Online Semi-radius Probe Tip Cleaning and Reshaping

Authors:

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Agenda

- Acknowledgements
- Background info
- Setup and measurement technique
- Contact resistance results
- Cleaning recipe parameters to consider
- Silicone vs polymer based materials
- Summary
- Future work

Acknowledgements

- Jack Courtney
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- Les Griffith
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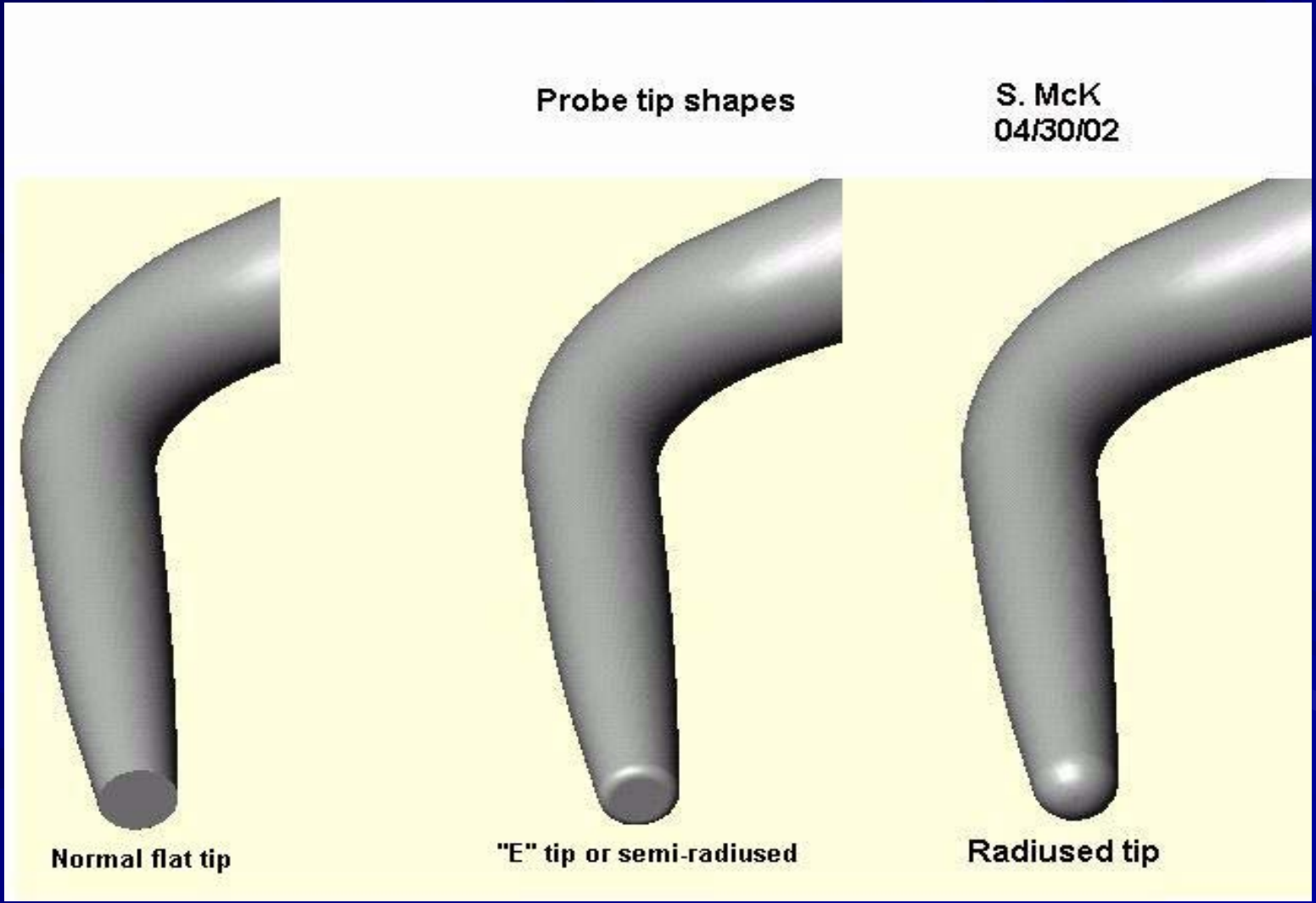
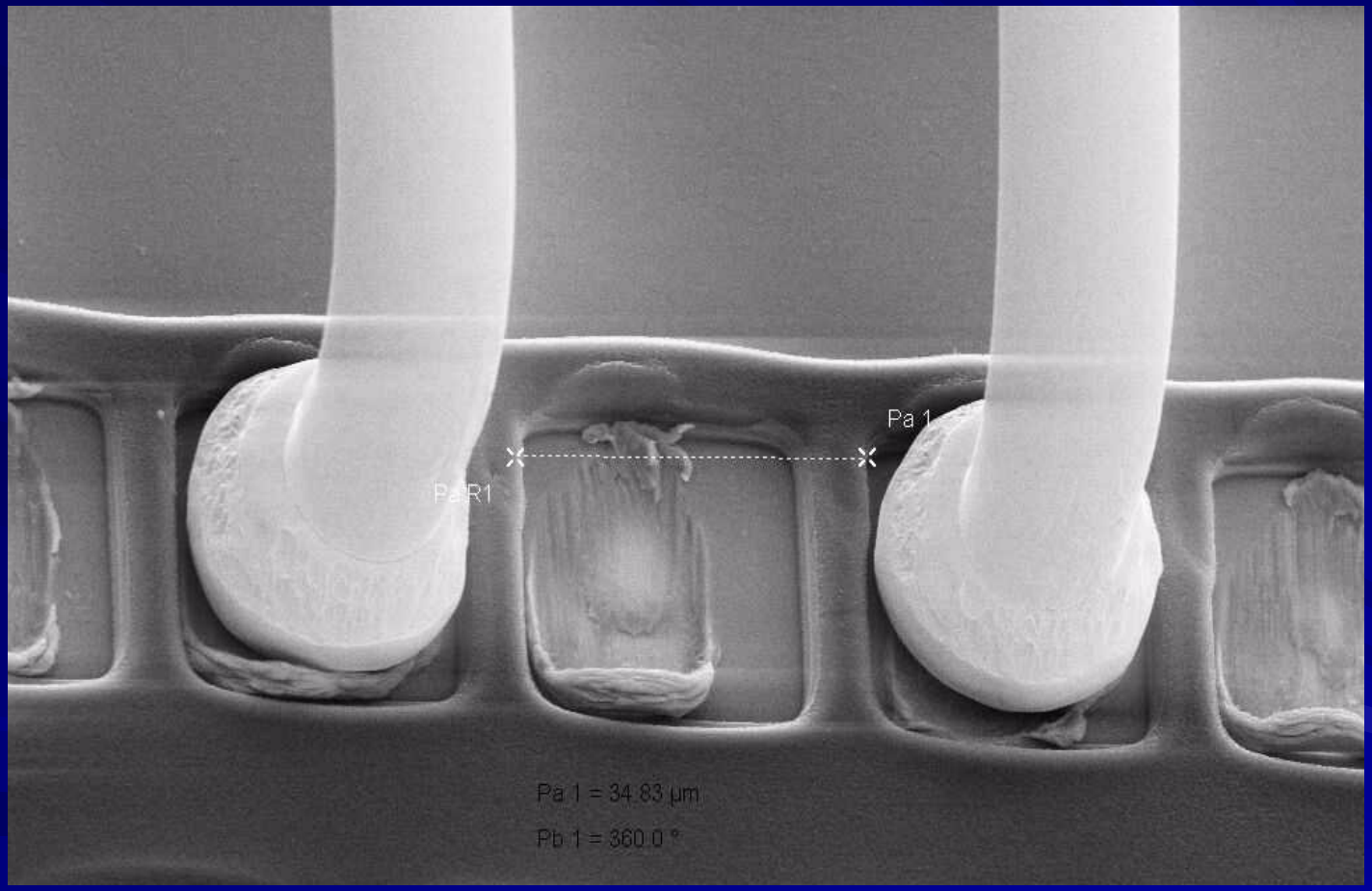
Basic cantilever probe types



