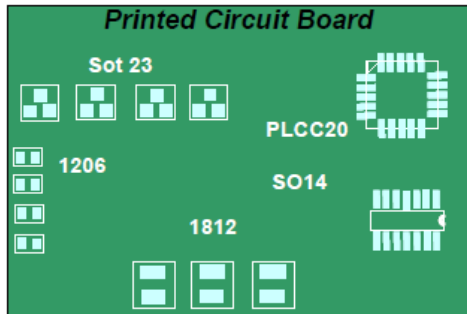


Precise solder dispensing in high-throughput micro-device packaging applications

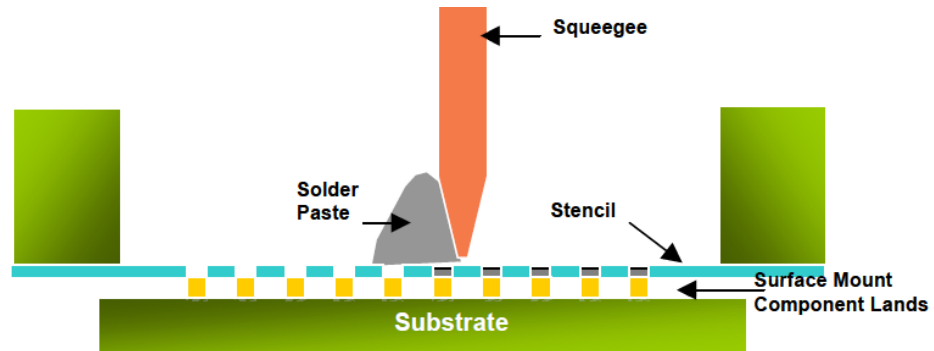
*Dr. Hanzhuang Liang, Linh Rolland, Floriana Suriawidjaja,
Mani Ahmadi and Heakyong Park*

Nordson ASYMTEK
Carlsbad, CA

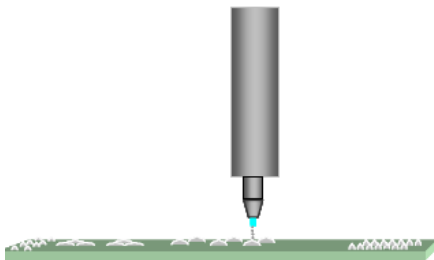
Solder paste in electronics assembly



(a) PCB to be soldered



(b) Solder printing through stencil



(c) Solder dispensing by valve

Solder paste:

metal balls in flux

applied, melted, solidified between metal surfaces

Function:

interconnection between PCB/components

electrical, mechanical, thermal support

Soldering coverage:

principle of electronic assembling

covering 1st to 2nd level packaging

Method:

printing, dispensing, flowing/waving

Solder dispensing in micro-device packaging

Device packaging industry request:

- Large to small size
- High throughput

Advantage of solder printing:

- High speed
- Easy operation
- Low cost

Technical limits:

- Size >300um, not micro-scale
- Simple and straight pattern
- Rigid stencil, not flexible
- Cost high when design changes



Micro-device packaging request:

- High precision in position and size
- High throughput
- Complicated design/structure
- Flexibility

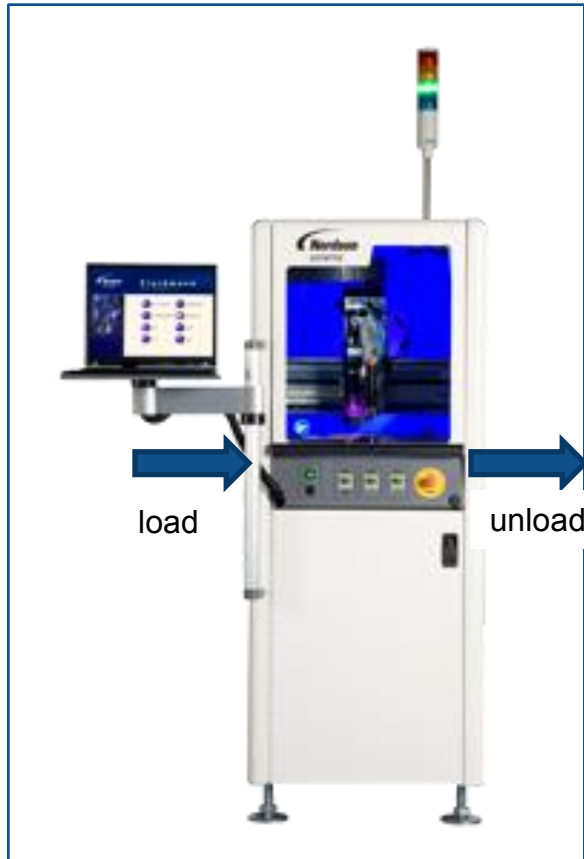
Advantage of ASYMTEK dispensing:

