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The Impact on Probe Pin Performance of Different Plunger Cutting Methods at Device Side

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Problem Statement

- Lead-free solder balls can easily cause solder migration
  - Require frequent cleaning
  - Increase production down time
  - Shorten the EOL of probe pin
  - Reduce the throughput of test operation
  - Increase the cost of testing
- One of the known reasons for heavy solder migration is inconsistent and high contact resistance (CRES) during test

Goal and Objective

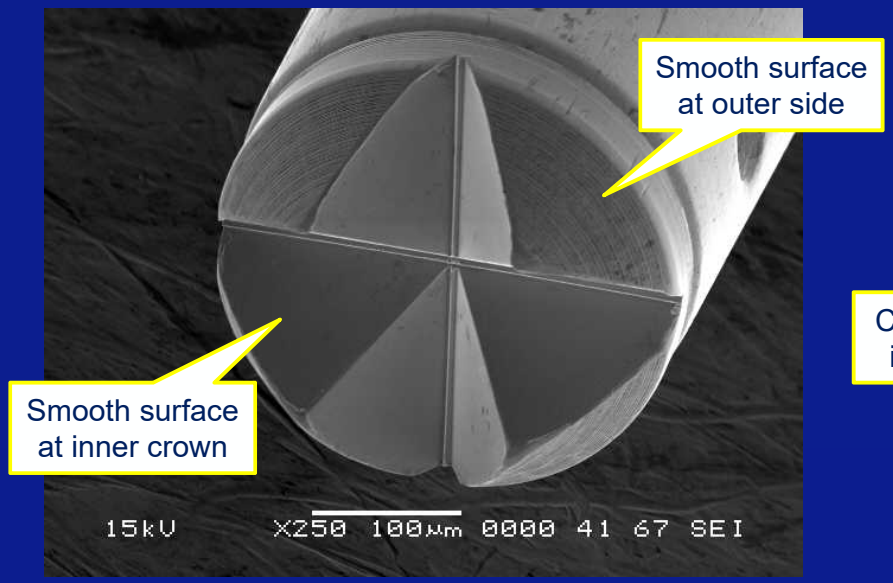
- To investigate the impact of the surface roughness of plunger on the CRES and thus solder migration onto the probe pin
  - Use different cutting tools and processes on the same device side plunger (Plunger A) design
  - Assemble the pins using the same parts from the same production lot, apart from the cut Plunger A
  - The assembled pins are mounted into common cycling jig at the same time to conduct the experiment
  - Current is passed to accelerate the solder migration
  - Measurement of CRES is taken at every interval
  - Observation of solder migration is taken after cycle test

Test Parameters

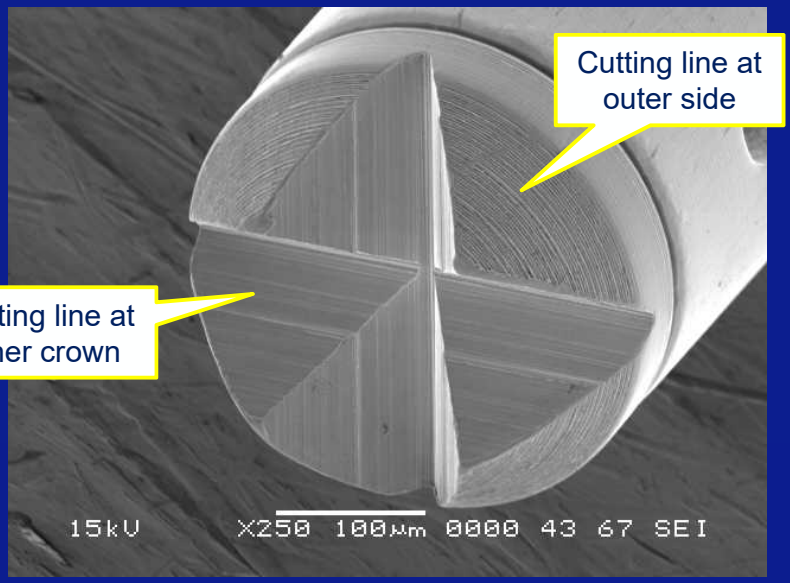
- New pin, 7 pieces each of smooth and rough surface finishing
- Current, 2.5 A @ 10 sec
- Device Simulator, SAC 105
- Total Cycle, 200
- Device Simulator movement, every cycle