Why Semi-radius?

- Lower pad damage in general for today's soft aluminum
- Approximately same scrub length as flat tip while reducing the amount of material removed from base material
- Equivalent contact resistance to flat or full radius tip
- Reflectivity similar to flat tip for prober and probe metrology alignment (easier to align to vs. full radius material)

Bonding – Semi radius tips



Pad opening shown is 29X29 microns - running out of room!

The problem with Semi-radiused probes

- Variable tip geometry using standard material cleaning solutions
- No insitu solution – non silicone based
- Either flat tip or radiused tip solution but no semi-radiused solution

Traditional way to maintain semi-radius probe tips

- Use elastomeric abrasive i.e. polymer based material – continues to radius tips
- Remove periodically to reshape (put a flat back on it)

The solution

- Two part cleaning – insitu
  - Abrasive material for flat tip – SiC
  - Elastomeric material for radius tip and removes stringers (contact pad and cleaning detritus)

Two basic cleaning mediums

- Two part cleaning – insitu
  - Solid Abrasive material for flat tip – SiC (Silicon Carbide)
  - Elastomeric material for radius tip and removes stringers (contact pad detritus)
  - Order is important – see data

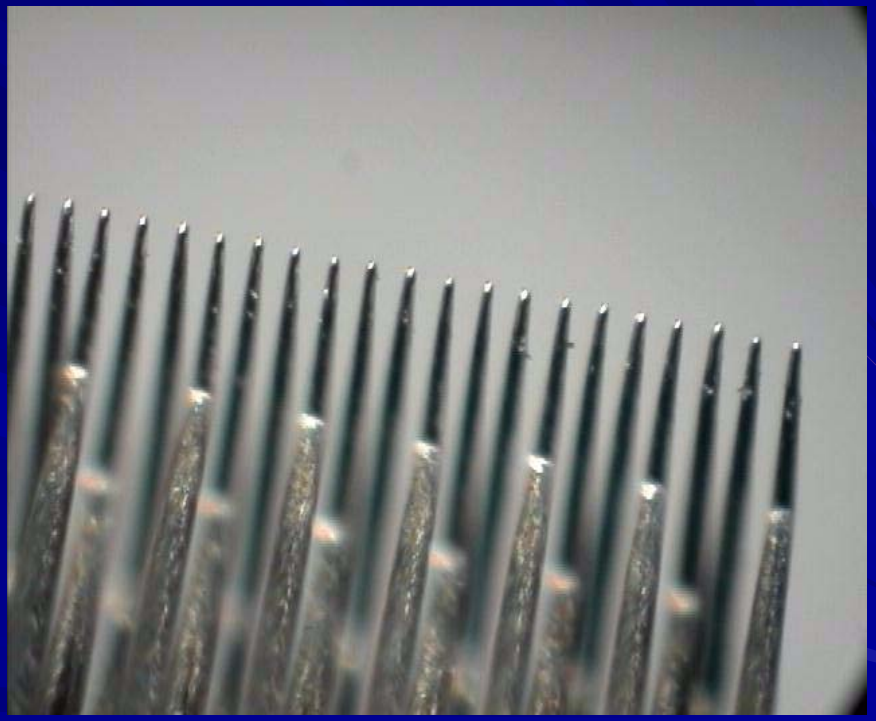
Typical recipes

- 5 -10 up/down touchdowns on each medium
  - SiC abrasive removes all detritus down to base material (flat tip)
  - Elastomeric abrasive -removes probing/cleaning detritus (radius tip)
- Use same OD as with product for SiC, OD + 30% for elastomeric (typical) - pitch dependant
- Move to new location between Up/Down cycles