- Minimum size $\leq 300\mu\text{m}$
- Placement accuracy $\pm 50\mu\text{m}$
- High speed
- Easy to change route in program
- Straight/curved lines, dot, rings

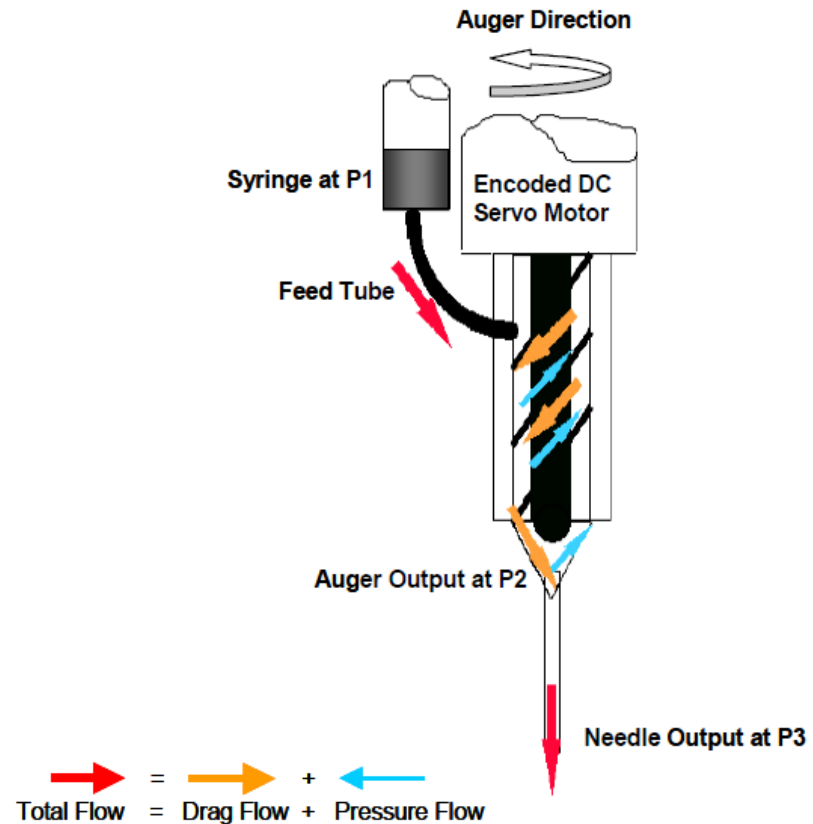
Challenge:

- More precise
- Faster
- More flexible in fluid, design, process

Solder paste dispenser



(a) Platform: Spectrum 900, II
Speed $a=1-1.2g$, accuracy $3\sigma = \pm 50\mu m$



(b) Rotary auger pump
Precision, repeatability, adaptability to fluid

Applications of the new design

Application 1:

2nd level packaging on fully assembled smart phone to seal RF shield
550um size, line segments, type 4 solder (metal content 87%)

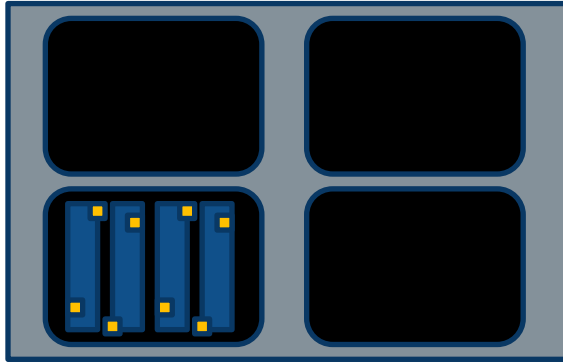
Application 2:

1st level packaging on automobile control panel
250um size, thin lines, annular rings, dots, type 4-5 (metal 86-90%)

