 3 axis
- Vibration, sinusoidal and random
- Thermal cycling, 500 cycles according to ECSS-Q-70-08A, §13.2

## □ Analysis methods

- Electrical monitoring during environmental testing using Daisy Chain
- Visual Inspection
- X-ray inspection using 2D-5 axes microfocus equipment
- Micro sectioning
- Dye penetrant and pull test

# Test Boards

- ❑ 4 test boards, A1 – A4,
  - 18-layer glass reinforced polyimide, thickness  $2,9 \pm 0,3$  mm
  - Board dimension 160,0 x 233,4, manufactured by Printca
  - Circular pads and tear-drop pads with  $\varnothing 31$  mil and via-in-pad design
  - Plating minimum  $10 \mu\text{m}$  Sn63/Pb37 hot oil reflowed solder

Matrix showing environmental tests etc subjected to each board. The light grey colour indicates the board submitted to repair.

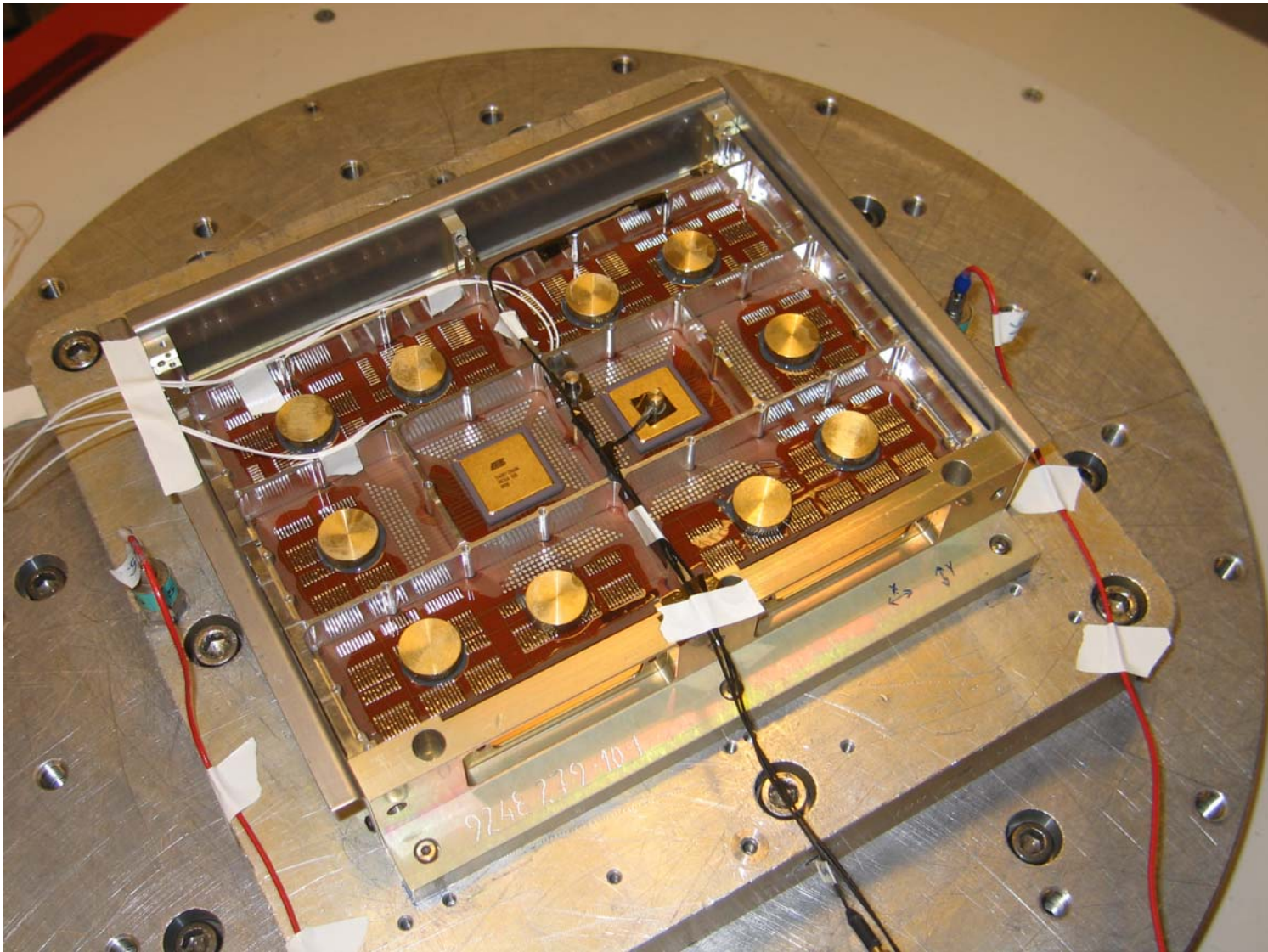
\* If needed, extended micro sectioning can be performed

\*\* Dye penetrant test after 200 thermal cycles

\*\*\* 600g shock test

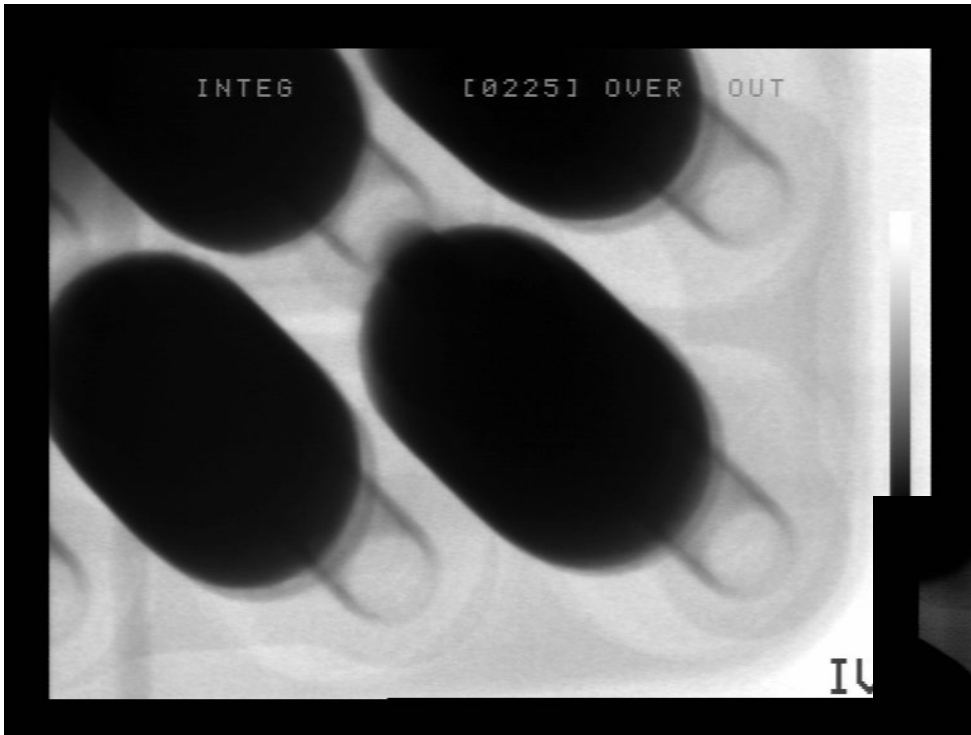
Board submitted to repair.

PCB/Work order	No. of MCGA62 5	Environmental tests					
		Random vibration §9.1	Sinus Vibration §9.1.2	Shock §9.2	Thermal Cycling §9.3	Micro sectioning	Dye Penetrant Test
A1 / 1353	2	Yes	Yes	Yes***	Yes	Yes* (Tear)	No
A2 / 1354	2	Yes	Yes	Yes***	Yes	No*	No
A3 / 1355	1	Yes	Yes	Yes***	Yes	No	Yes** (circ)
A4 / 1356	1	Yes	Yes	Yes***	Yes	No	Yes* (Tear)