SEM Photo 0 Cycle

Smooth surface



Rough surface



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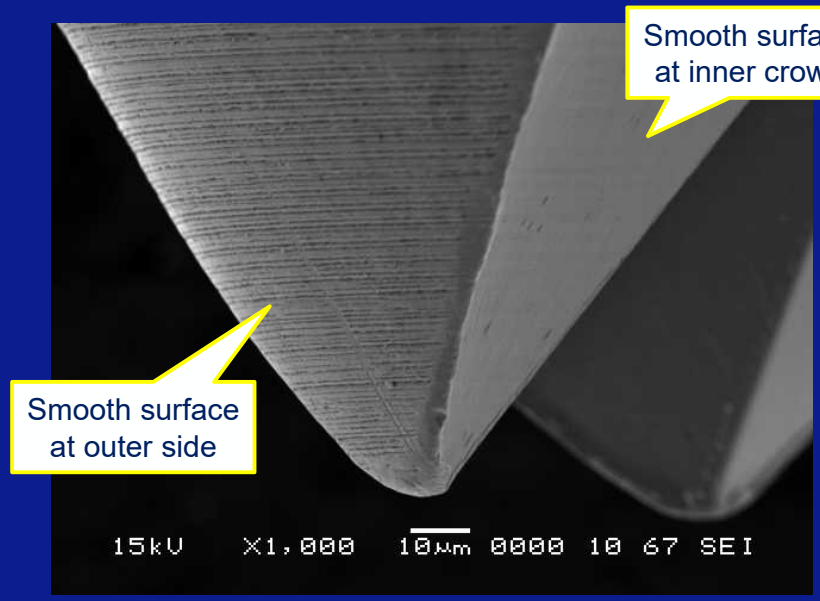
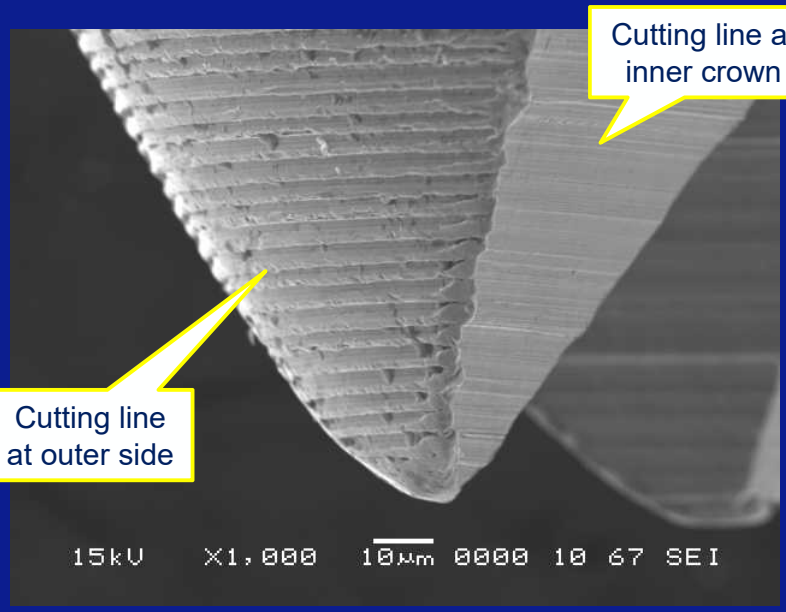
SEM Photo 0 Cycle (Close-up)