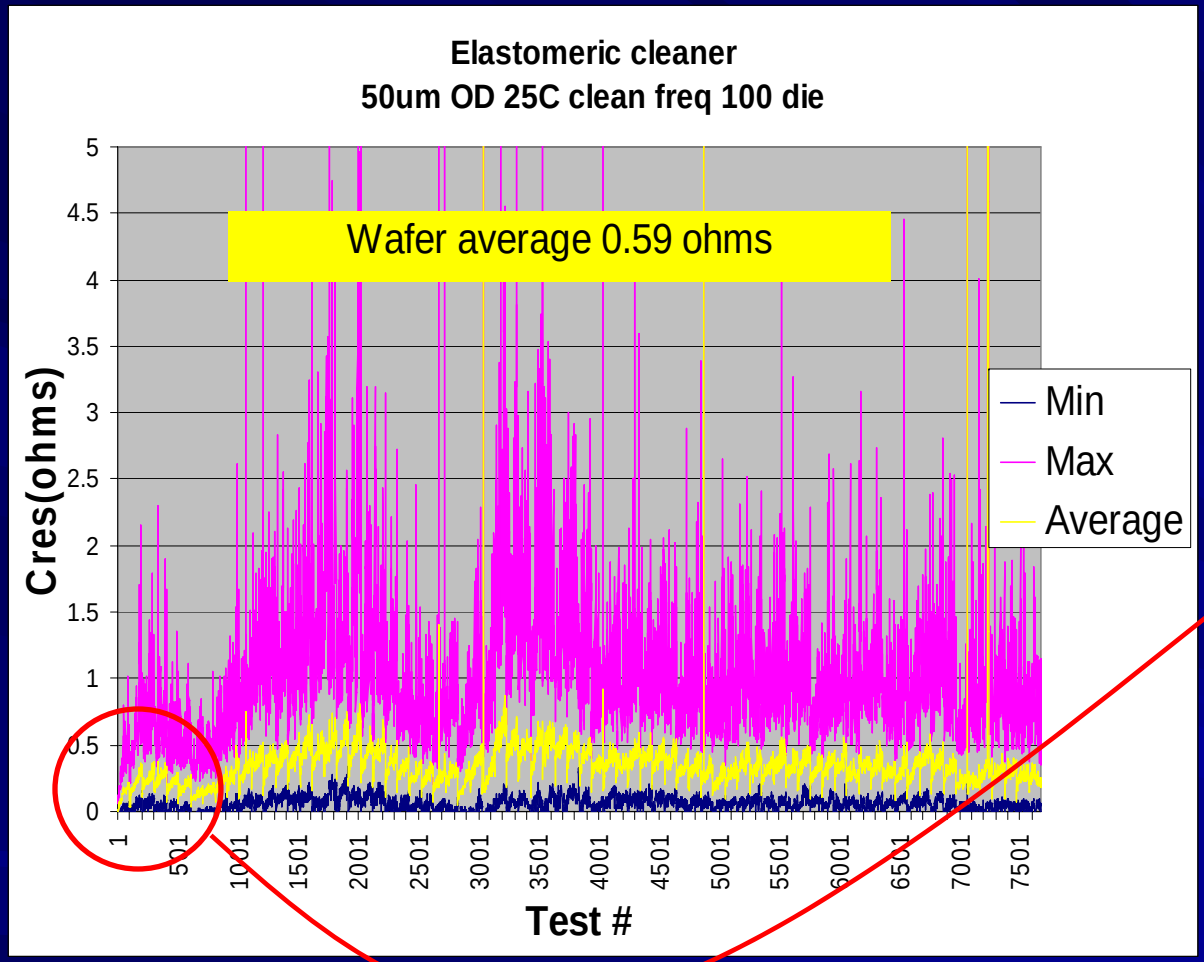
Polymer based abrasive clean

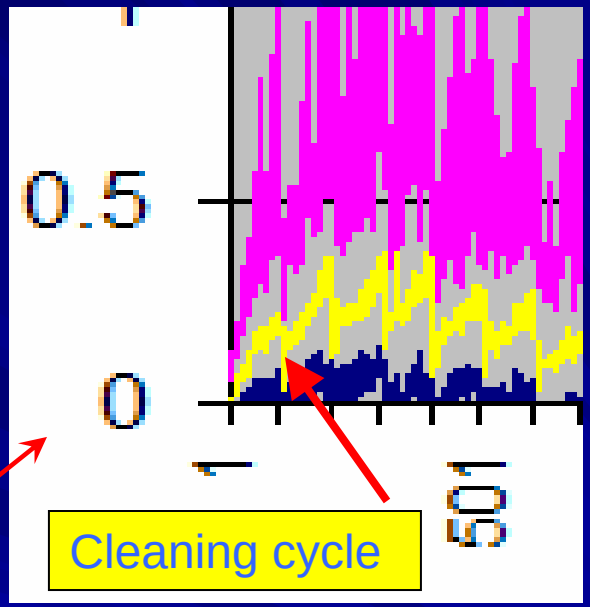
Before clean

After clean



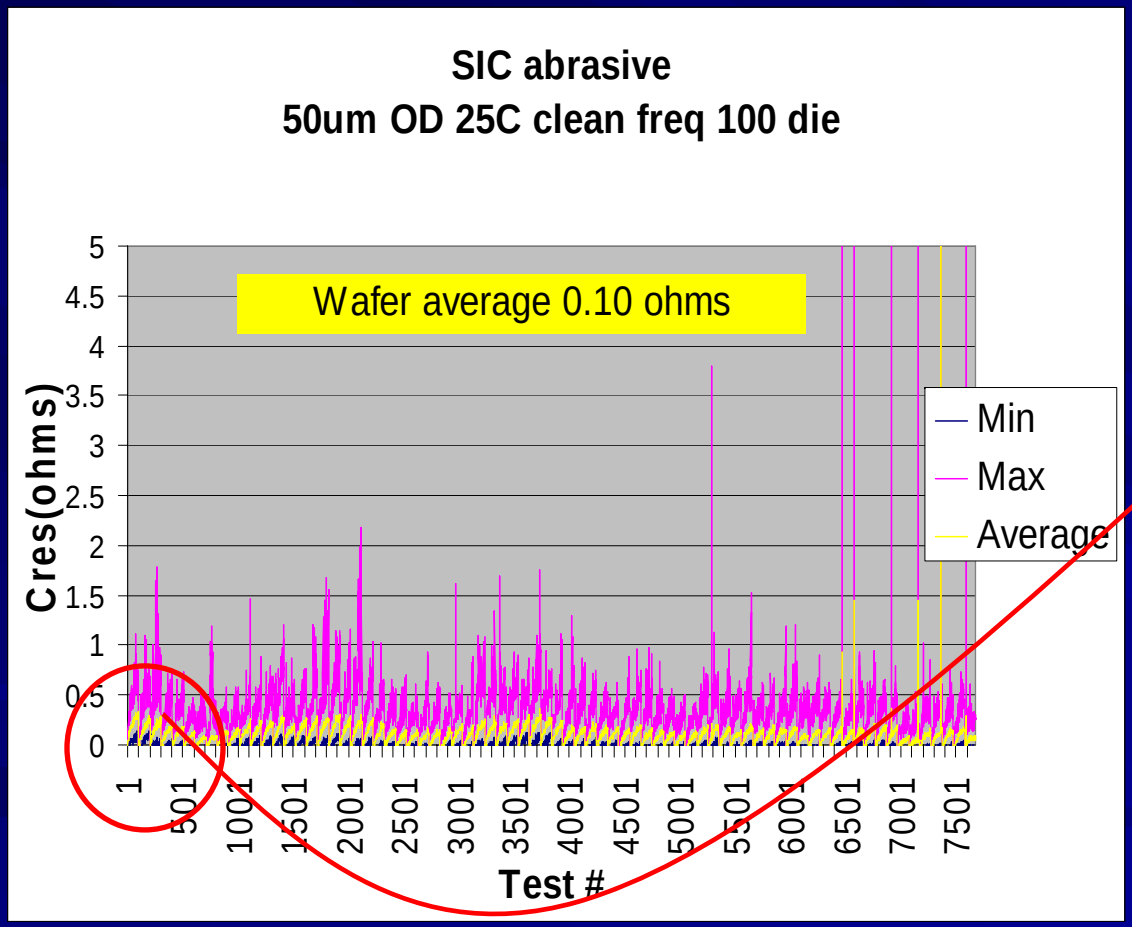
Contact resistance - Elastomeric

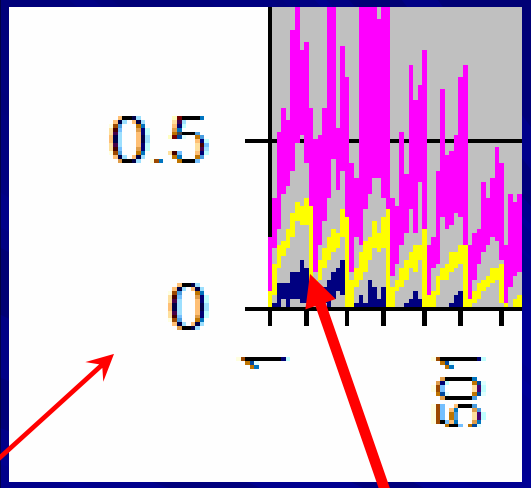




Each "test" represents 25 contacts (190K data points total)
opens removed from average data – all CRES charts