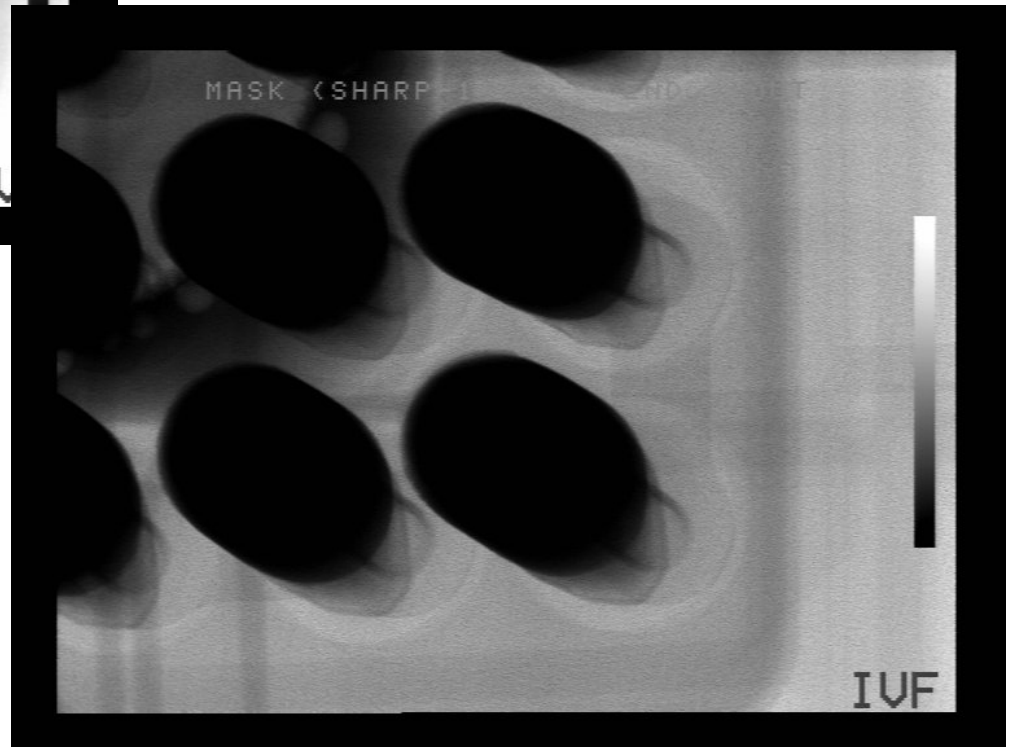


# 3D X-Ray After mounting



Circular pad

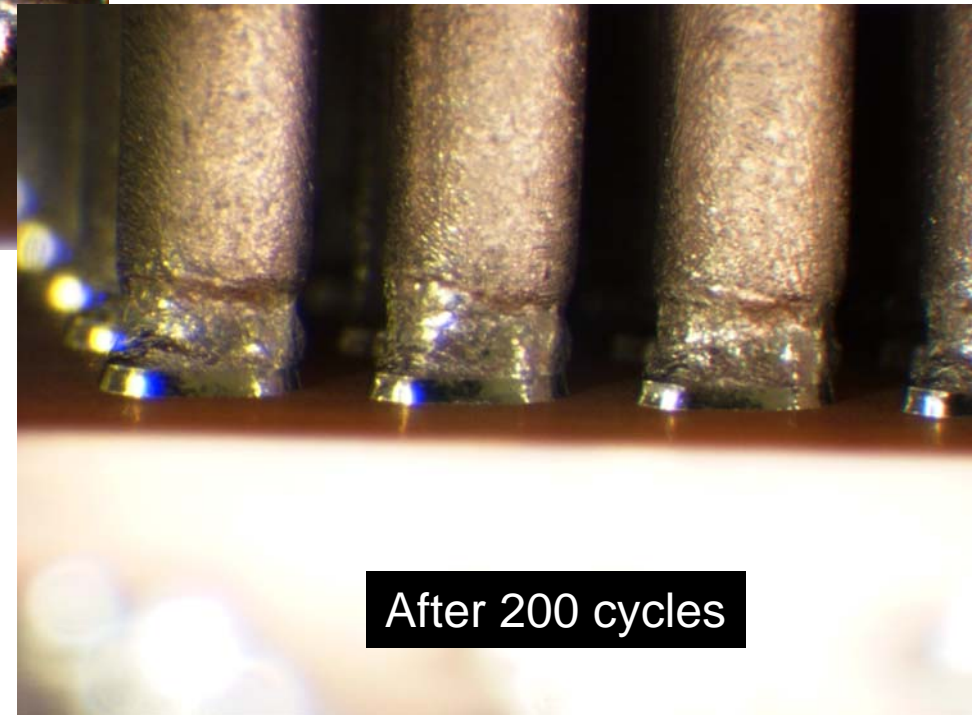
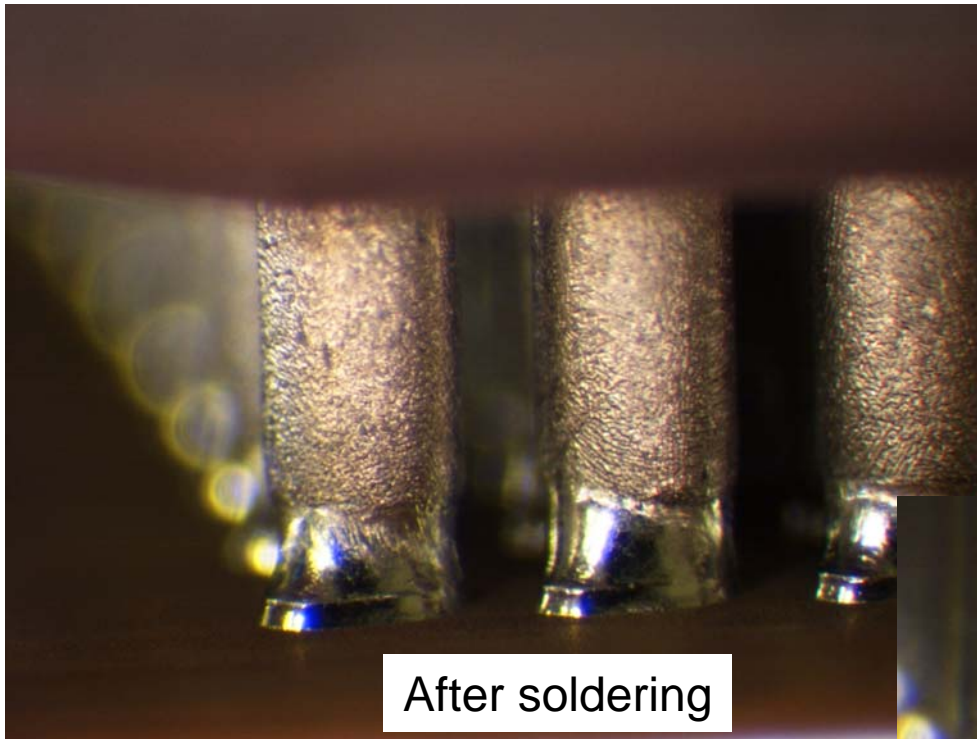
Teardrop pad



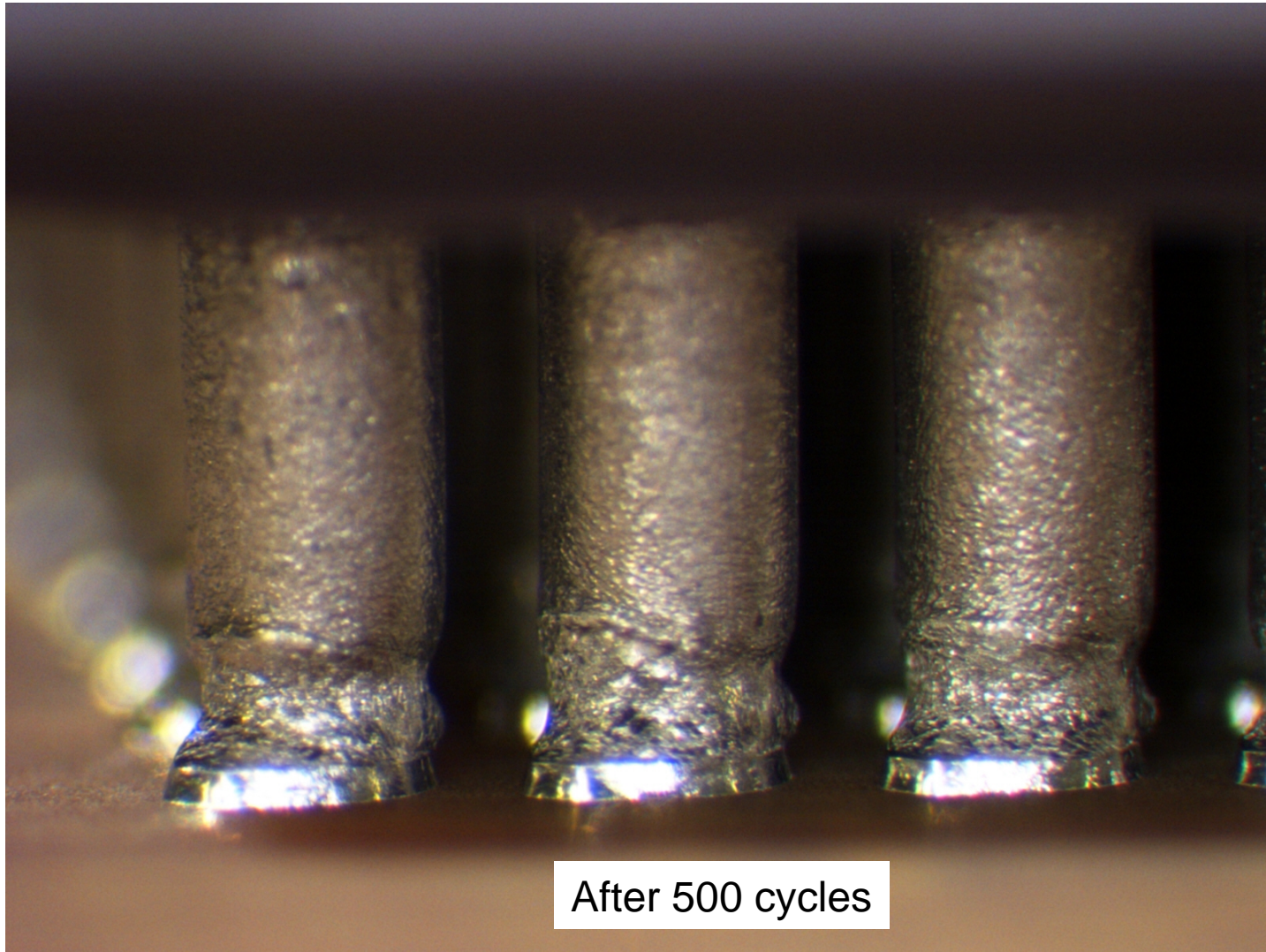
## Results after 500 cycles

- Electrical: No failures detected
- Visual: No cracks observed in 60x magnifications