Smooth surface



Rough surface



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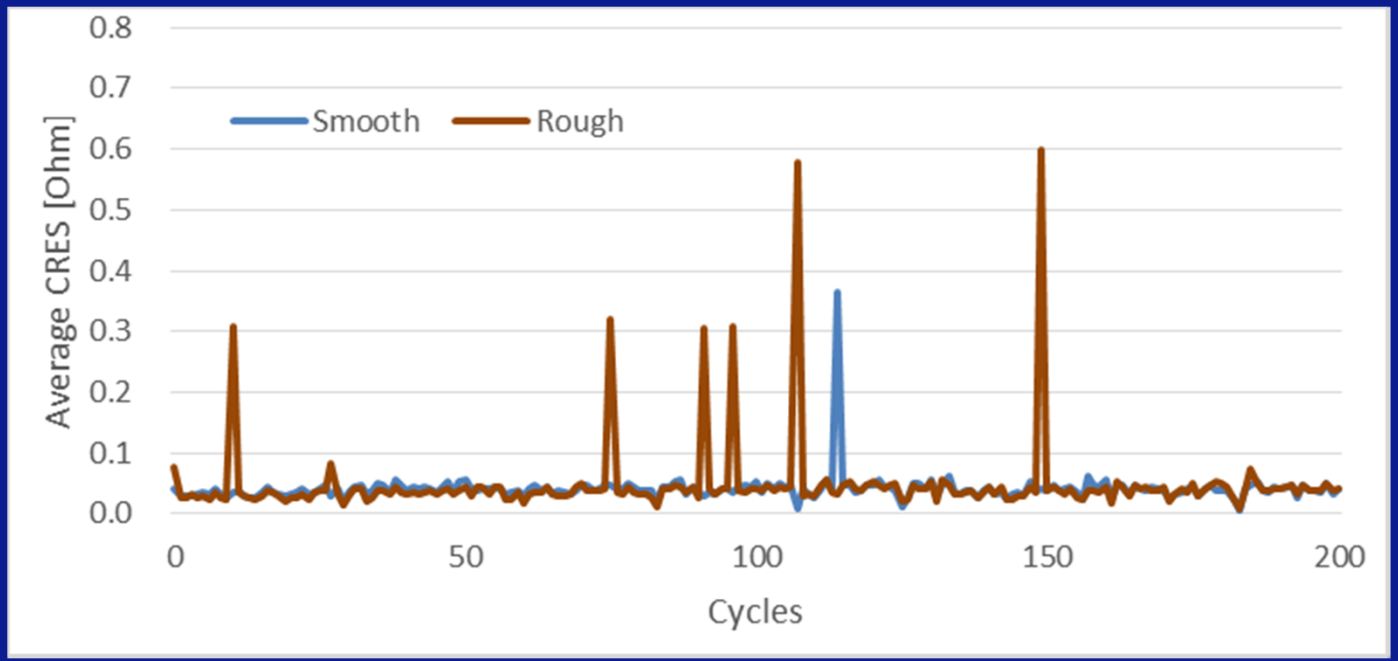
Average CRES



