



Extending Probe Card Life for Fine Pitch Probe Cards

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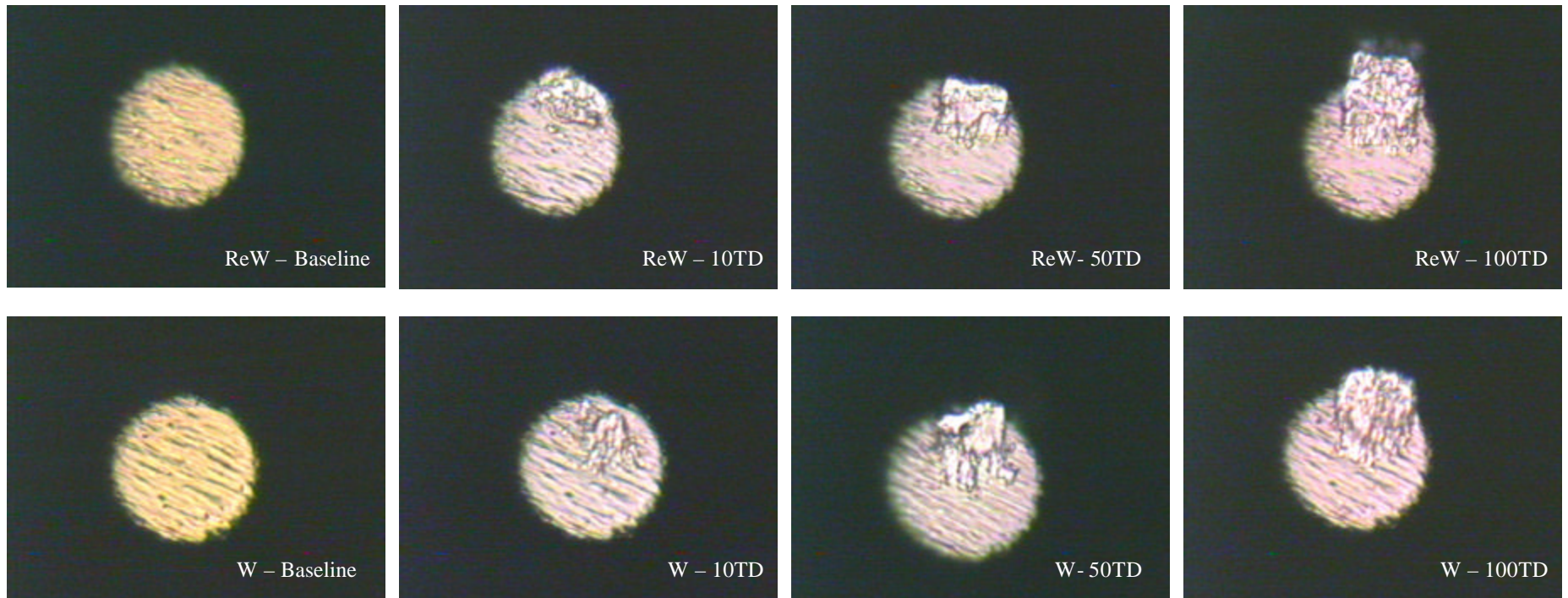
Material Considerations

- Relative Accumulation
 - Comparison of 5 Common Probe Materials
 - Effects of Probe Tip Roughness
- Effect of Cleaning Materials
 - Comparison of 4 Common Probe Materials
 - Comparison of 5 Common Cleaning Materials

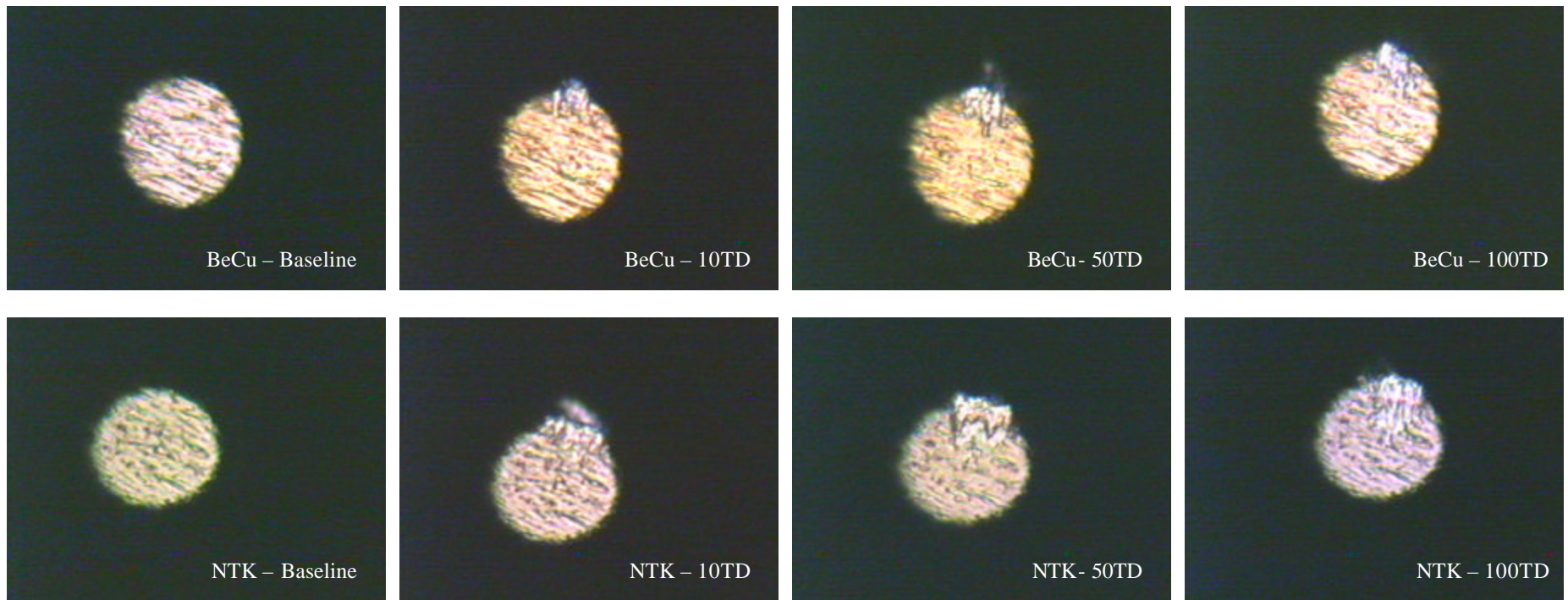
Accumulation Study

- 5 Probe Cards
 - One each of ReW, W, BeCu, P, NTK
 - Each Card with 10 Probes of the Same Material
 - Same Build Configuration
 - Study Conducted in Production Environment
 - No Electrical Testing
 - One Touch per die
 - 3 mil Overdrive
 - Same Test Condition for All Cards
 - No Cleaning