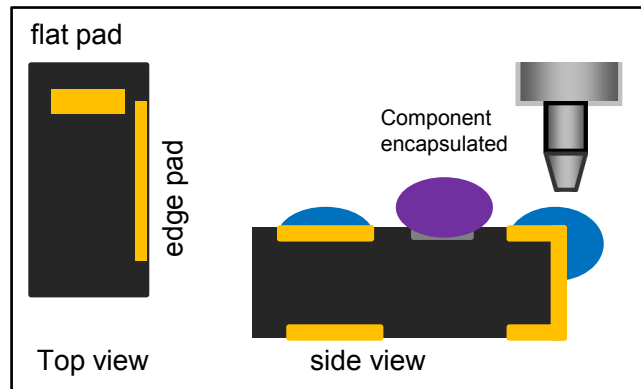
Application 3:

2nd level packaging on MEMS devices to seal RF shield
180um size, connected lines, type 4 (metal >90%)

Application 1: 550um lines on smart phone to seal RF shield at the end of 2nd level packaging => 6192 dispense/hour



(a) One carrier can fully load
4 substrates with 16 boards



(b) Needle dispense on pads

Customer specs

Cycle time: 100s per substrate, 172 lines

Placement accuracy: $\pm 50\mu\text{m}$

Line shape, height, area, etc

AOI inspection yield: 98-100%

Process design

Dispense speed: 30-35mm/s

Machine acceleration: 1.2g

High flow rate, high line quality

=> Enhanced precision valve

Placement accuracy

=> S900 and SII: machine accuracy $\pm 50\mu\text{m}$

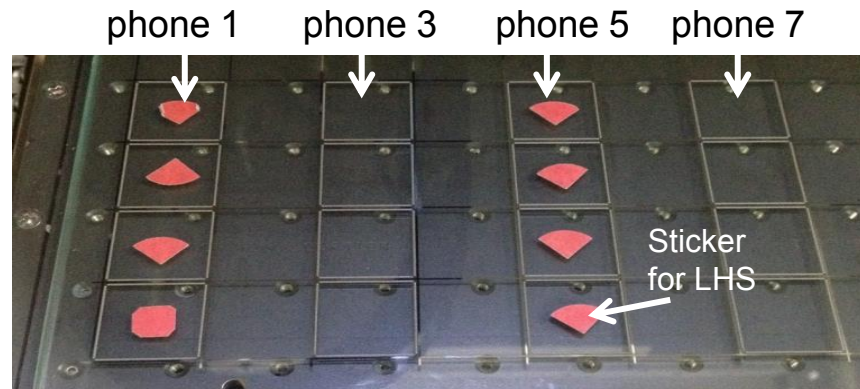
Software new feature: edge detection

Results

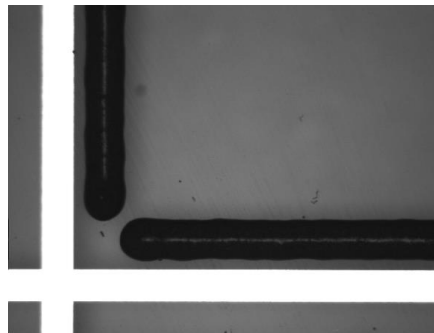
20-25 production lines/250 S900

All pass yield

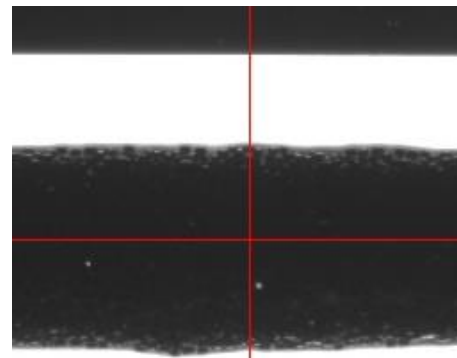
Application 1: 550um lines on smart phone to seal RF shield at the end of 2nd level packaging