- Spikes indicate open contact

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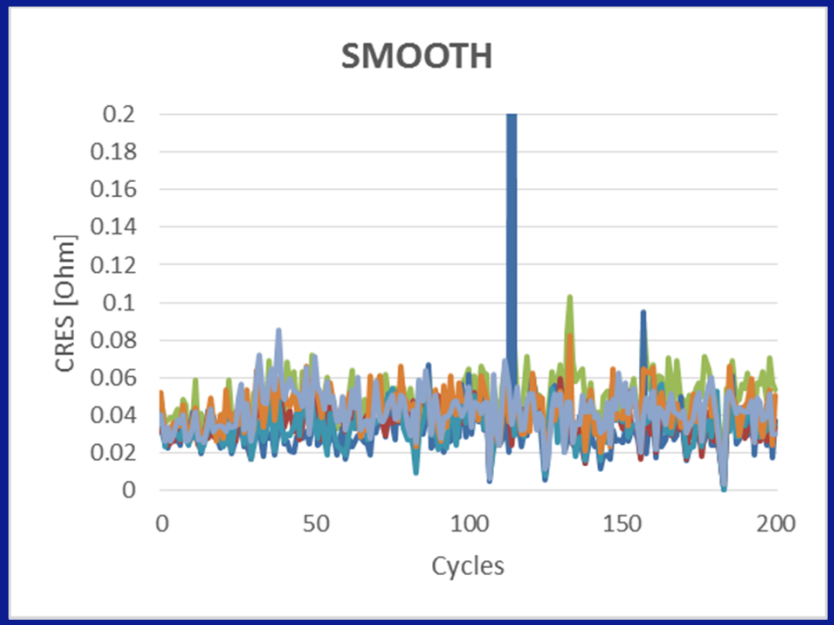
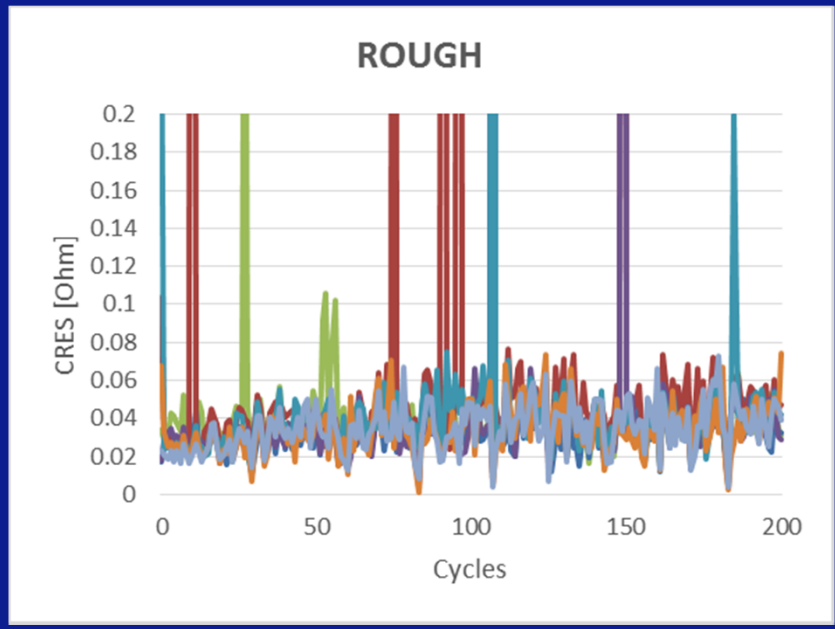
CRES Comparison





- Open contact 1x
- Open contact 8x

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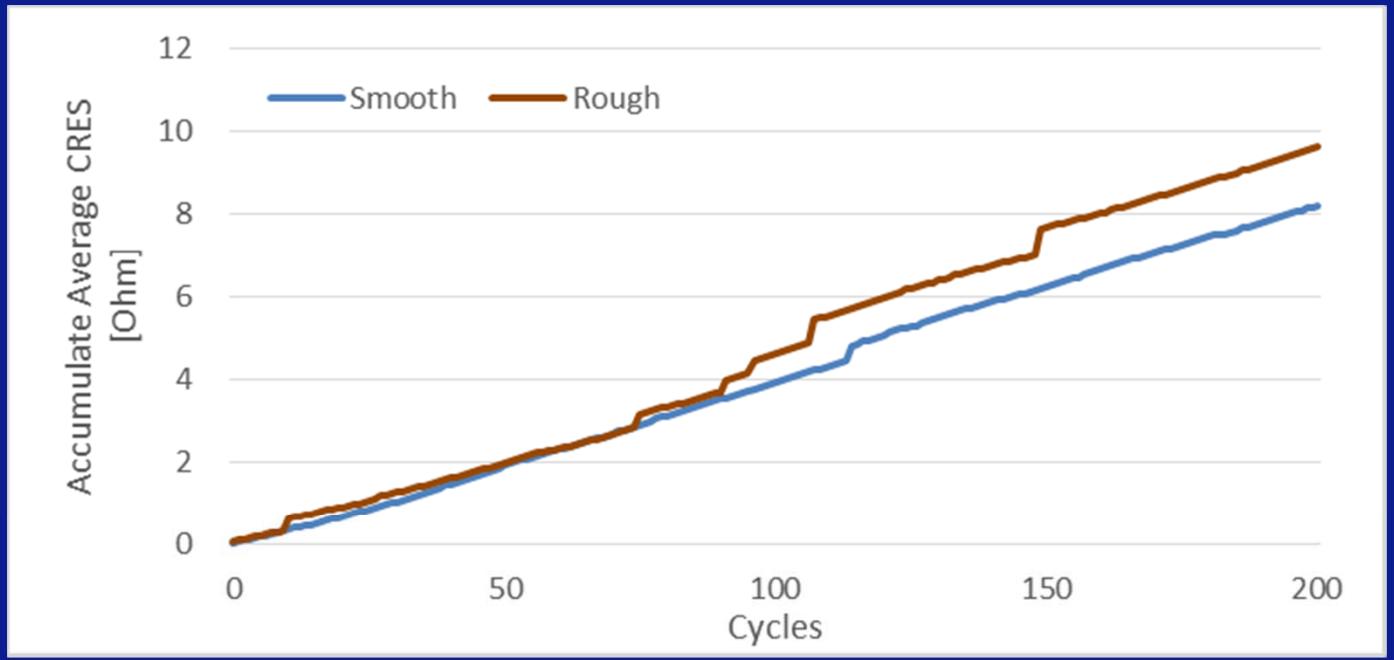
Accumulated Average CRES