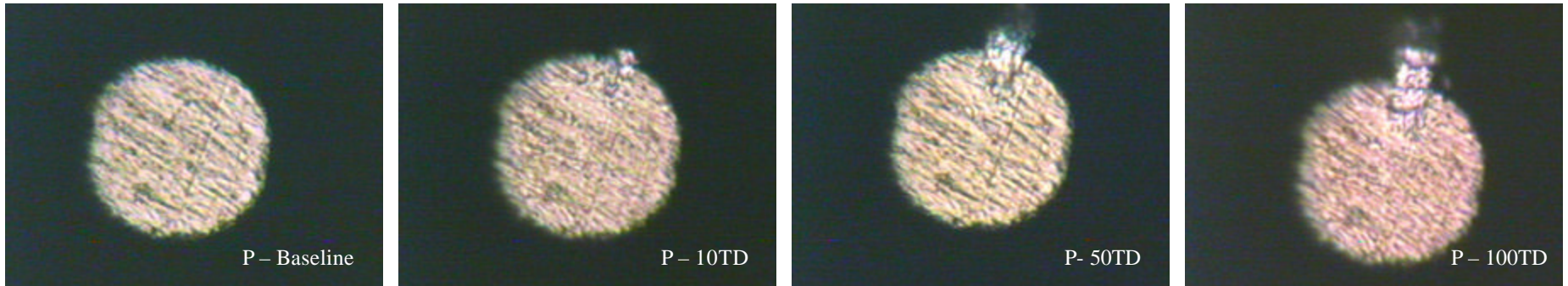
Probe 1 Comparison



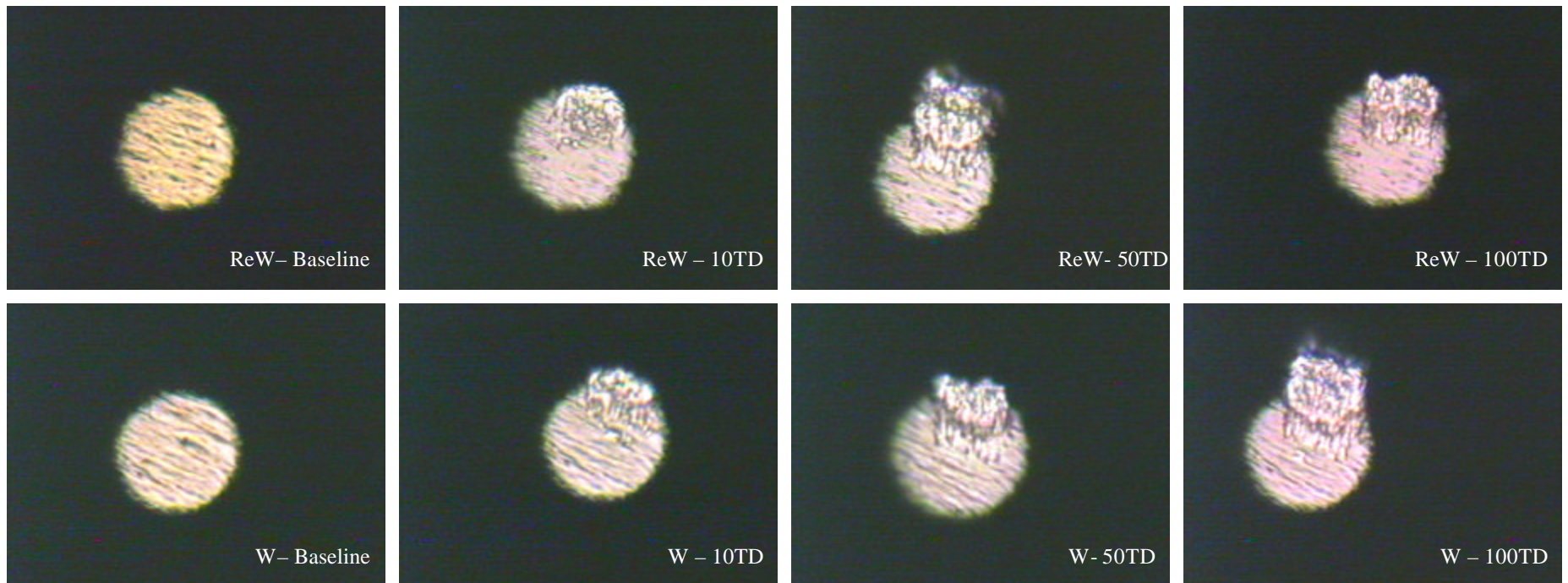
Comparison Probe 1



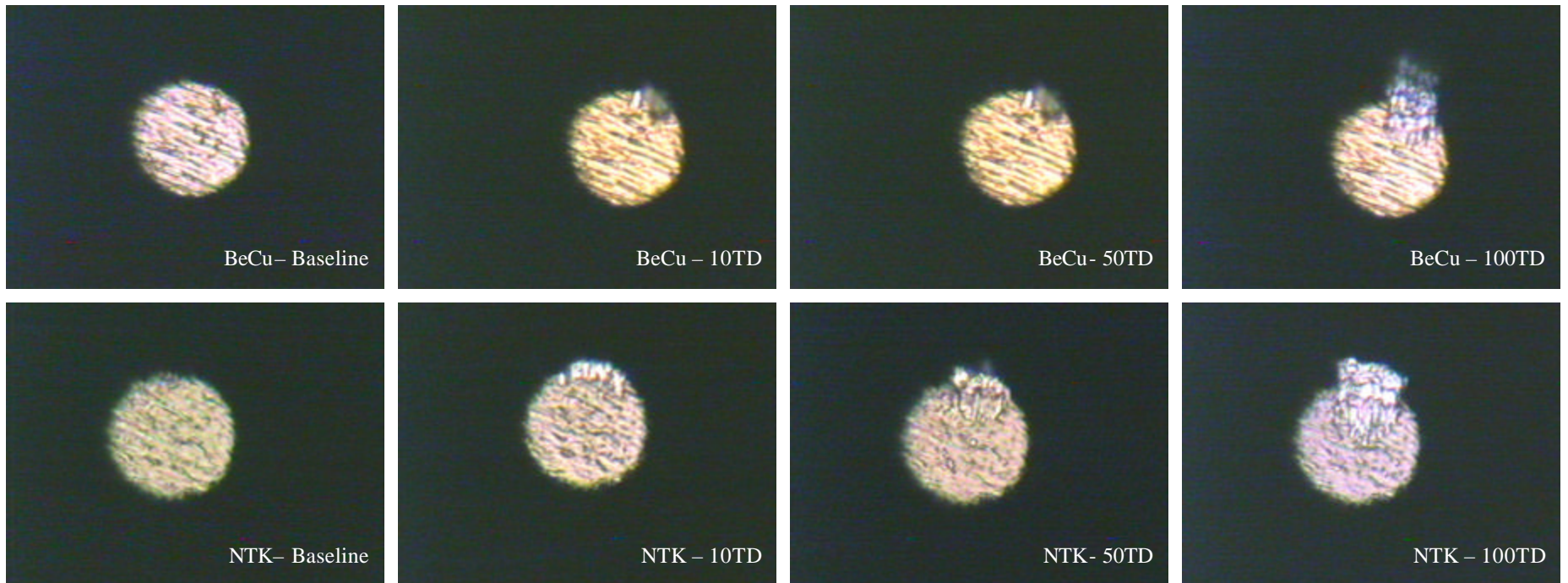
Probe 1 Comparison



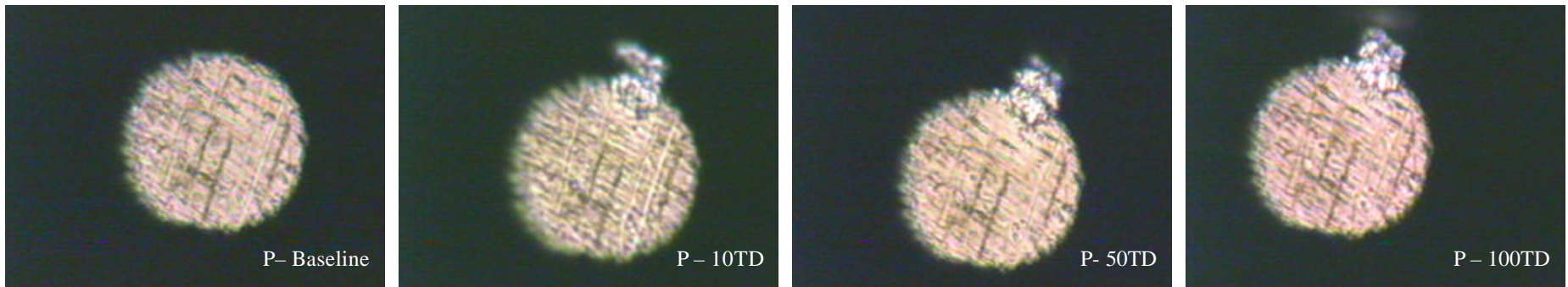
Probe 2 Comparison



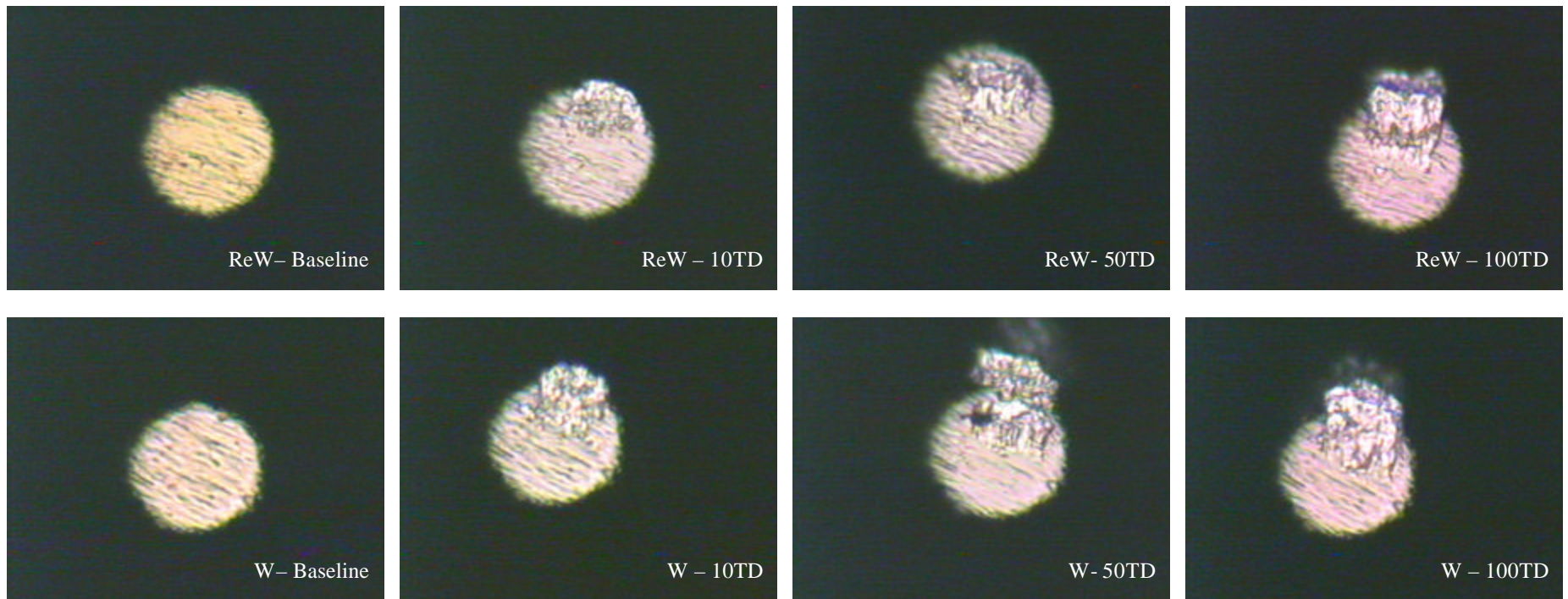
Probe 2 Comparison



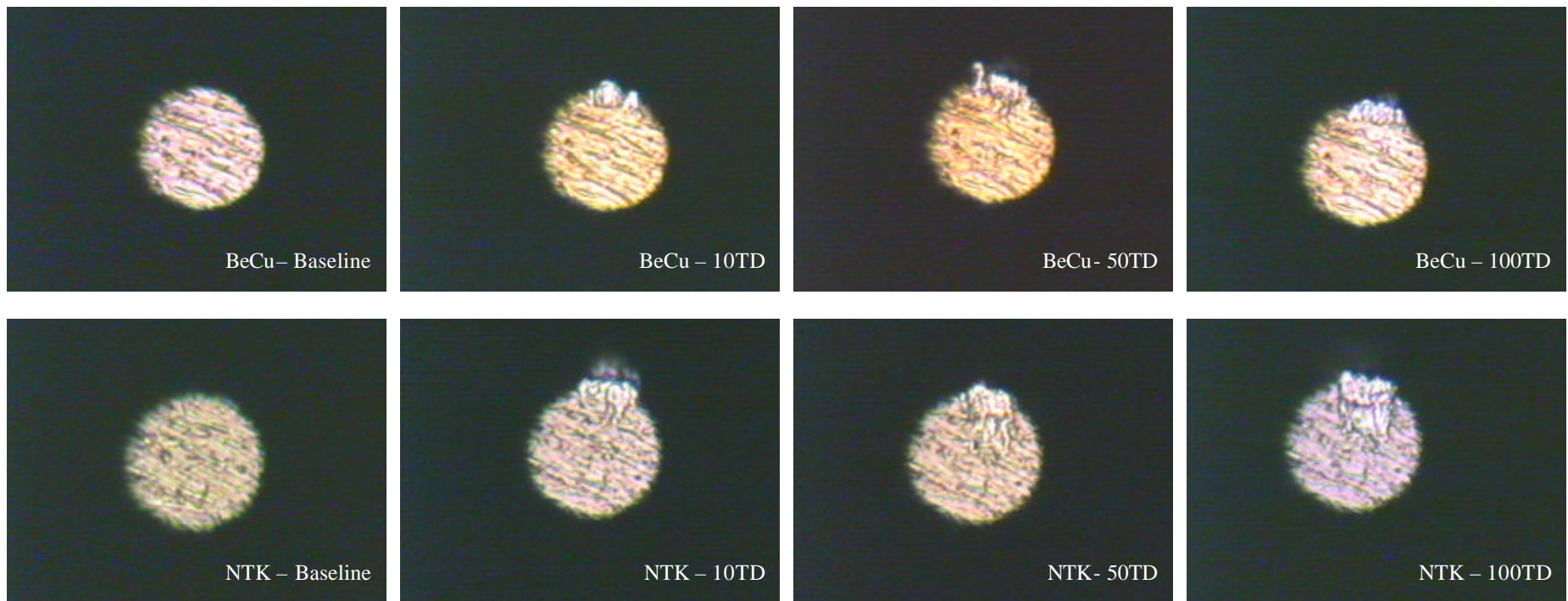
Probe 2 Comparison



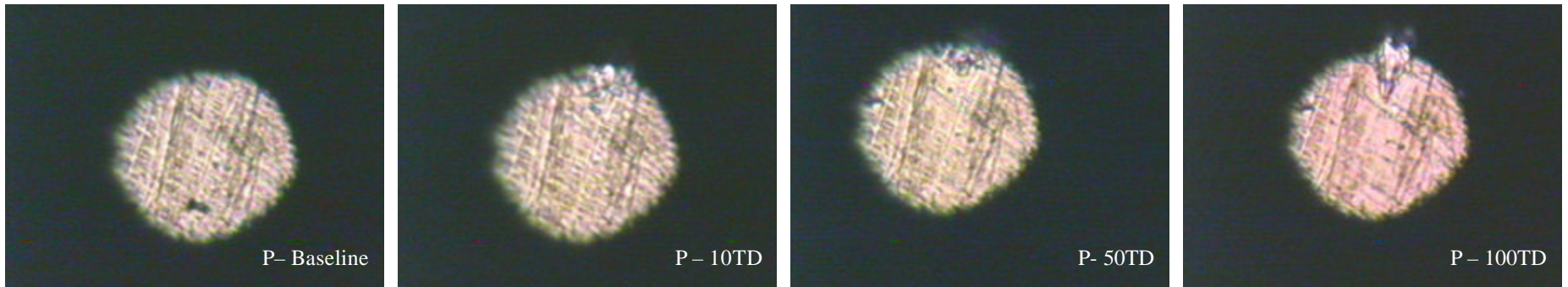
Probe 3 Comparison