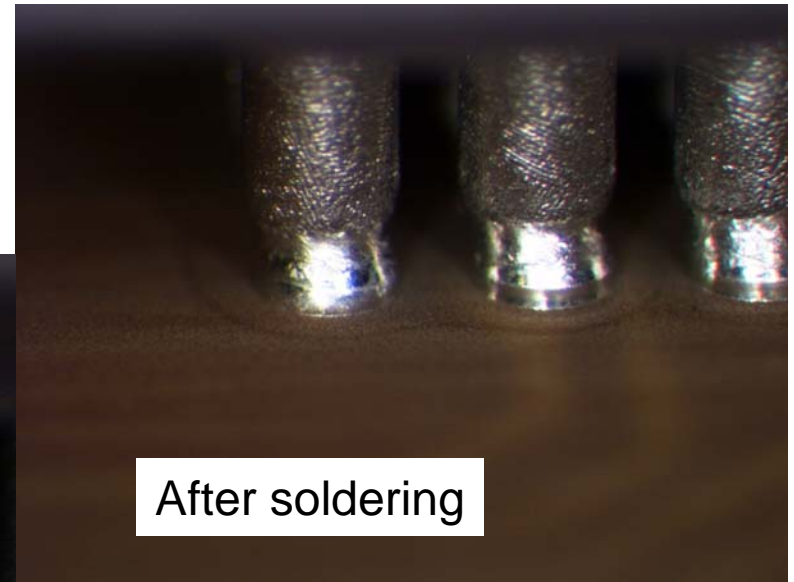
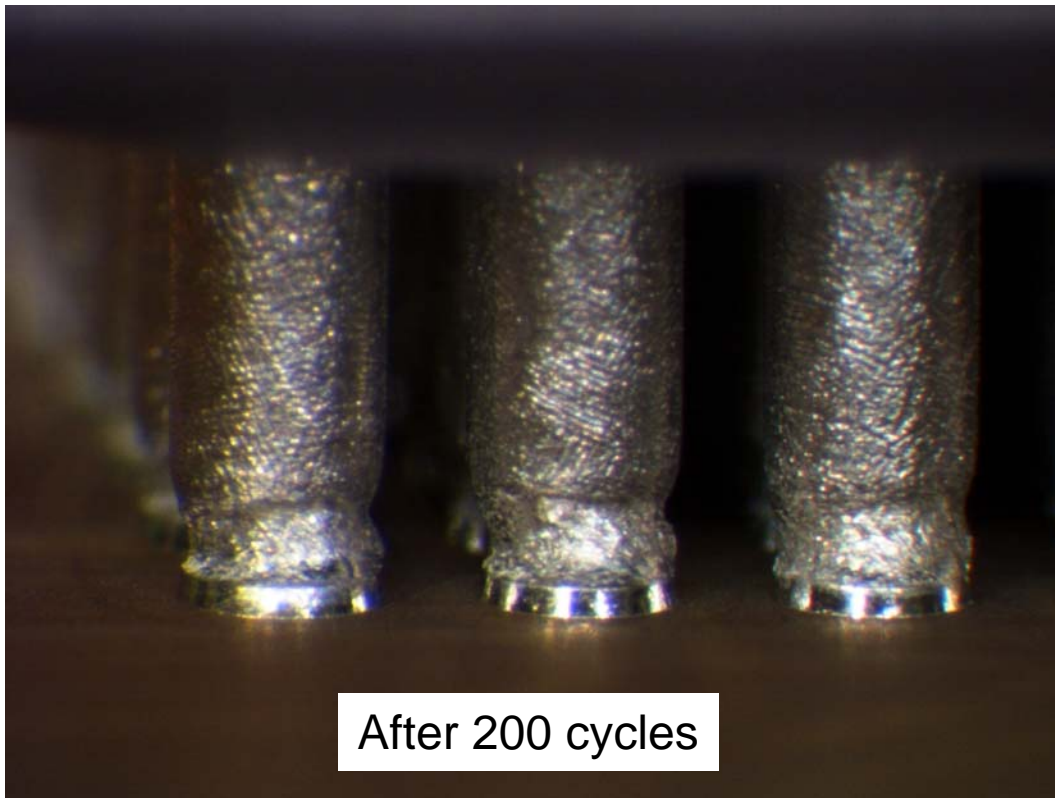
## Visual Inspection - teardrop (1356)



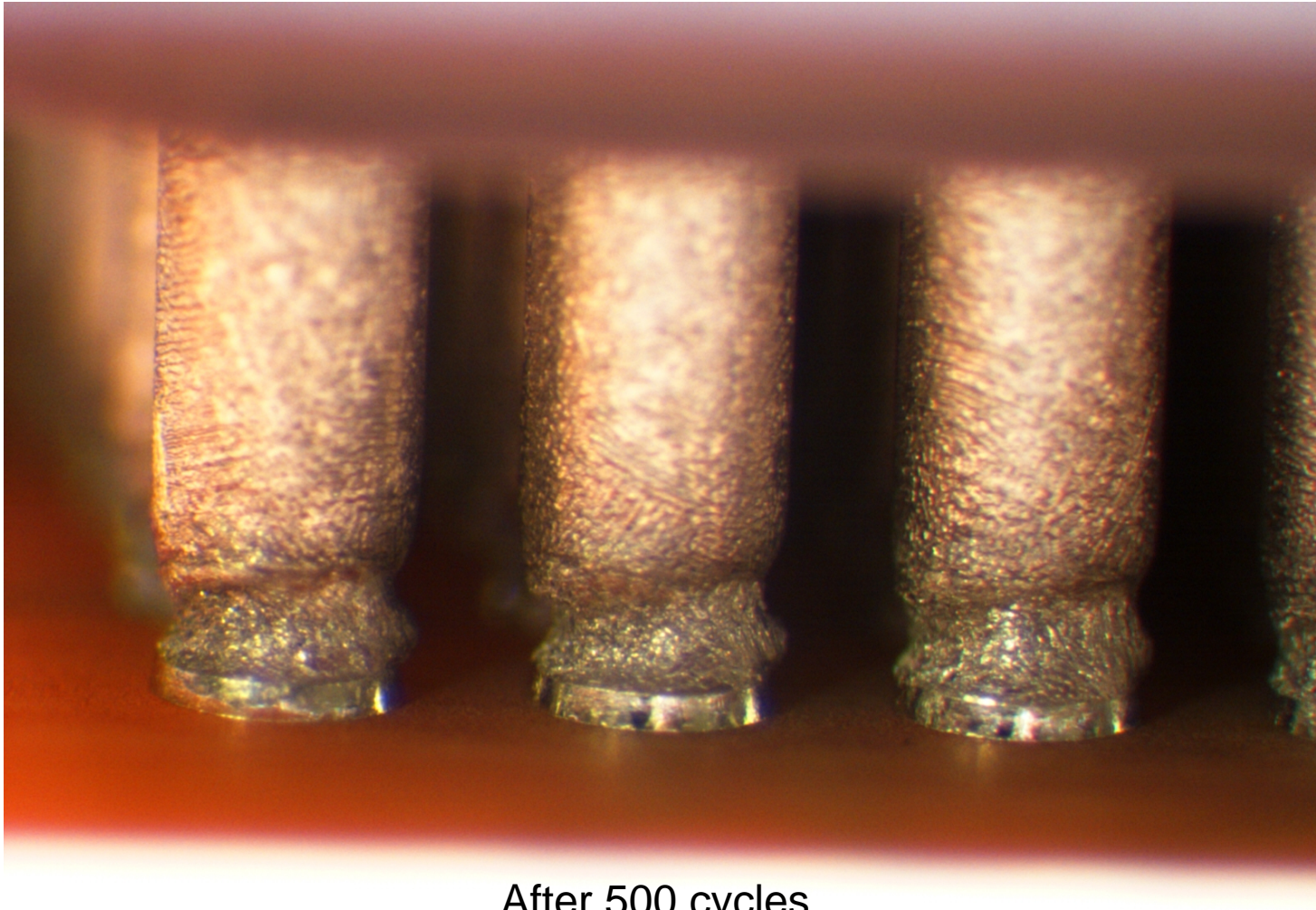
## Visual Inspection - teardrop (1356)



## Visual Inspection – circular pad (1353)

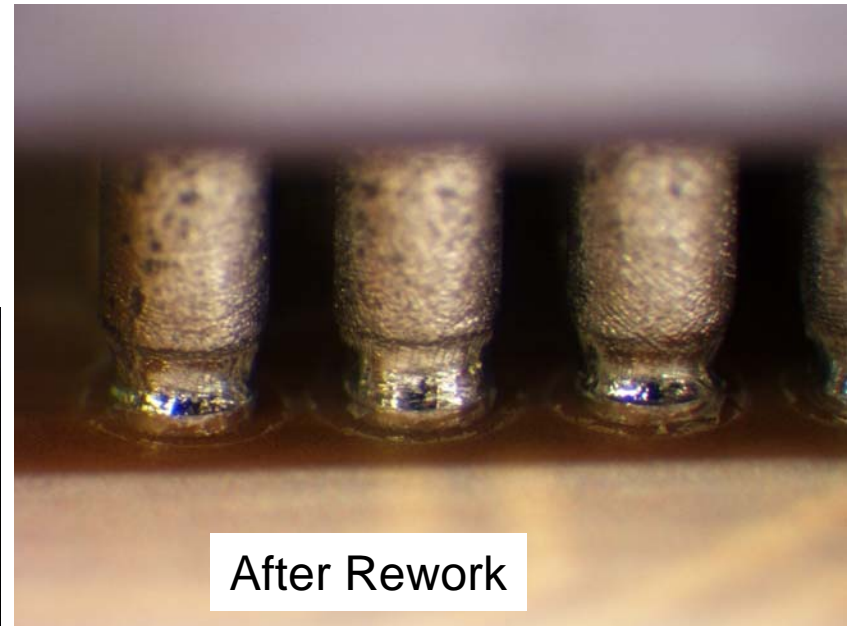
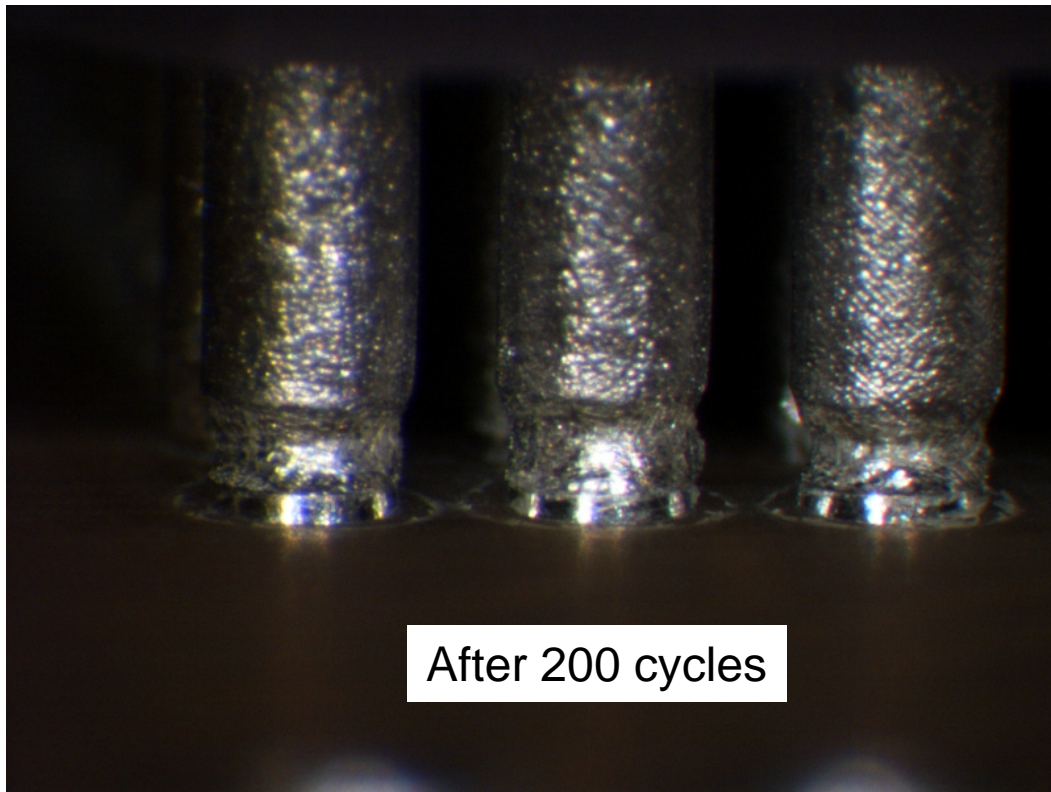