- Smooth surface has a lower and more stable CRES than rough surface

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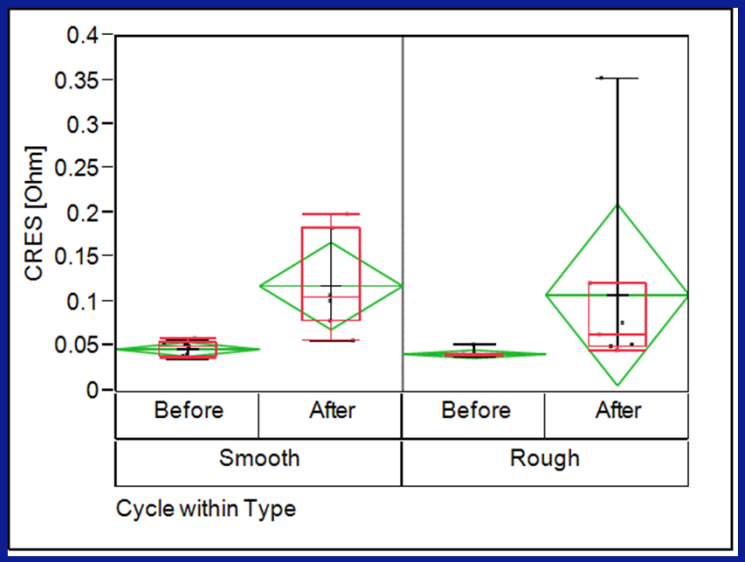
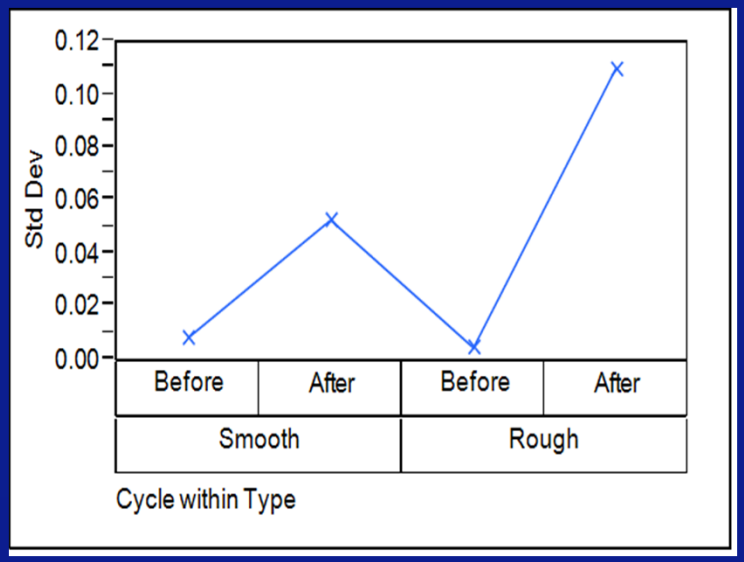
CRES Distribution