Probe 3 Comparison



Probe 3 Comparison



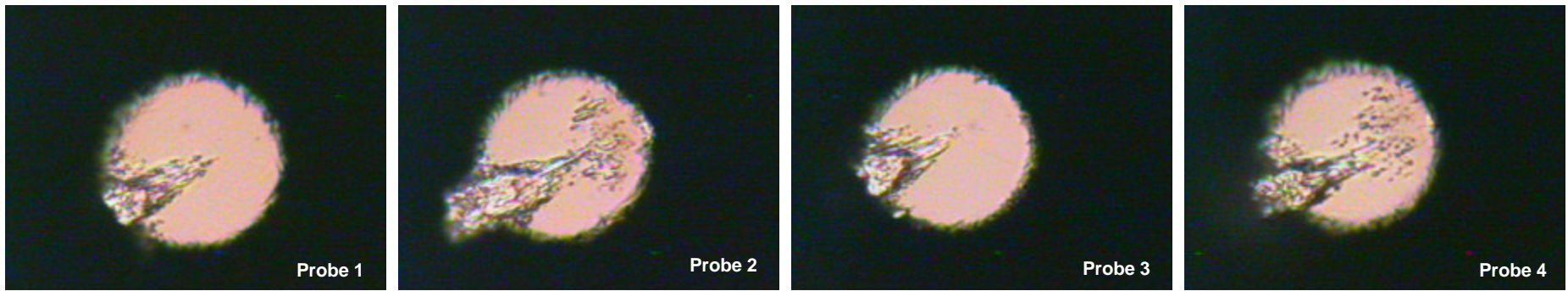
Accumulation Conclusions

- Relative Accumulation
 - ReW and W Accumulate at nearly the same rate
 - BeCu and NTK Accumulate at nearly the same rate
 - P Accumulation Rate Least of All Materials Studied
 - Substantial Difference in the Accumulation on ReW and P

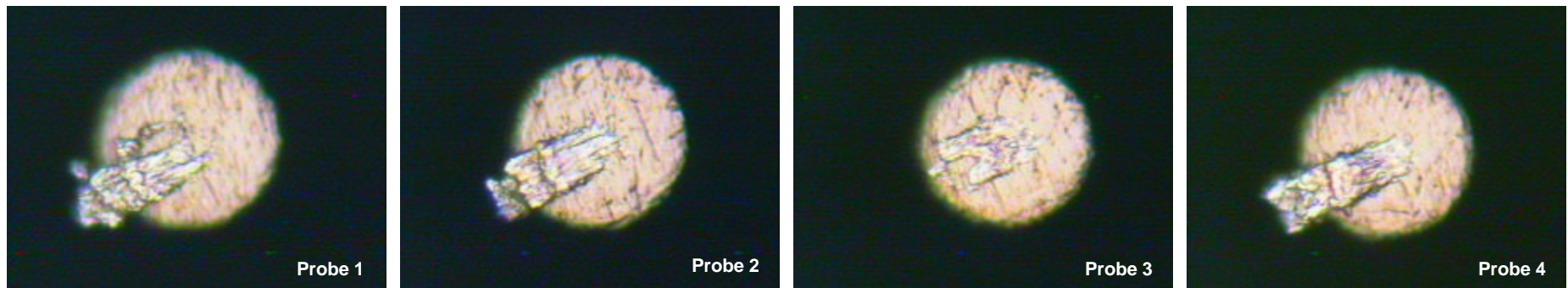
Effect of Roughness

- Does the Probe Roughness Effect Accumulation Rates?
 - One ReW Probe Card
 - 100 Touchdowns After Sanding Flat with 3 μ m Lapping Film
 - 100 Touchdowns After Sanding Flat with 0.5 μ m Lapping Film
 - No Electrical Testing

0.5 μm vs 3 μm



Probes sanded with 0.5 μm AlO₂ lapping film, 100TD



Probes sanded with 3 μm AlO₂ lapping film, 100TD

ReW Probes, same probes, same OD

Roughness Conclusion

- Appears That Roughness Does Effect the Rate of Accumulation of Material on the Probe Tips