(c) Lab simulation on calibration glass



(d) Line dispensed beside calibration lines

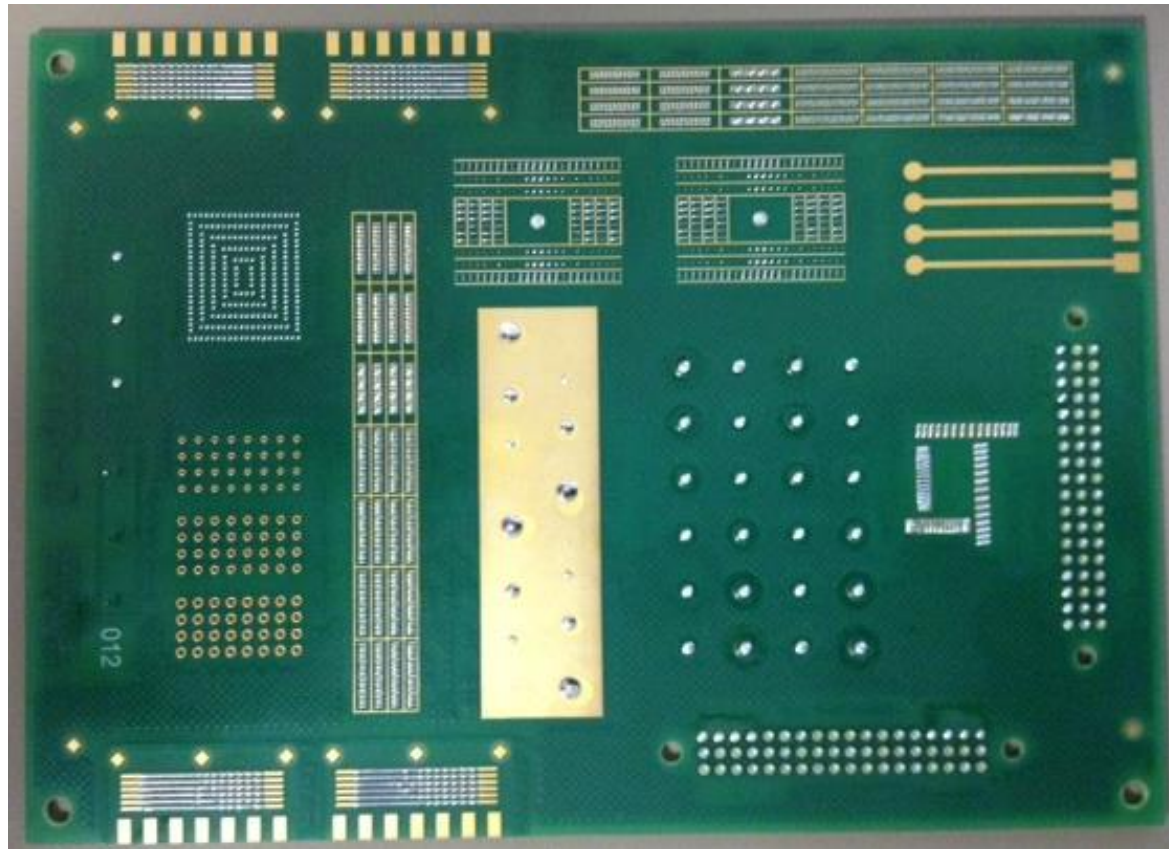


(e) Edge detection for position accuracy

Position accuracy:
 $< \pm 50\mu\text{m}$
Line width:
 $3\sigma = 8.5\%$
Volume per substrate:
 $3\sigma = 6\%$

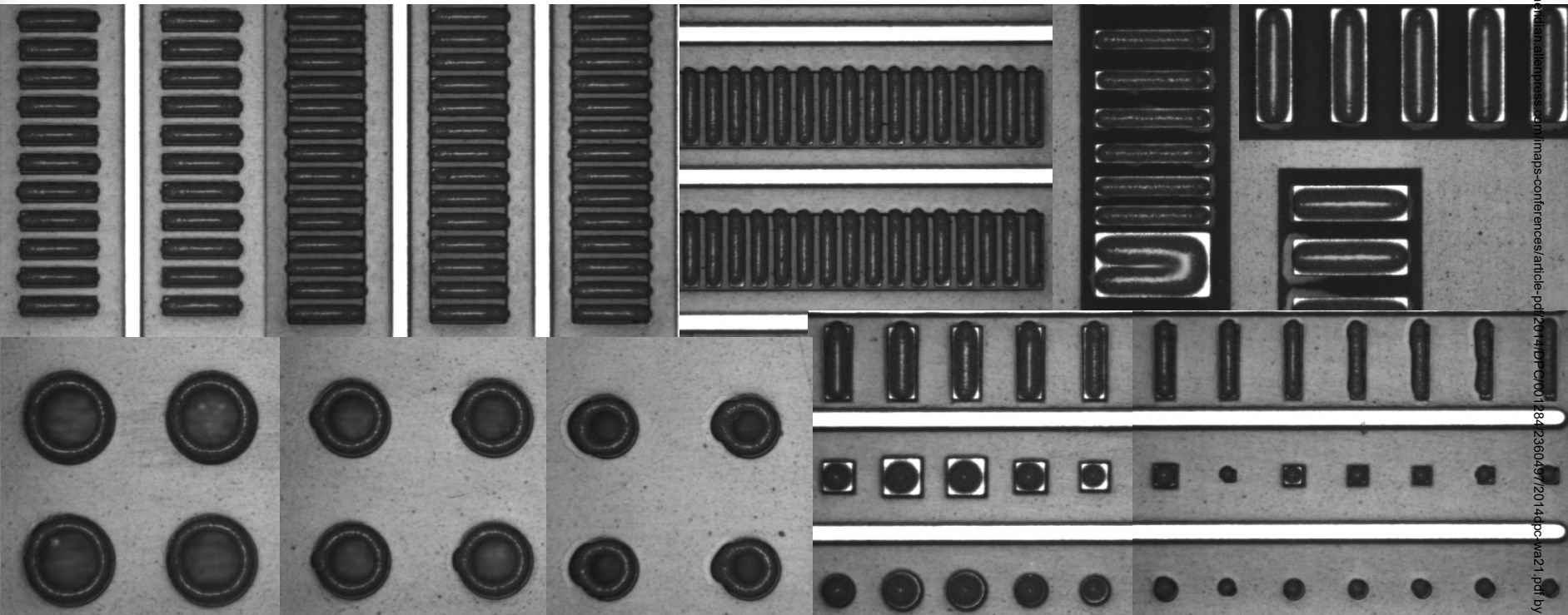
Application 2: 250um lines/rings/dots on automobile control panel during 1st level packaging