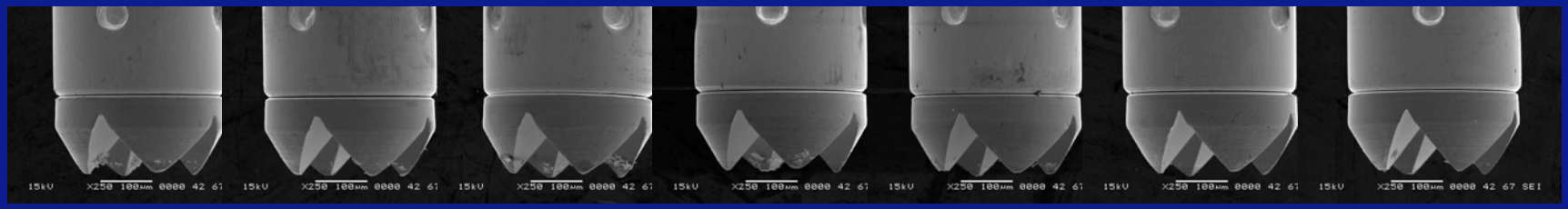




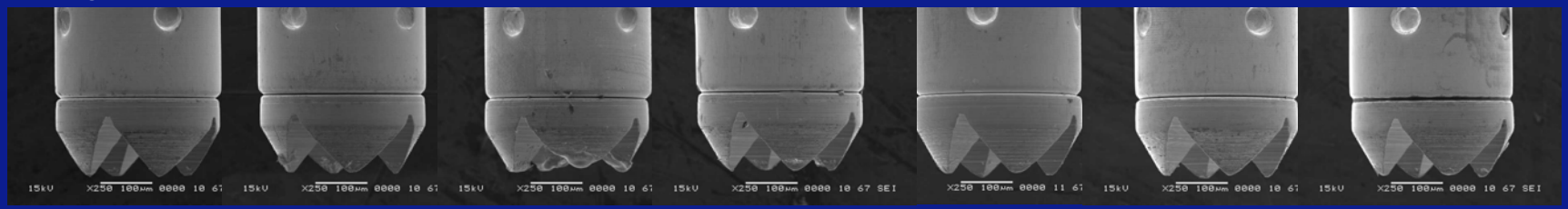
- CRES is measured by FDR machine with gold plated prober
- Smooth surface has smaller standard deviation compared to Rough surface