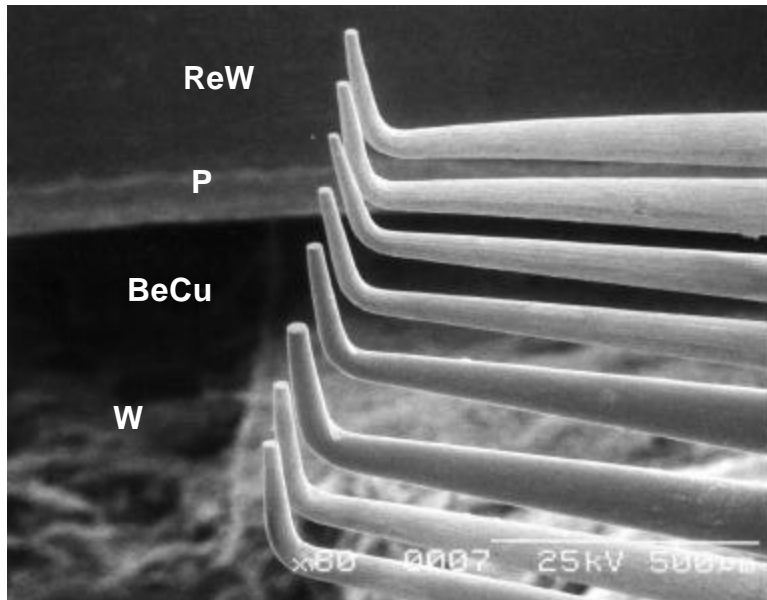
Durability Comparison

- “An Extremely Abrasive Analysis” Troy Harnish and Bill Wenholz, SWTW 2001

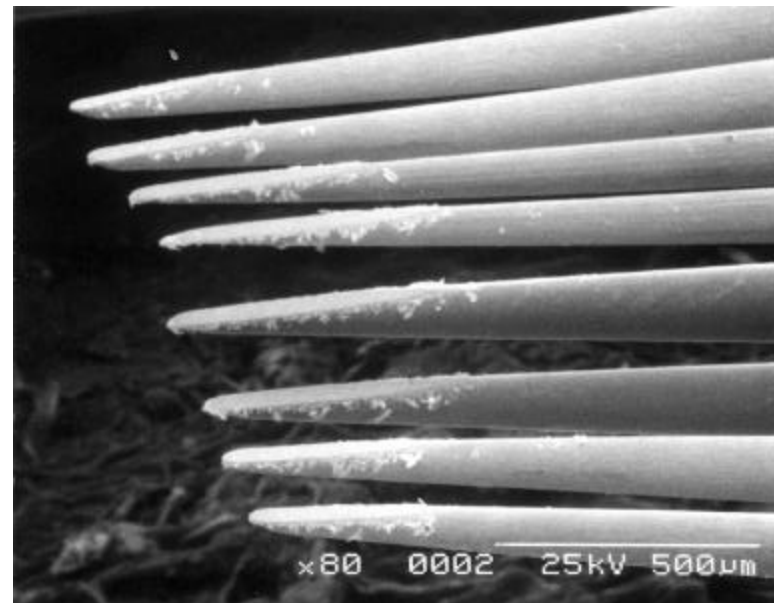
The Evaluation Basics

- Identical and simple probe cards
 - One probe card designated for each cleaning material
 - Cantilever design (epoxy ring)
 - Probe metallurgy and target size (flat)
 - Tungsten (25um)
 - Rhenium Tungsten (25um)
 - Beryllium Copper (25um)
 - Palladium (25um)
- Cleaning products in wafer format
- Common probe card metrology analysis
- Z only cleaning motion with indexing & OD extremes