## Visual Inspection – circular pad (1353)

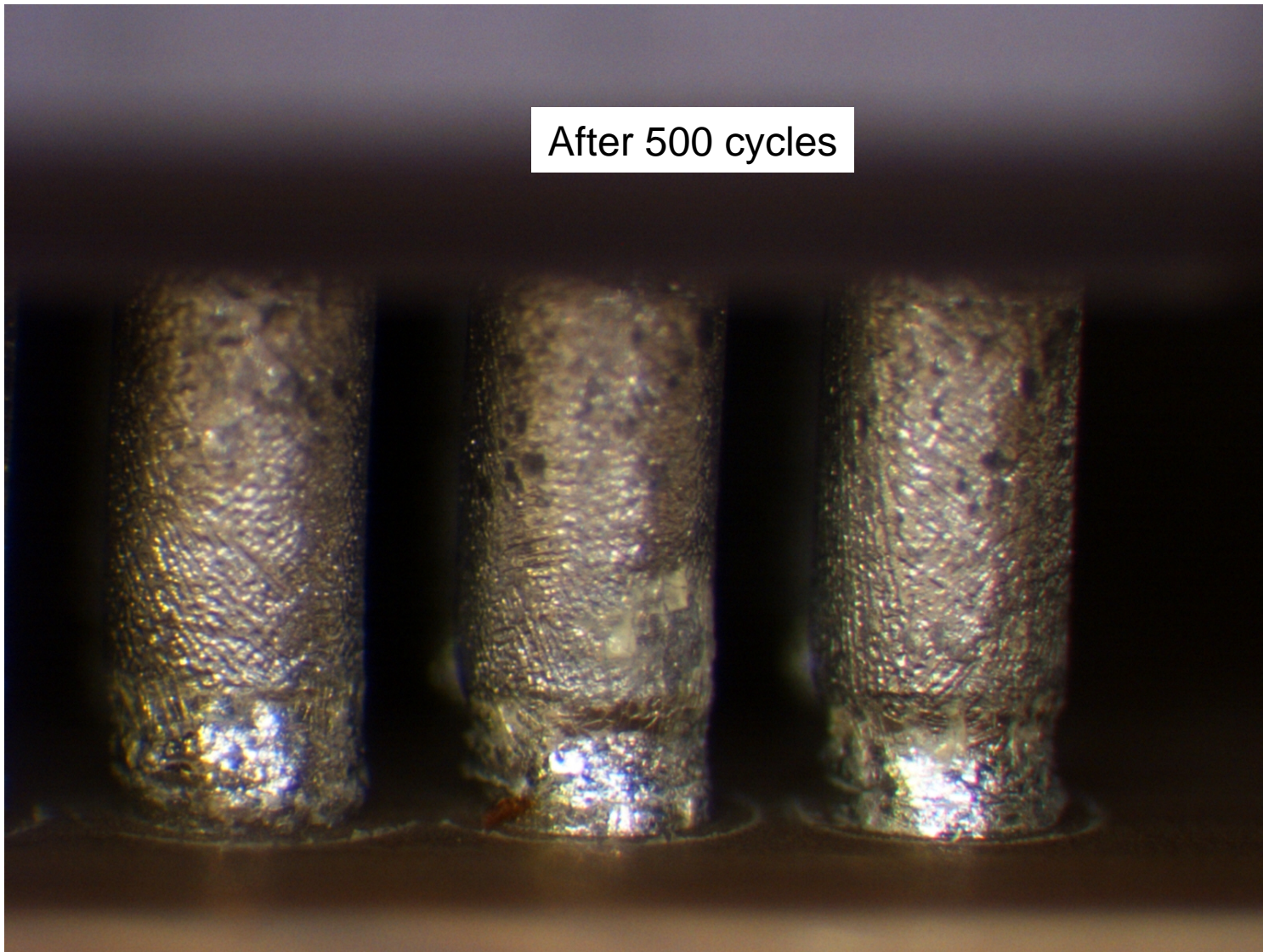


After 500 cycles

## Visual Inspection Rework – circular pad (1354)



## Visual Inspection Rework – circular pad (1354)



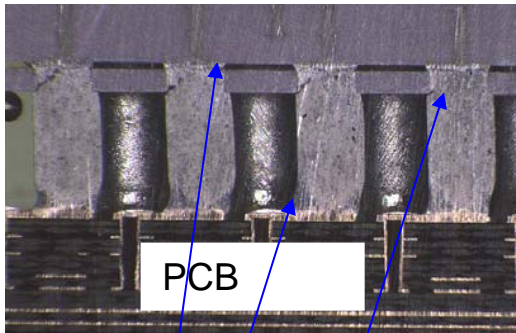


# Results after 500 cycles

## □ Dye penetrant:

- No cracks > 25% of the circumference of the column observed at PCB-column interface, cracks observed at interposer side

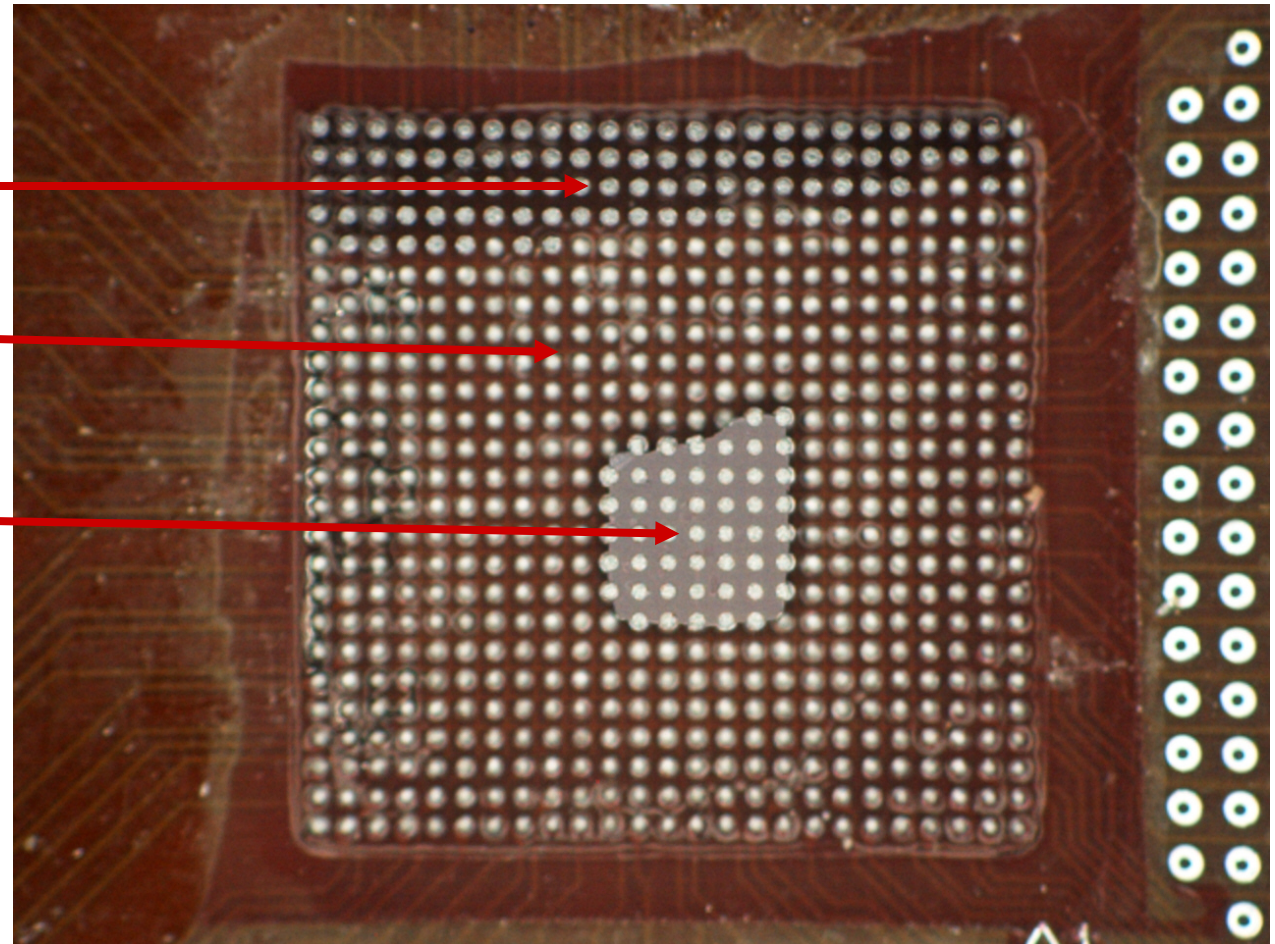
Dye Penetrant (1355)  
Picture of board After 200 cycles