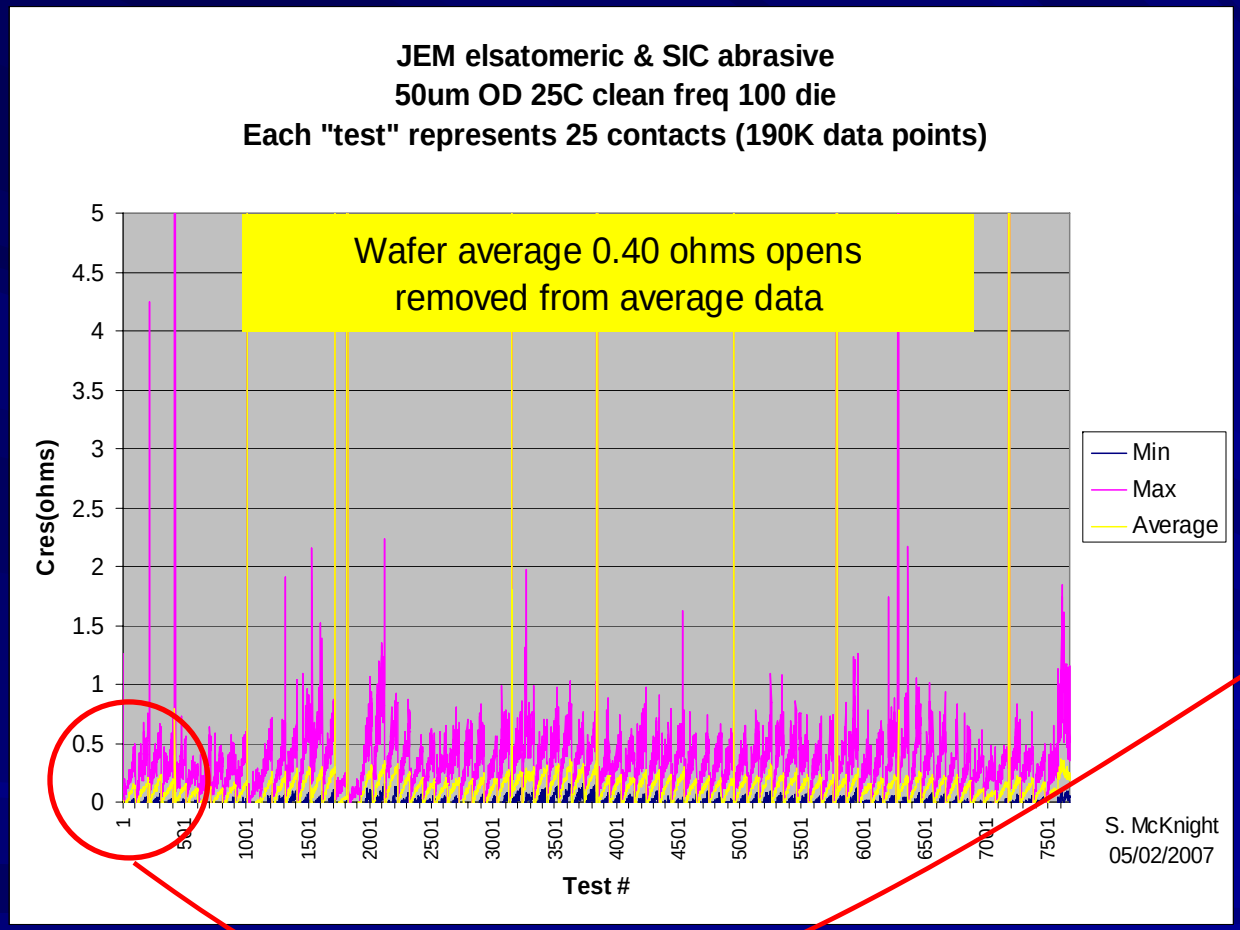
Contact resistance – silicon carbi

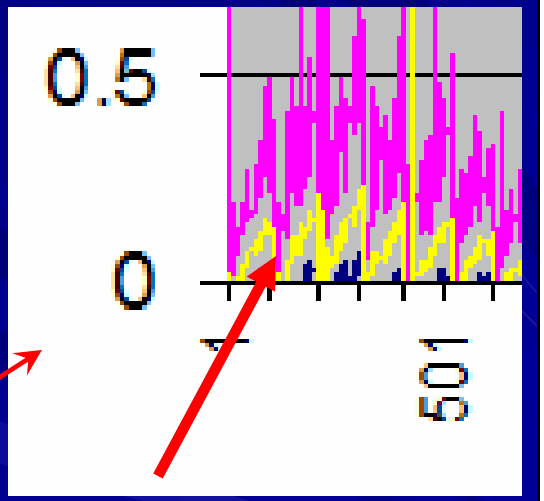




Cleaning cycle

Contact resistance – dual clean





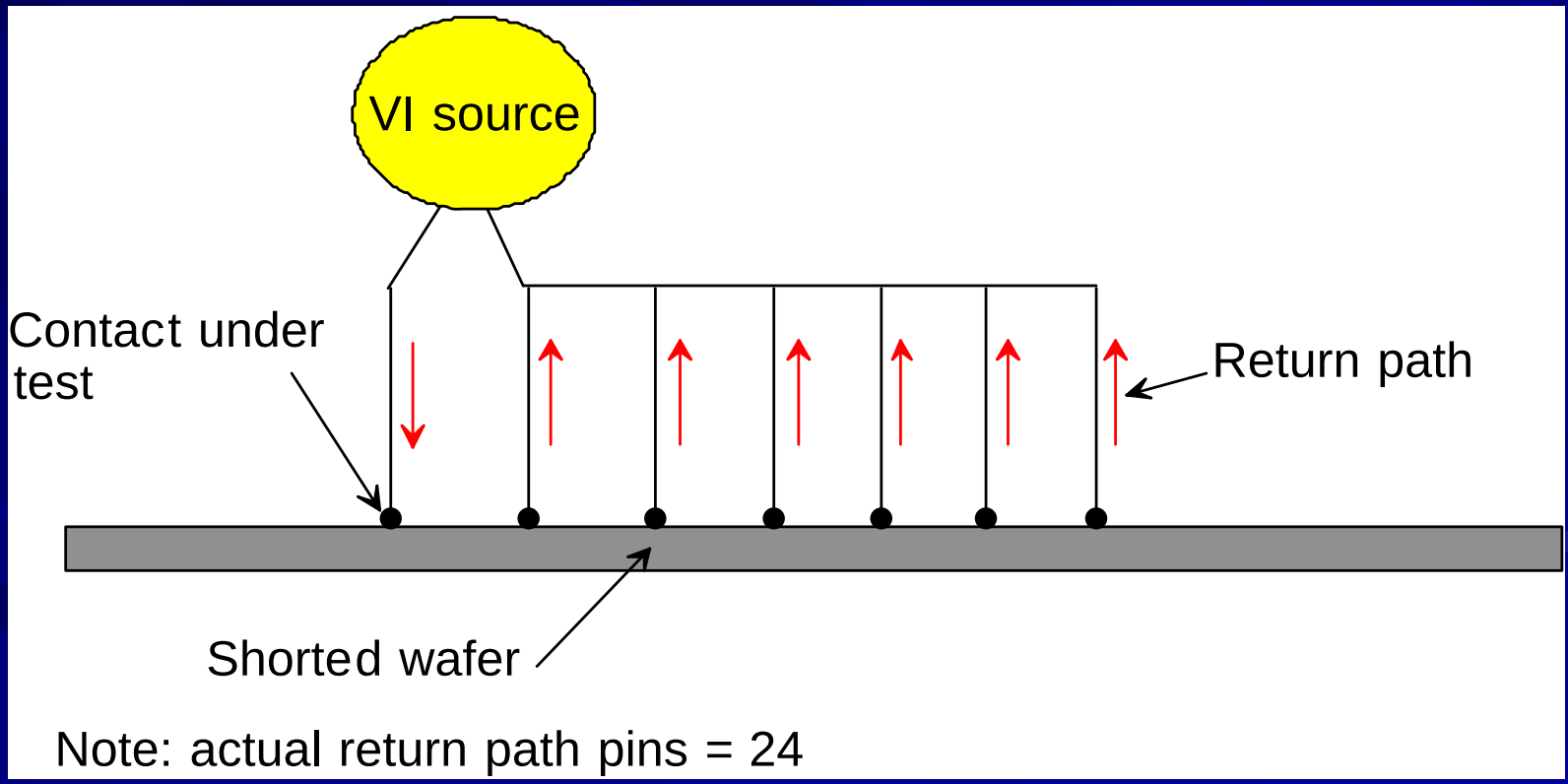
Cleaning cycle

Contact resistance setup and measurement technique

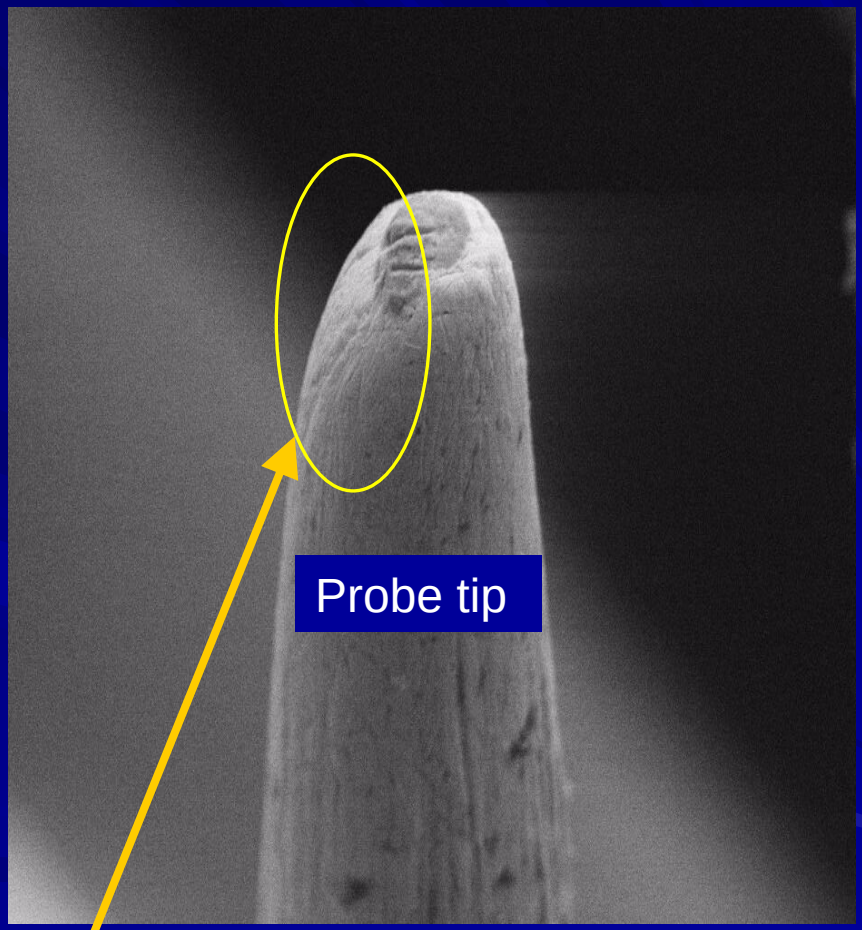
- TEL P12XLN prober @ 25C, Maximum z velocity
- Probe – 50 micron pitch 1X25 tungsten rhenium material, 20 micron nominal tip diameter ~ 1gf/mil spring rate
- 50 micron overdrive from first touch (contacts were within 9 microns from first to last touch)
- 100 touchdowns between cleans
- Relative measurement – not 4 point
- All data “nulled” – path or bulk resistance removed
- 300mm wafer – 1.2 micron as deposited aluminum – blanket deposition