3 μ m-LF SEM Comparison

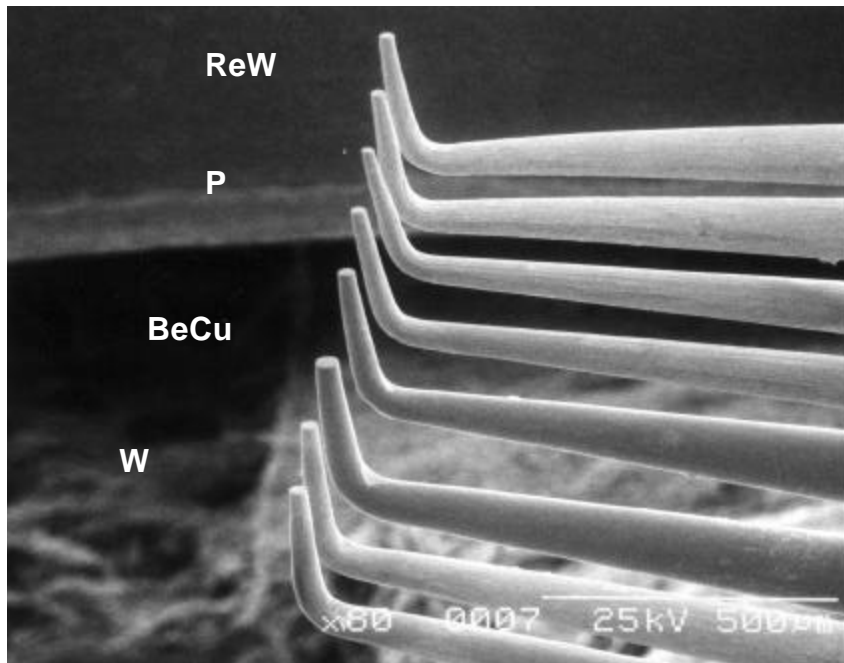


Baseline

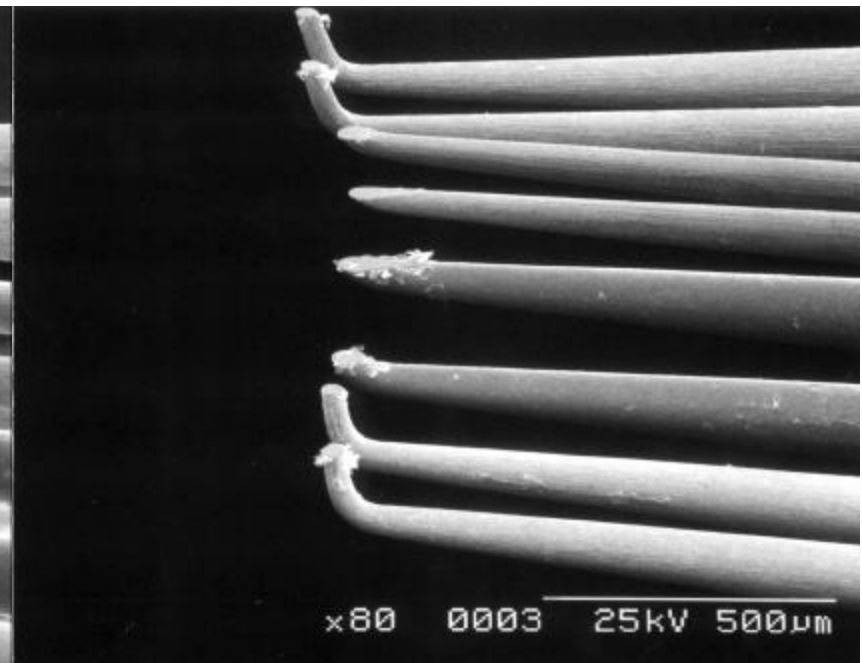


100k Touchdowns

0.5 μ m Cushion Lapping Film

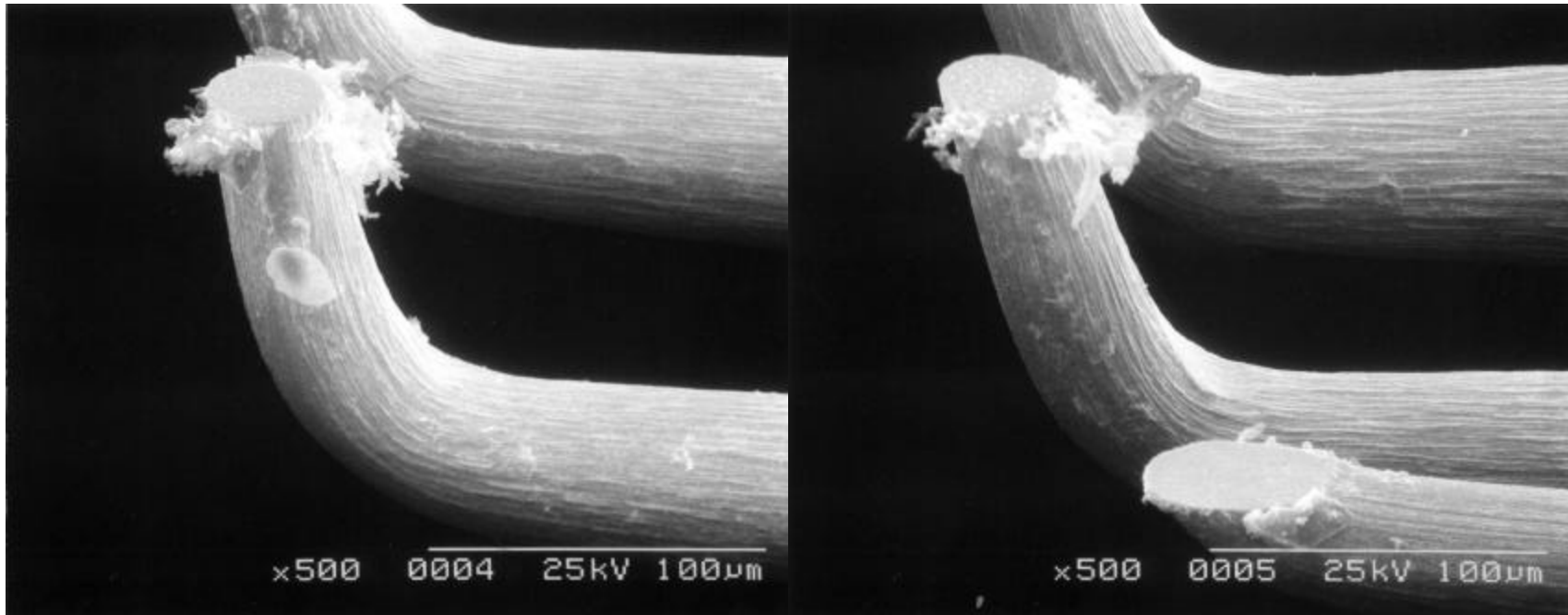