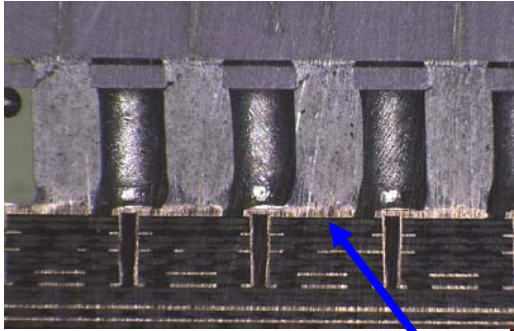
Columns

Break at Pads  
on PCB

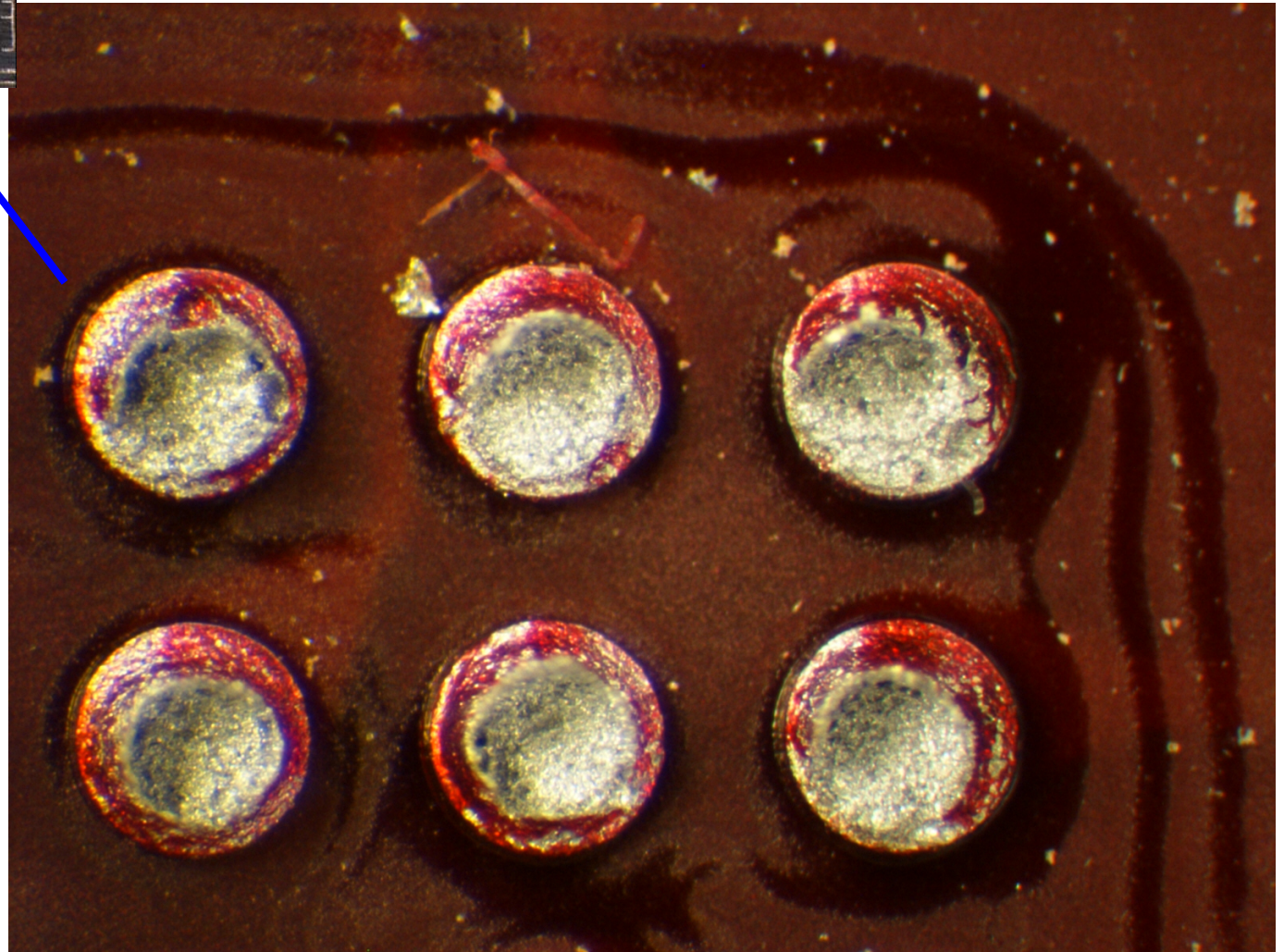
Break at  
Package  
pad



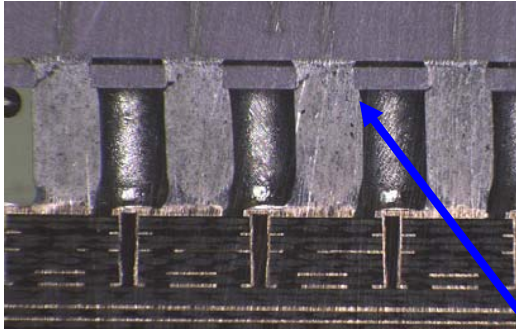
Die Penetrant (1355)  
Board After 200 cycles



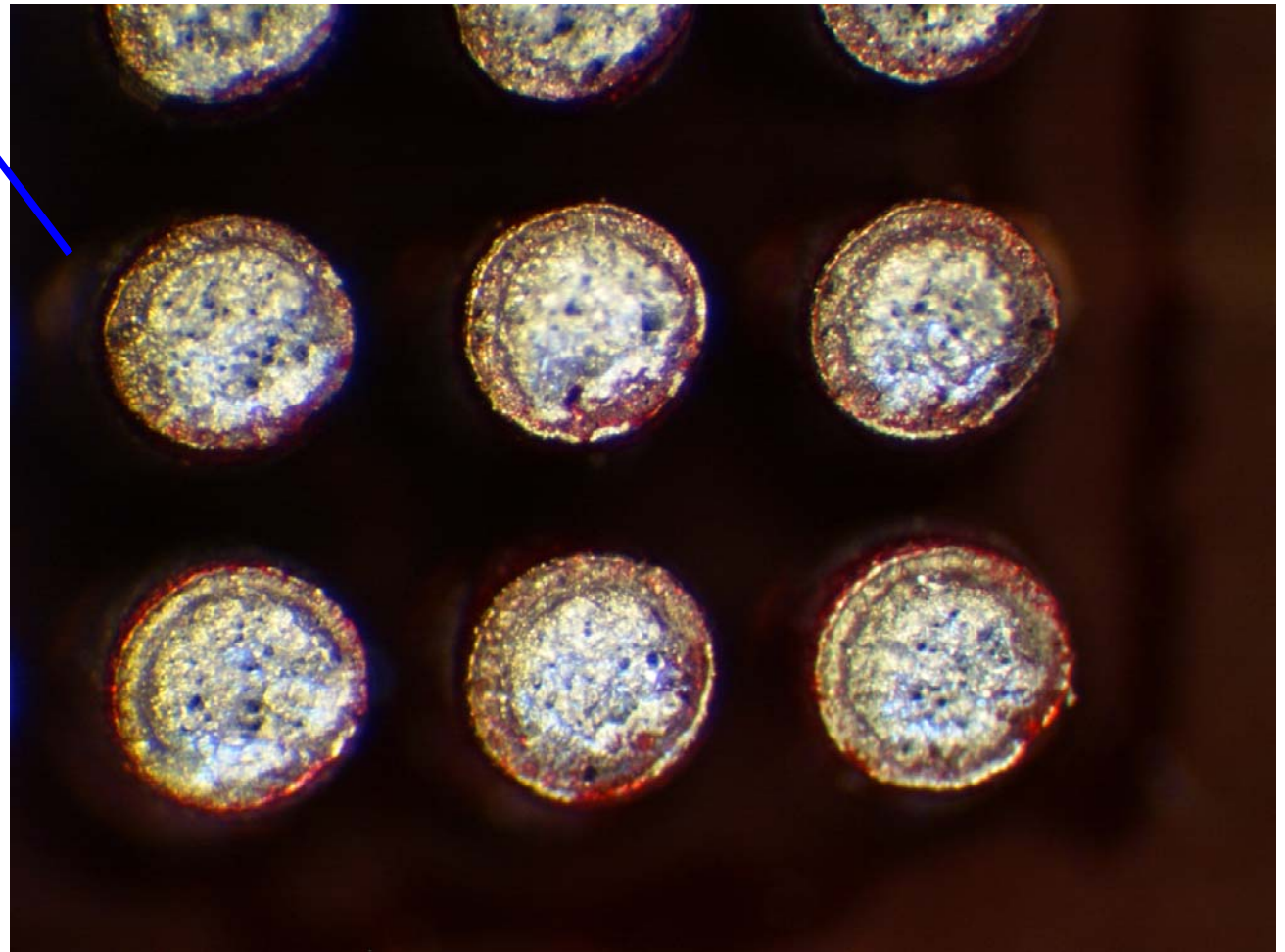
Corner Picture  
Solder joint break  
at PCB



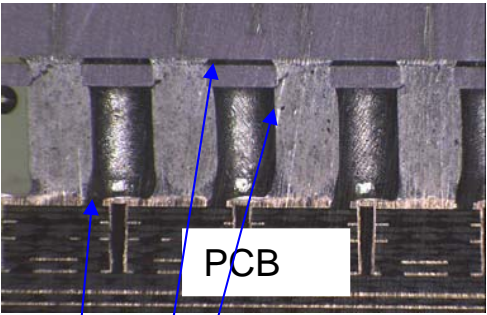
Dye Penetrant (1355)  
Board After 200 cycles