SEM Photo 200 Cycles

Smooth surface



Rough surface



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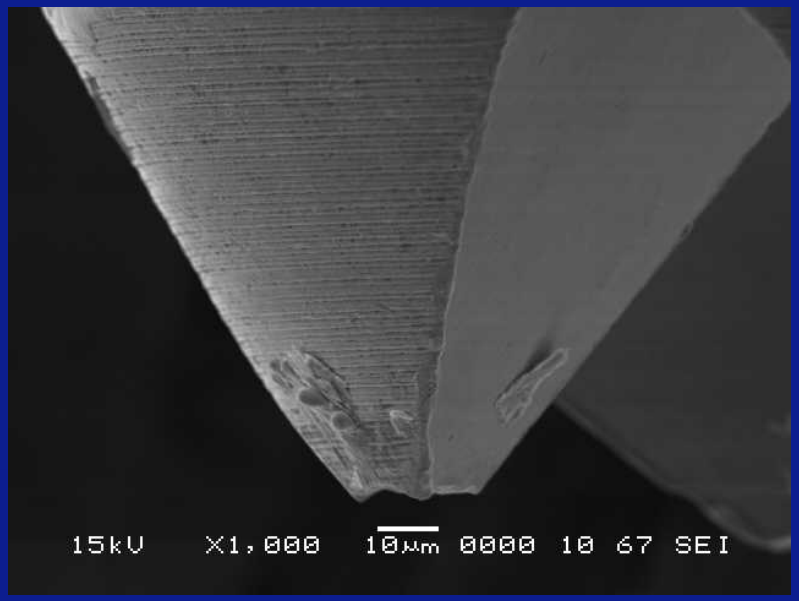
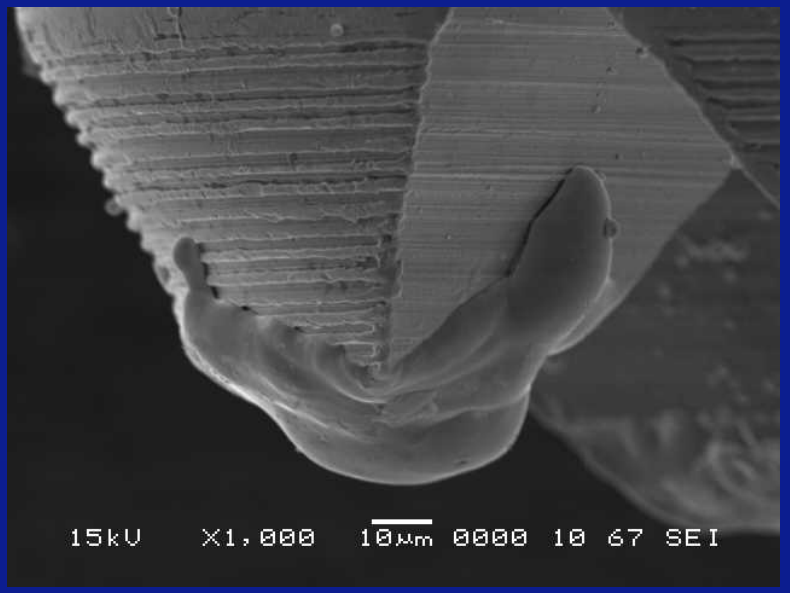
SEM Photo 200 Cycles (Tip Melting)

Smooth surface



- Small tip damage at pin tip

Rough surface



- Tip melt at pin tip

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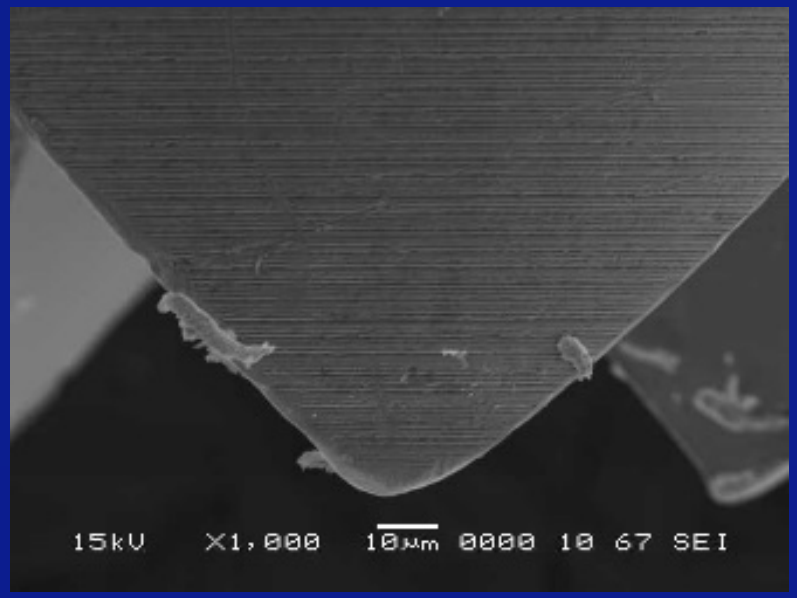
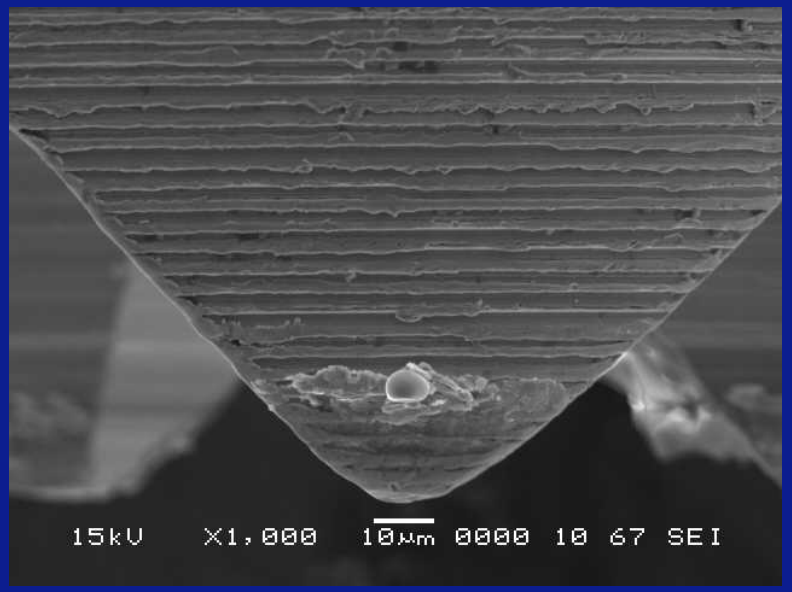
SEM Photo 200 Cycles (Solder Migration)