Baseline



100k Touchdowns

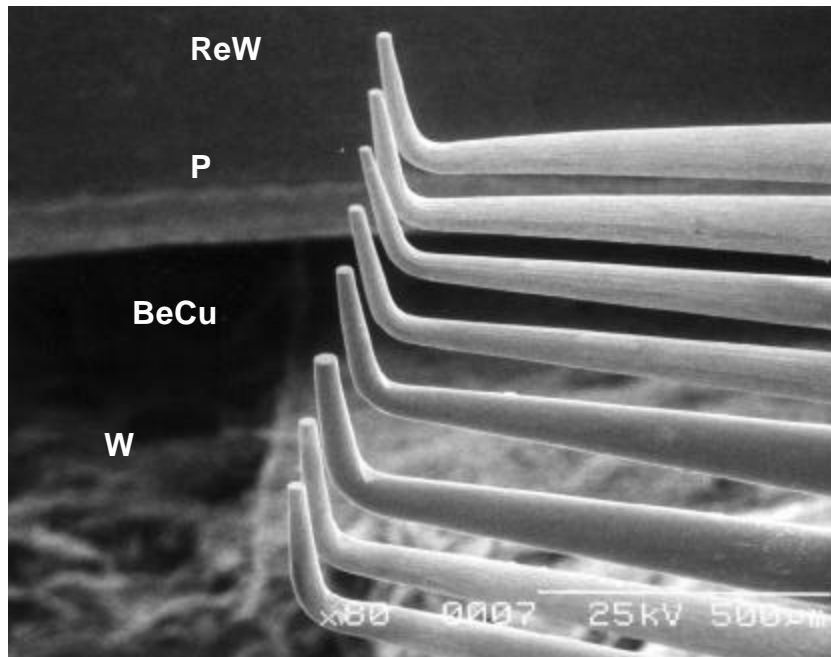
Sanding Debris



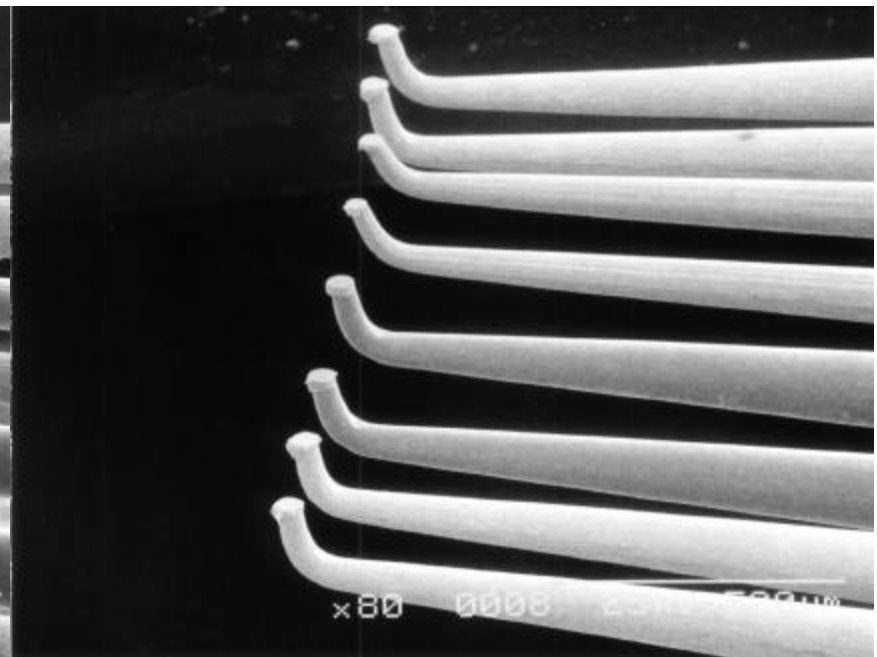
Tungsten - 75µ l

Rhenium Tungsten - 80µ l