Corner picture  
Solder joint break  
at Interposer



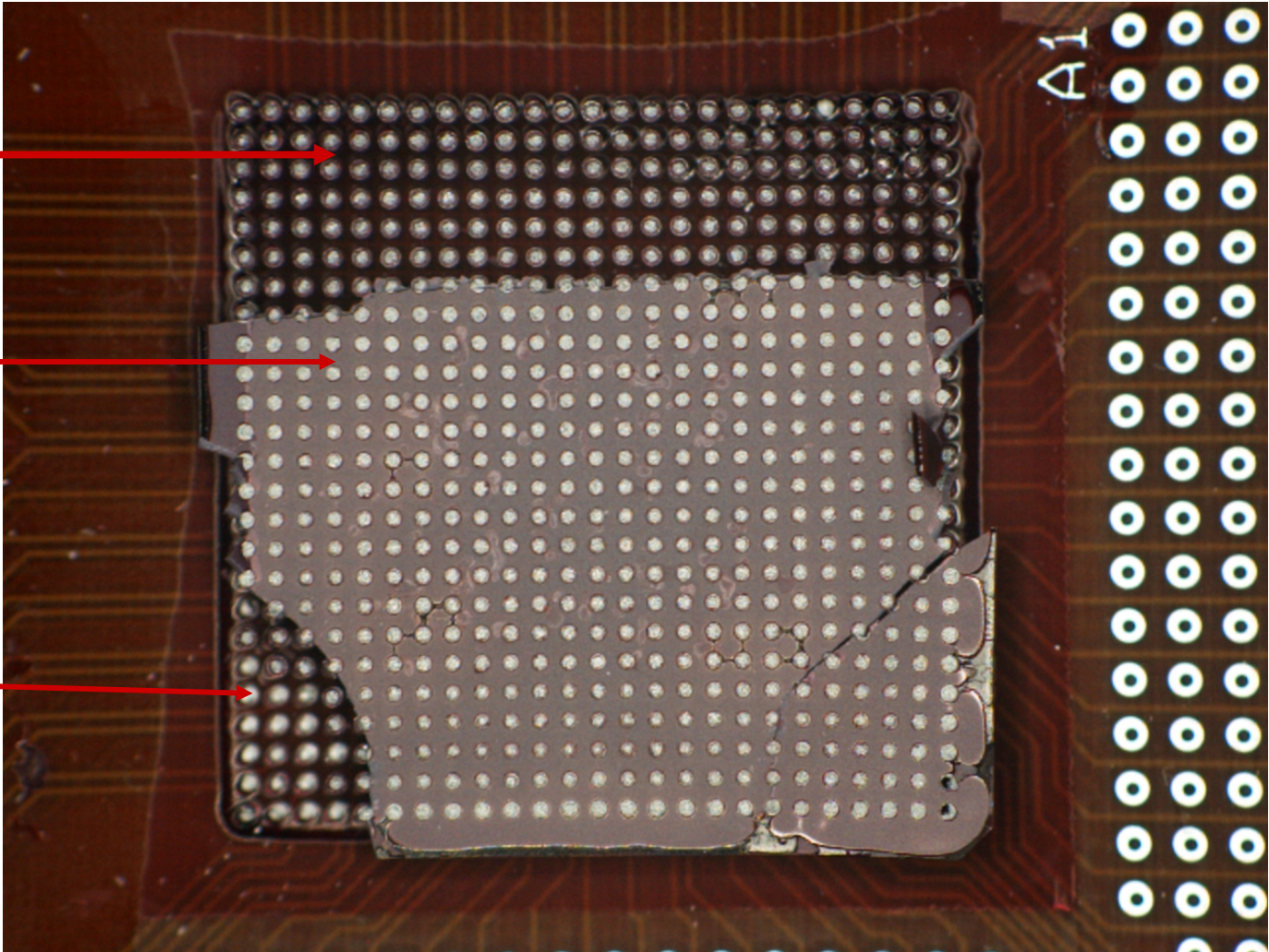
Die Penetrant (1356)  
Picture of board after 500 cycles

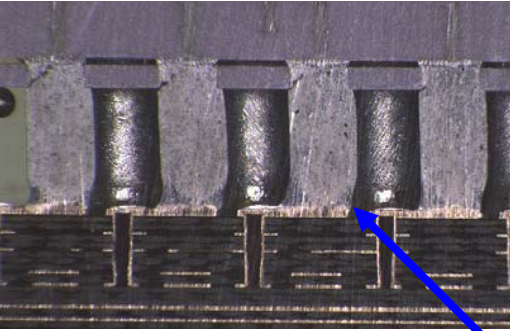


Columns

Interposer  
Ceramic

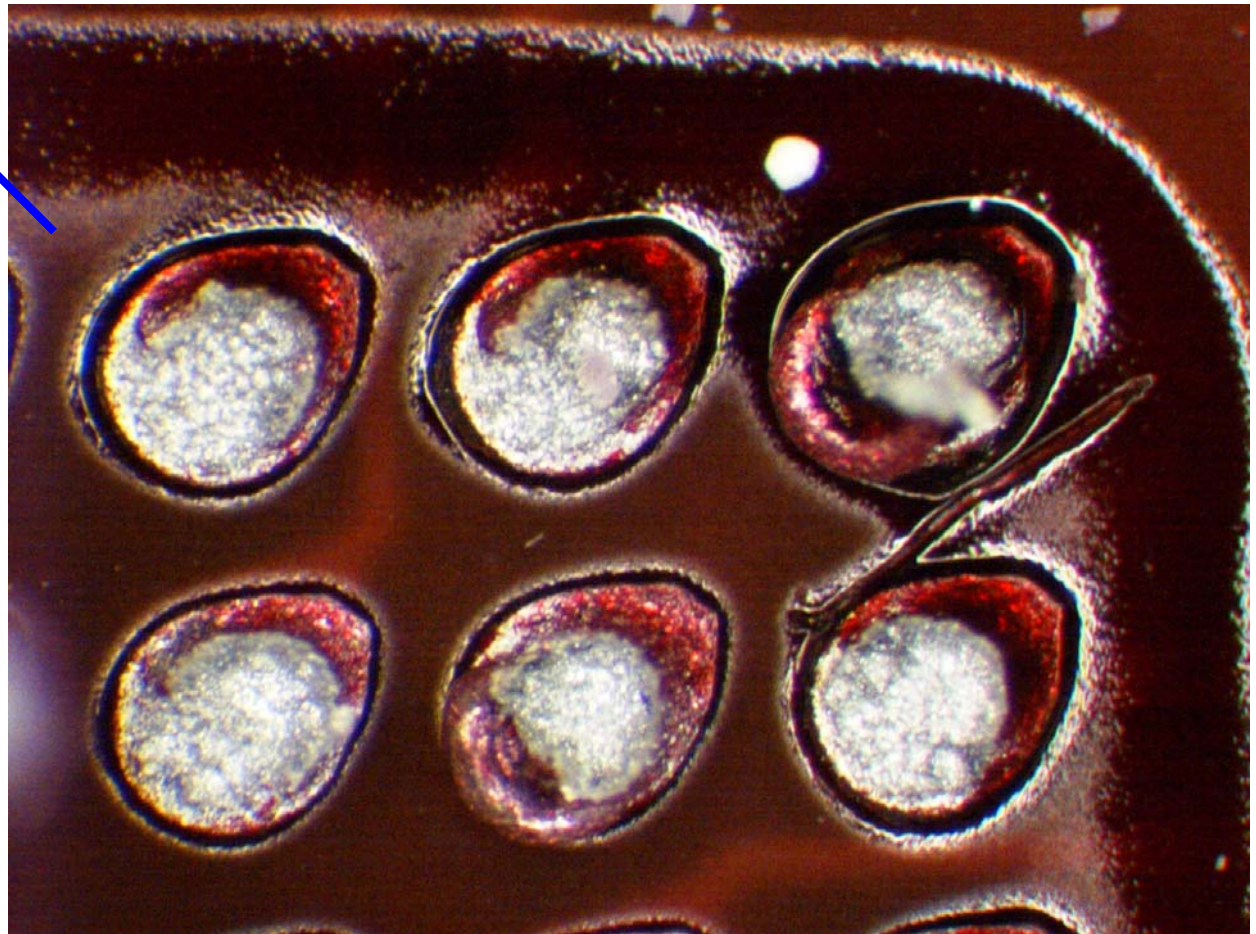
Pads on  
PCB



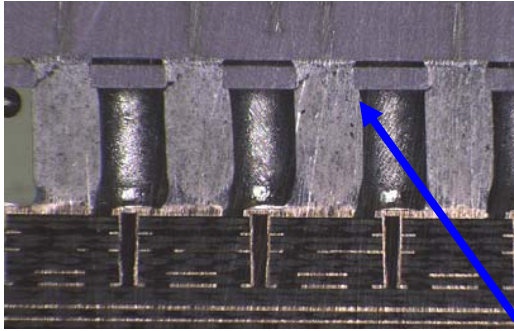


Dye Penetrant (1356)  
Picture of board after 500 cycles

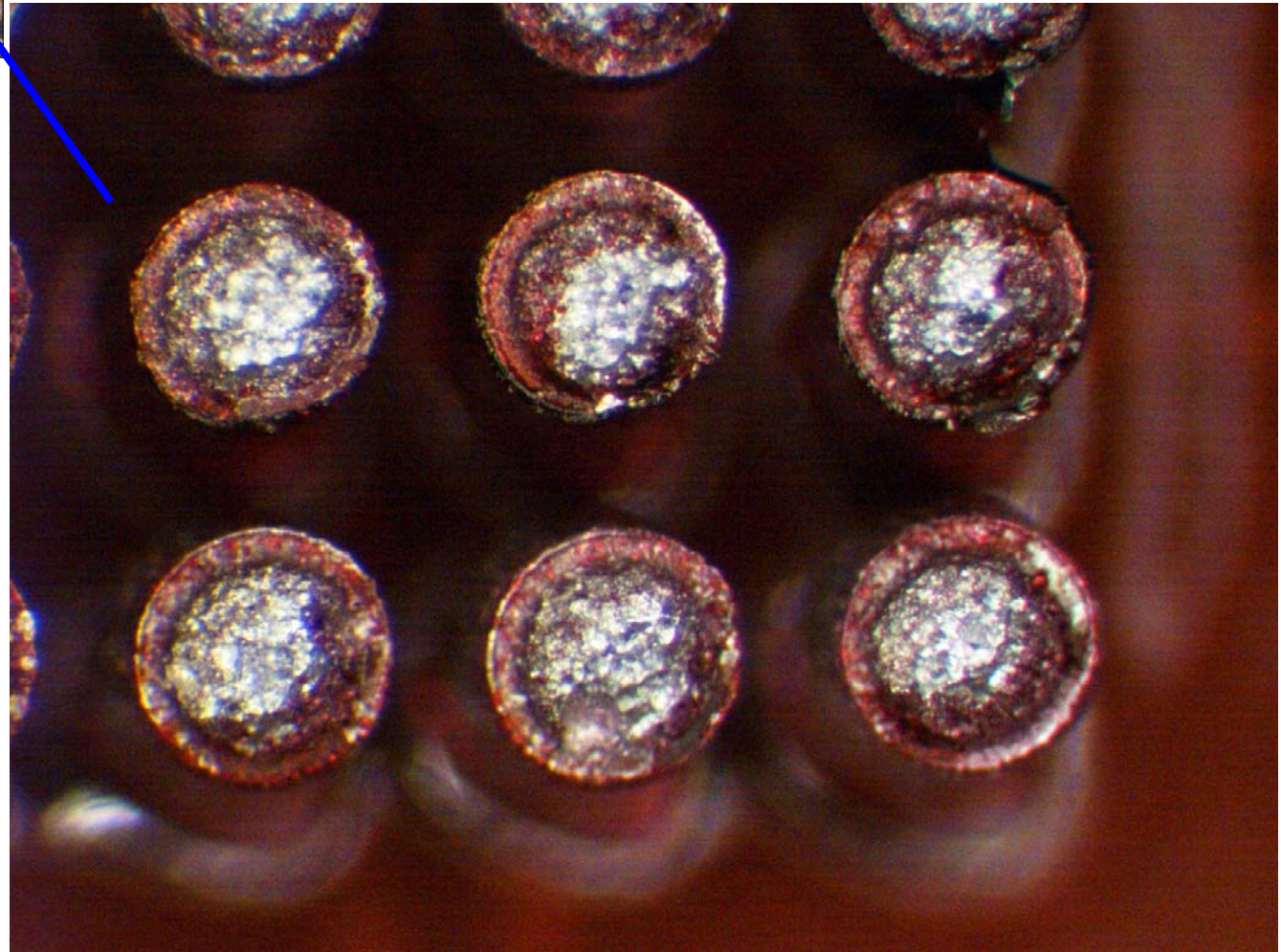
Corner Picture  
Solder joint break  
at PCB