Smooth surface



- Thin solder migration at pin tip

Rough surface



- Heavy solder migration at pin tip

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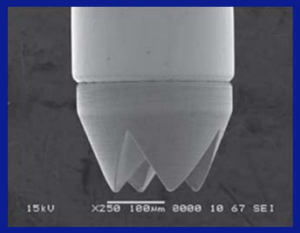
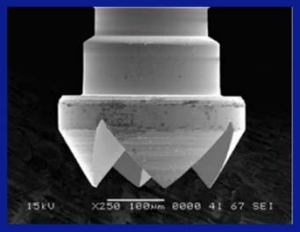
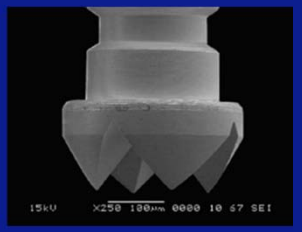
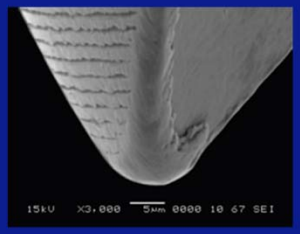
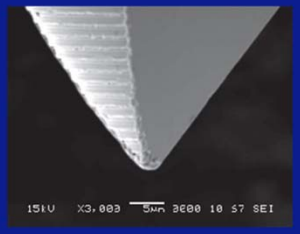
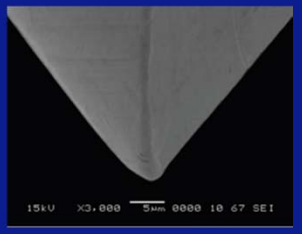
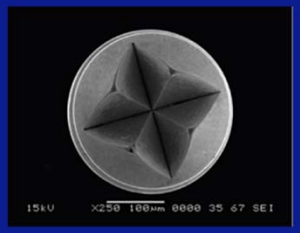
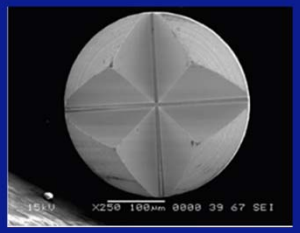
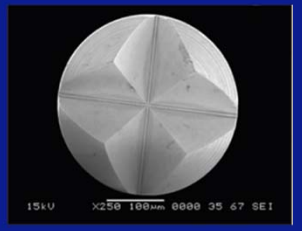
Conclusion

Plunger	CRES Average	CRES Stability	Open Contact	Tip Melting	Solder Migration	Overall
Smooth	☺	☺	☺	☺	☺	☺
Rough	✖	✖	✖	✖	✖	✖

- Smooth PA Surface has best overall performace
- ☺ Good
- ✖ Bad

Product Examples

Brand 'X'	TTS NCC	TTS NCC+
		
		
		

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