Measurement circuit

- **Test stimulus 10 ma forcing current – 5V clamp**
- **Min - Max - Average data collected plus raw data**
- **Keithley based matrix switch and source/measurement unit**



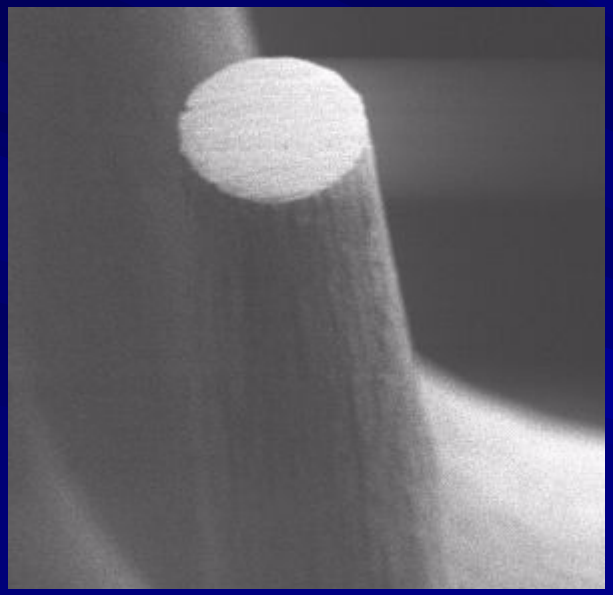
Polymer based abrasive clean



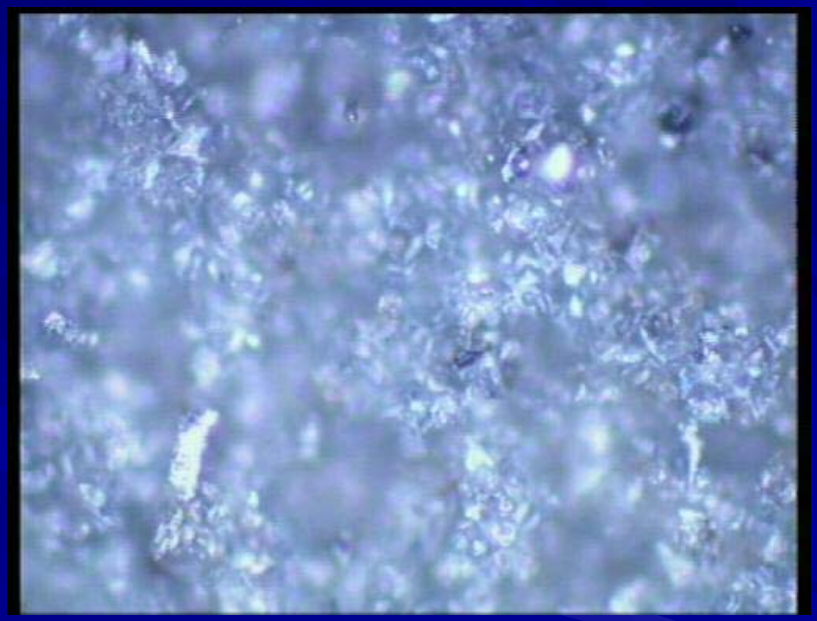
Abraded area – largest area expose to cleaning medium

SiC clean

Typical flat tip



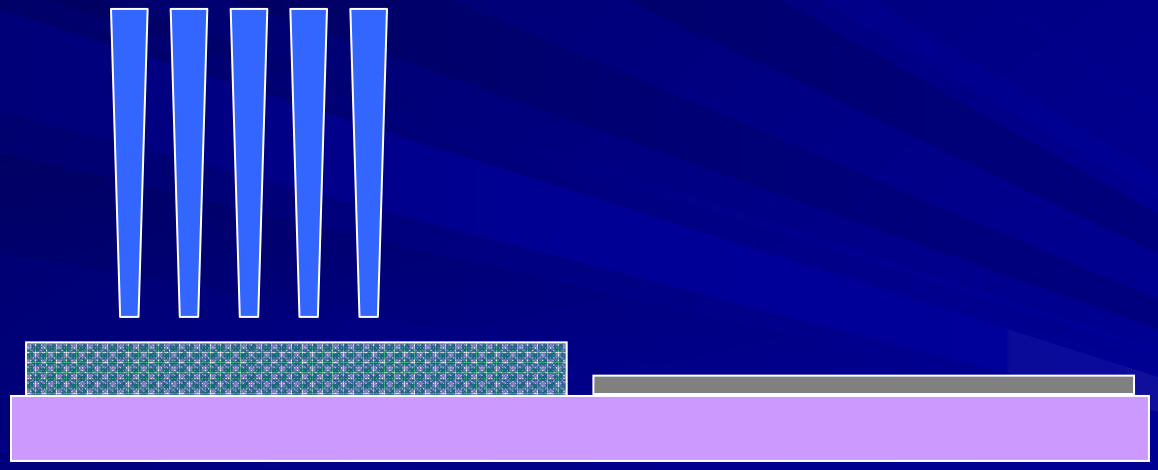
Silicon Carbide abrasive – 3µm



“Recipe” Considerations

- Probe characteristics
  - Tip diameter
  - Tip length
  - Taper
  - Spring rate
  - Material
- Cleaning order
  - Lowest CRES use SIC last
  - Maximum particulate removal use Elastomeric last