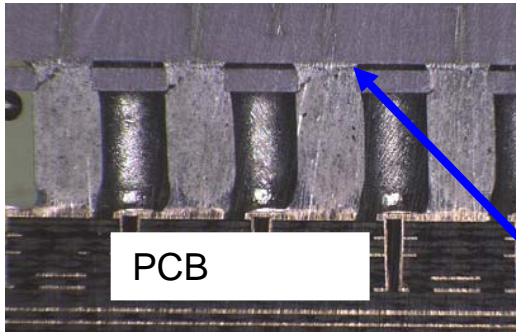


Dye Penetrant (1356)  
Picture of board after 500 cycles



Corner Picture  
Solder joint break  
at Interposer

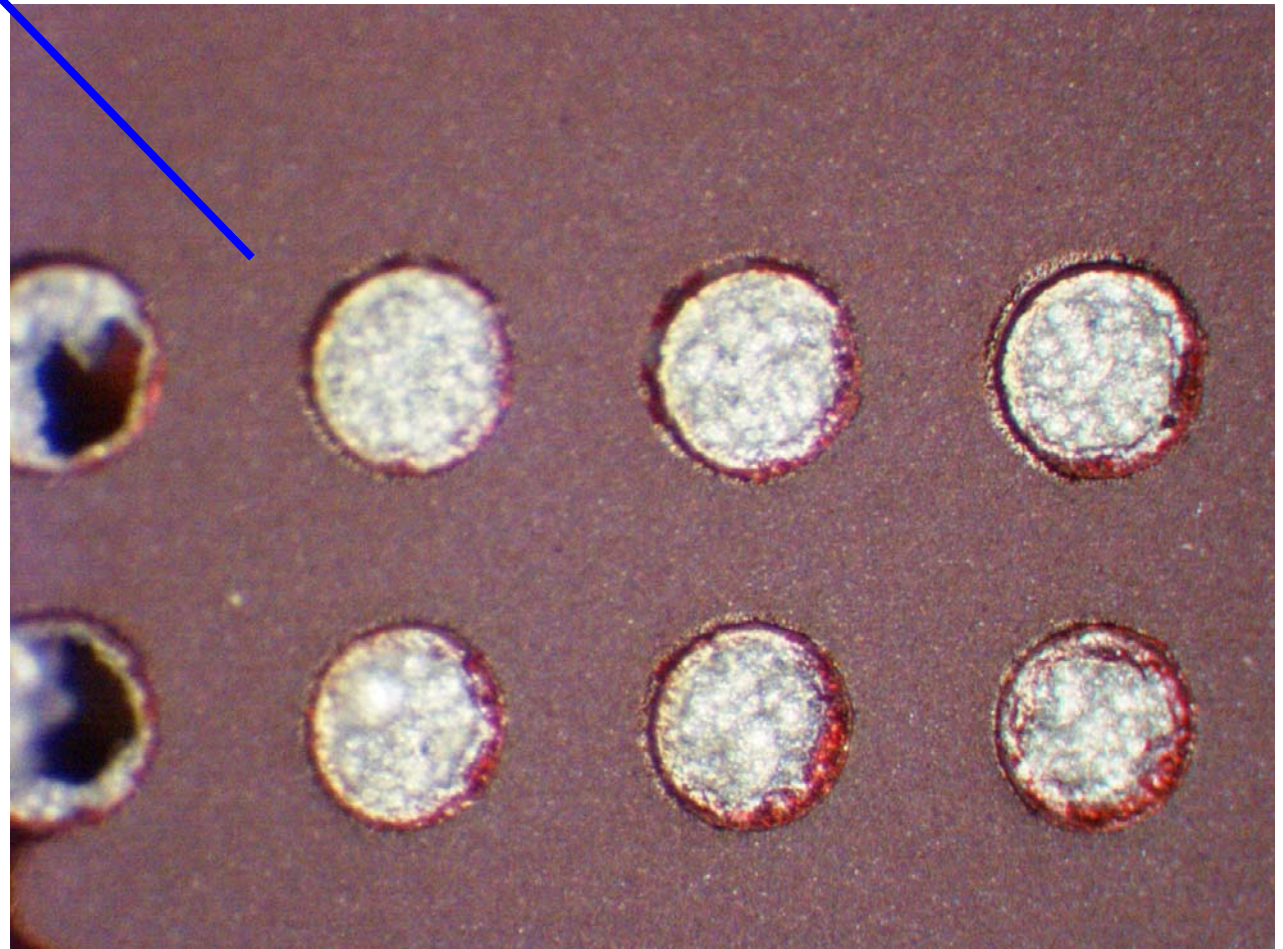




Dye Penetrant (1356)  
Picture of board after 500 cycles

Corner Picture  
Solder joint break  
at package pad

Dye penetrant difficult  
to flow between ceramic  
and package





# Results after 500 cycles

## □ Micro section:

- No cracks > 25% of the circumference of the column observed at PCB-column interface

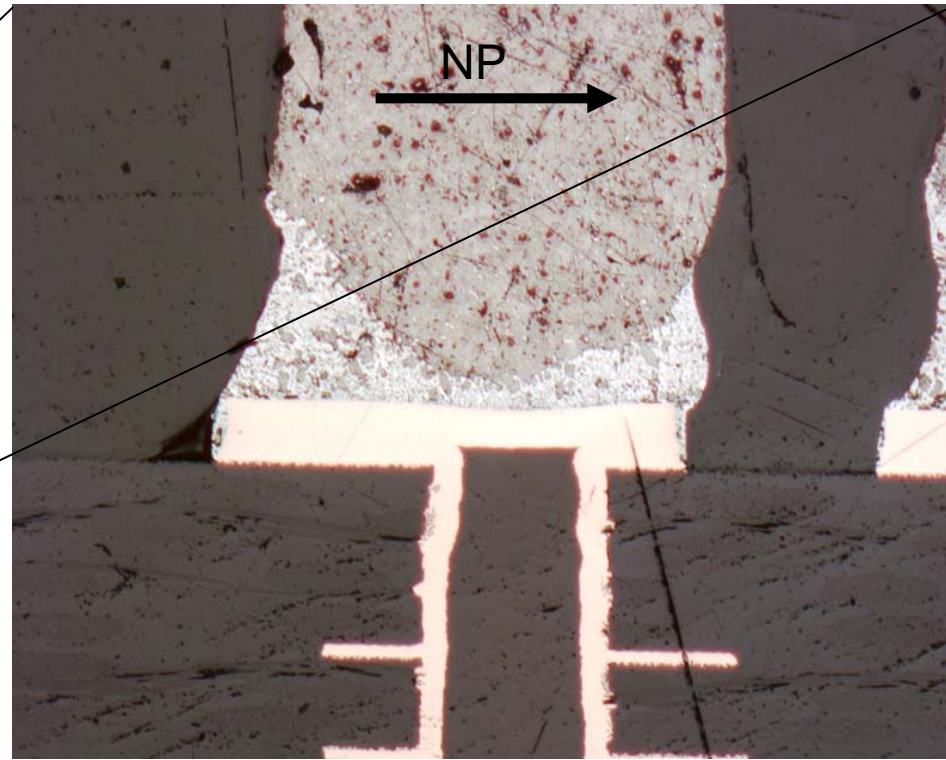
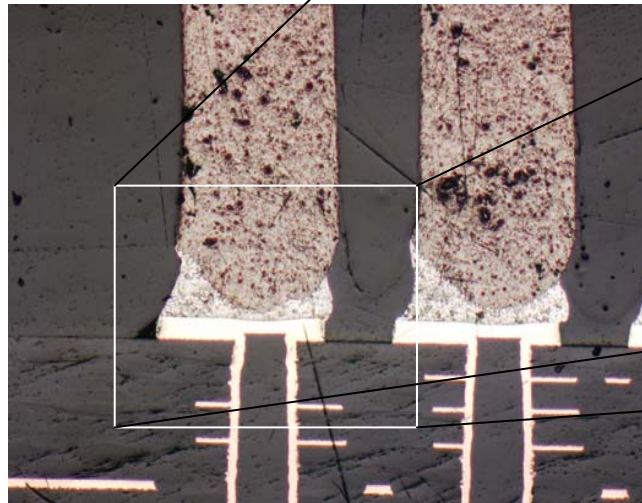
# Micro Sectioning of CGA 625