Challenge: 200-250um lines, gap 150um, > 2000 lines/dots/rings within 10min
solder paste type 4-5, viscosity 80-170kCps



(a) Customer test board

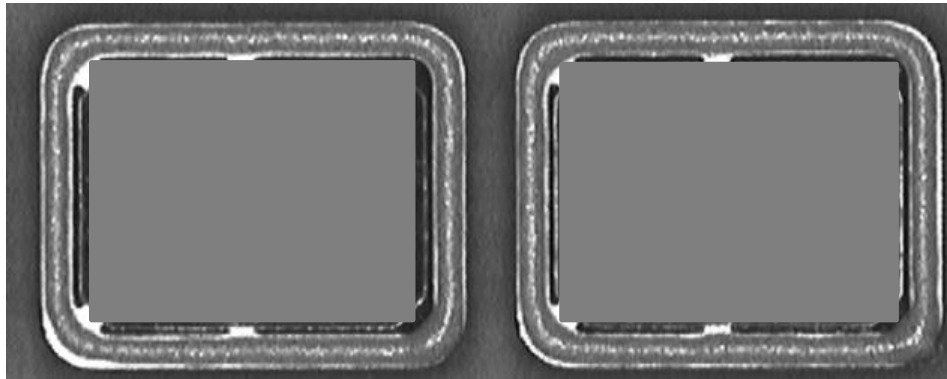
Application 2: 250um lines/rings/dots on automobile control panel during 1st level packaging => 12k dispense/hour



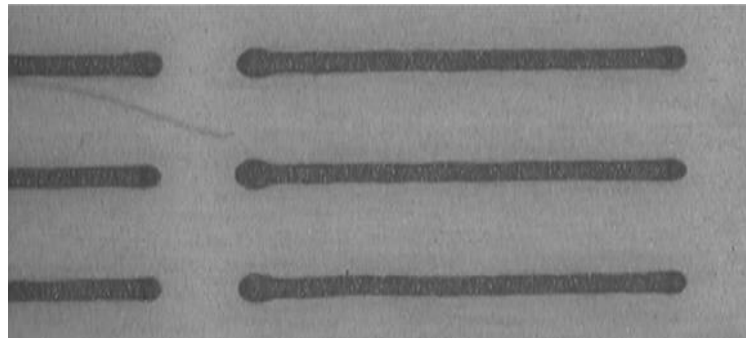
(b) Dispensed results

Application 3: 250-180um lines on MEMS to seal RF shield during 2nd level packaging => 10k dispense/hour

Challenge: 180um lines, type 4 dry solder with metal >90% viscosity >200kCps
UPH 2500, aided by dual simultaneous dispenser



(a) 225um seal lines in production



(b) 180um line in lab for new product request

Summary

Solder paste dispenser: ASYMTEK Spectrum I/II + auger pump

Application 1,3: smart phone, MEMS, 2nd level packaging

Application 2: automobile control panel, 1st level packaging

Advantage: high throughput, high precision, flexibility

Coverage: individual solution/complement, sizes 100mm-180um

Goal: to help customers to push limit on their packaging capability as leading suppliers

Contact

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