Sequence and motion (use animation)



Elastomeric material

SIC material

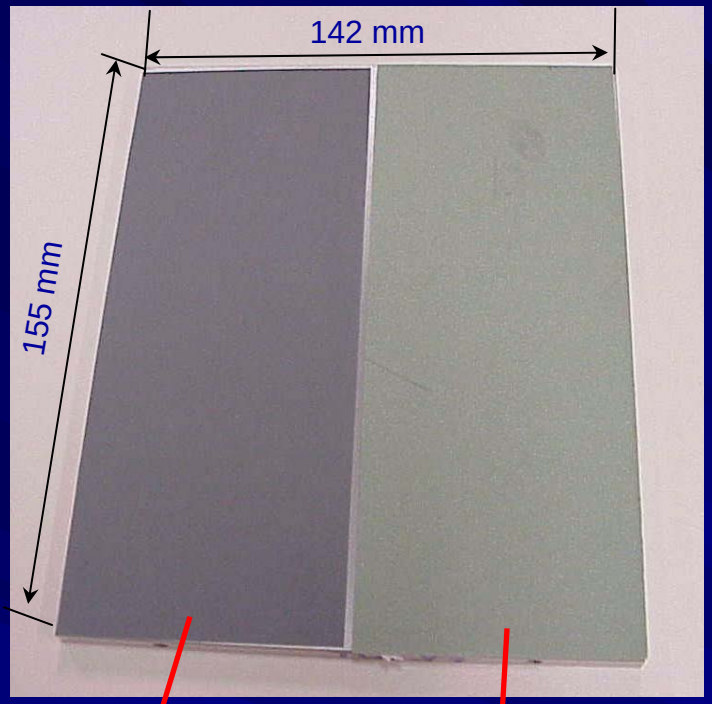
Benefits

- Low cost solution – use existing materials
- Comparable CRES to SiC material
- Non Silicone
- Uniform tip shape throughout life of probe
- Longer probe life

Detractor

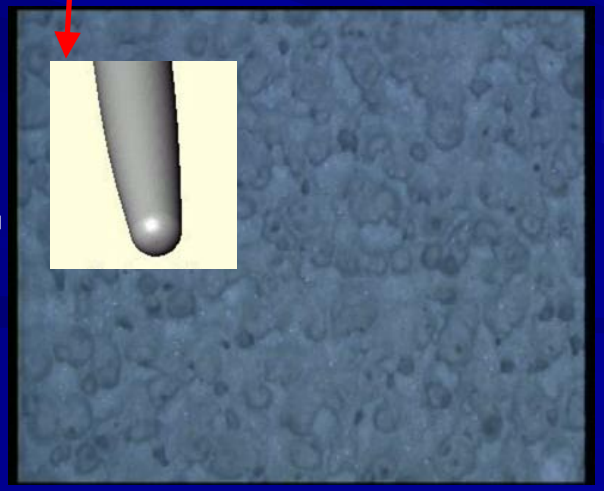
- Die Size limited – effectively cut cleaning area in half

Cleaning summary

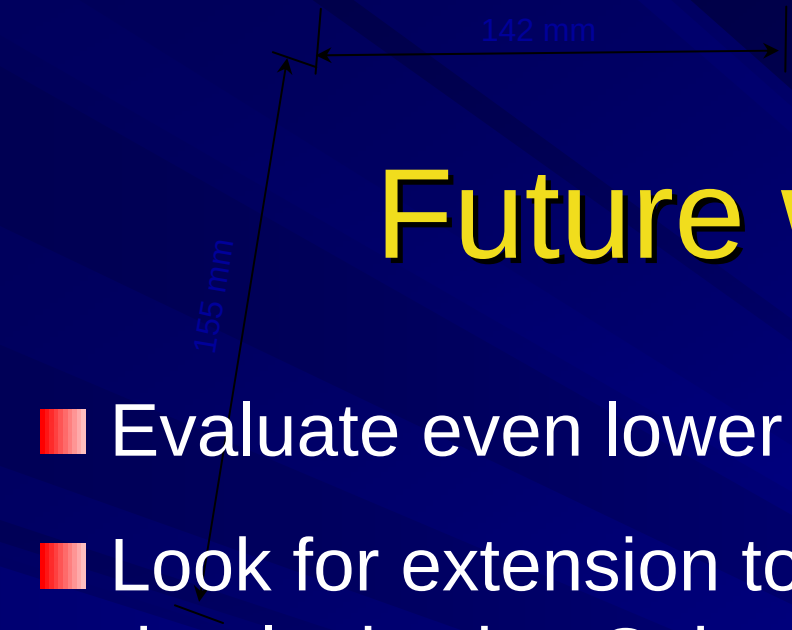


Flat material

Radius material



Semi-Radius tip



Future work

- Evaluate even lower cost materials
- Look for extension to other probe technologies i.e. Cobra, metrology usage
- Maximize cleaning medium lifetime
- Larger cleaning plate

Thank you! Questions?