Cross sections for the micrographs

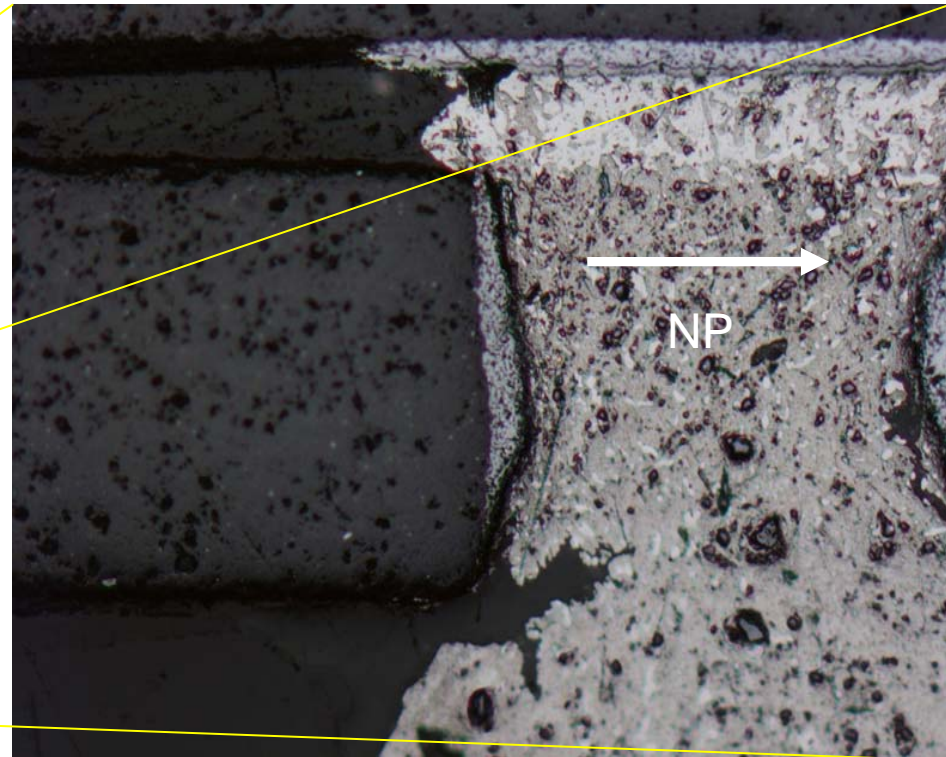
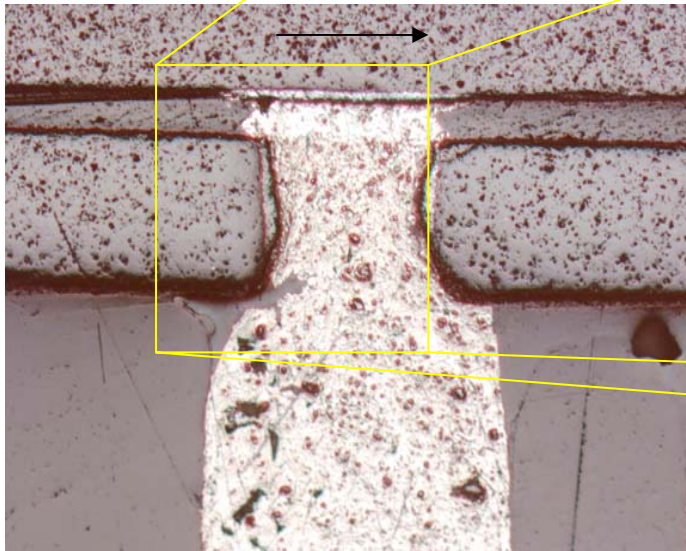
Micro Sectioning (1353)  
Picture of board after 500 cycles

Solder joints between corner columns and PCB.  
No cracks were found in these solder joints.



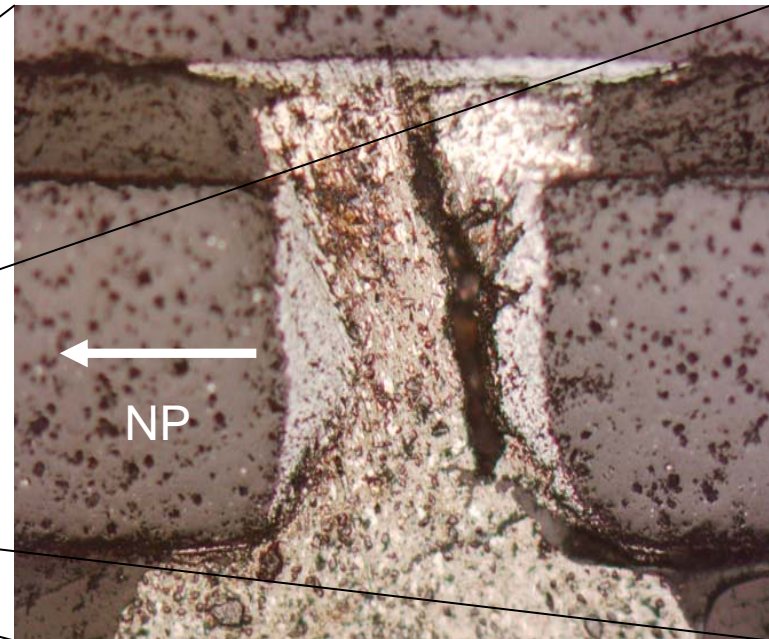
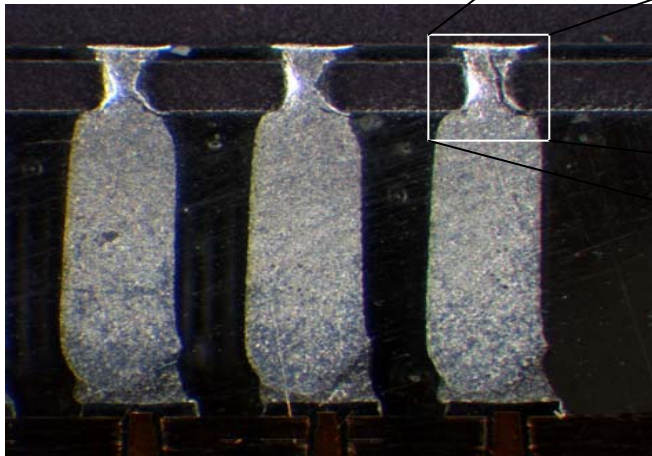
Micro Sectioning (1353)  
Picture of board after 500 cycles

Solder joints between corner columns and package.  
Cracks (typical) were found along the interposer.

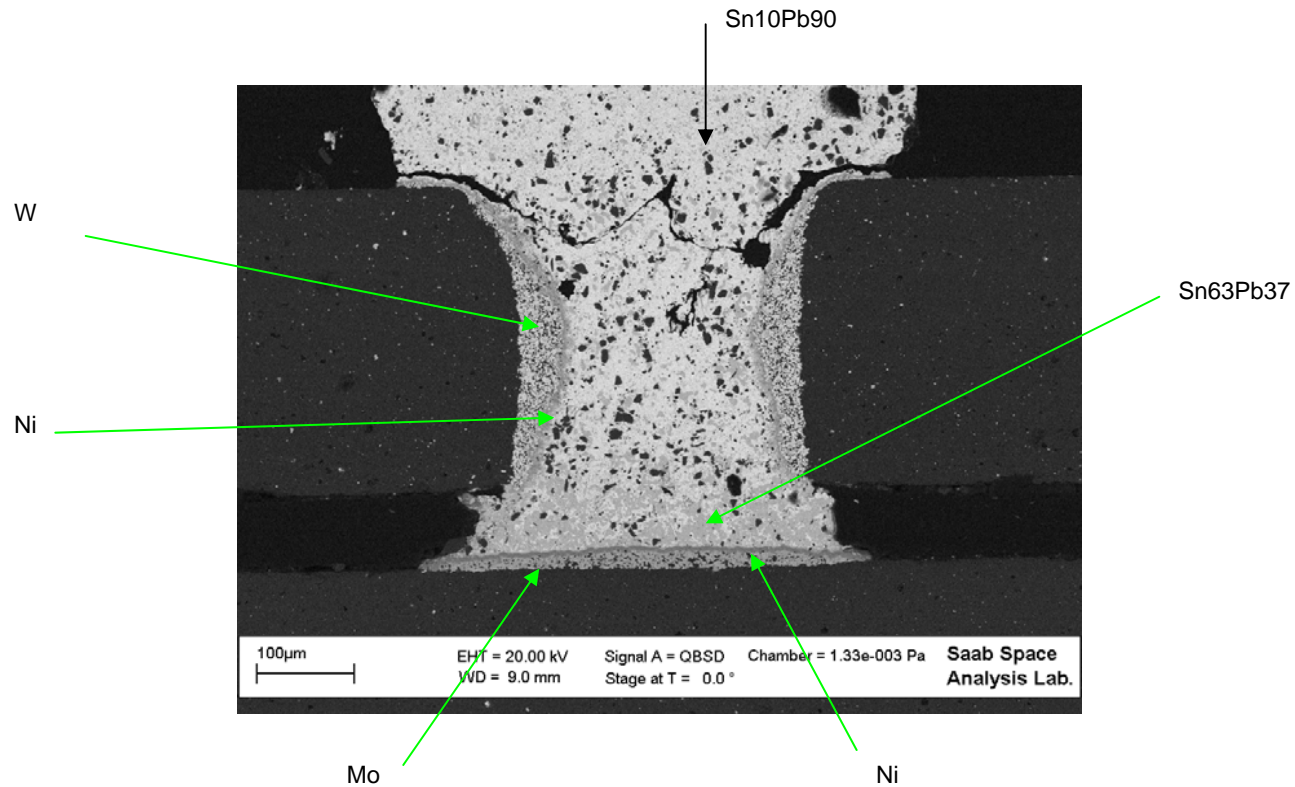


Micro Sectioning (1353)  
Picture of board after 500 cycles

Solder joints between corner columns and package.  
A severe crack were found in the Interposer region.



# Material analysis of the column / package interface



[www.space.se](http://www.space.se)

Thank You for Your Attention