Tungsten Carbide SEM Comparison

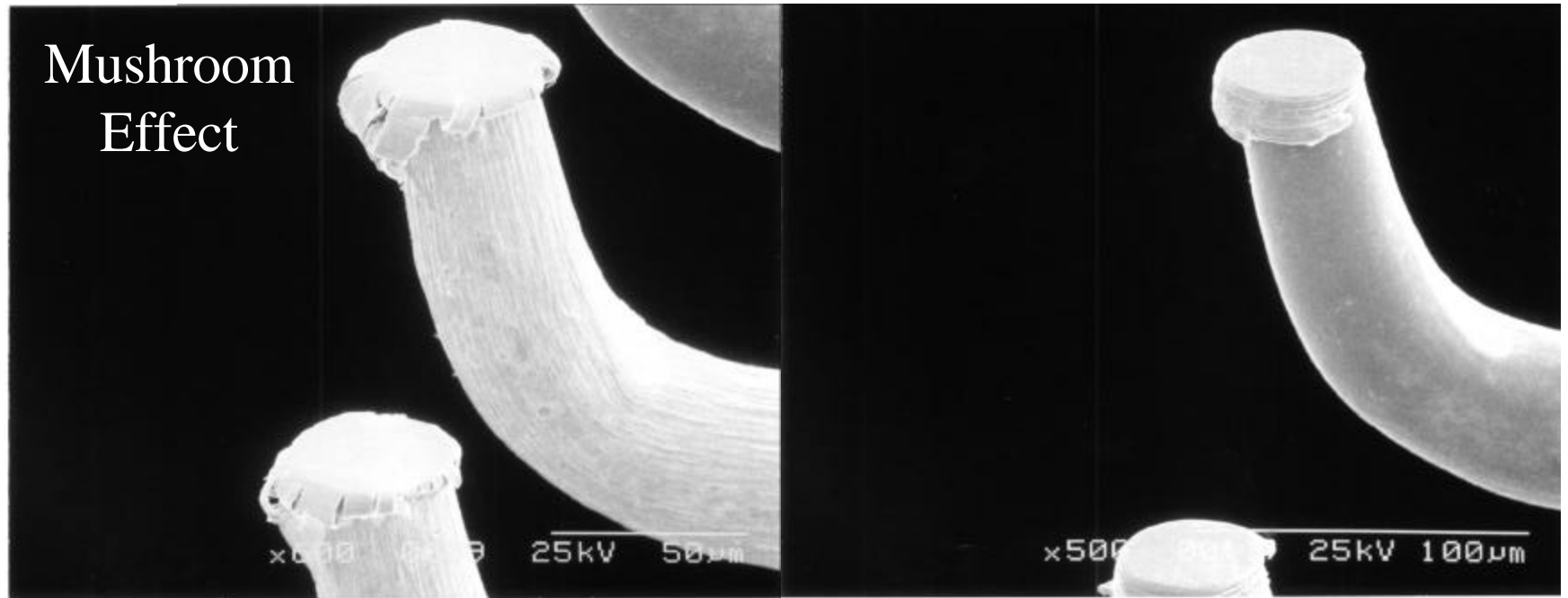


Baseline



500k Touchdowns

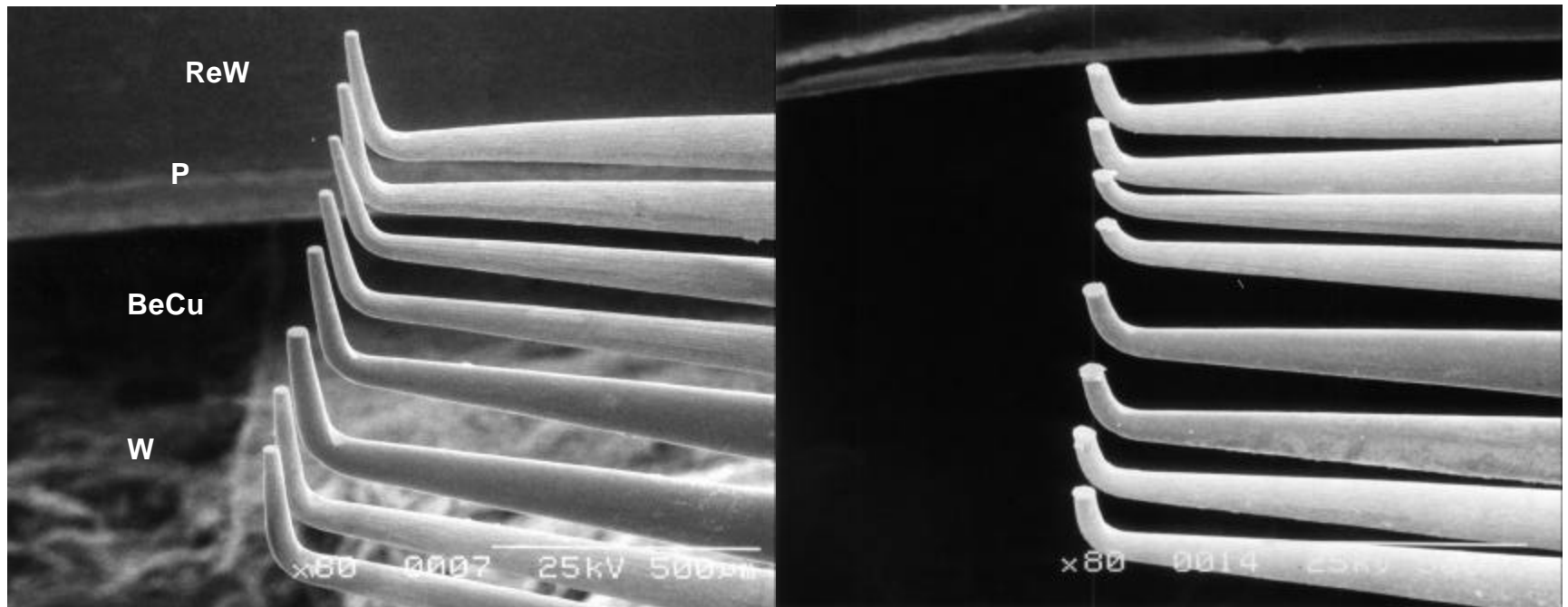
Tungsten Carbide Photos



Tungsten

Beryllium Copper

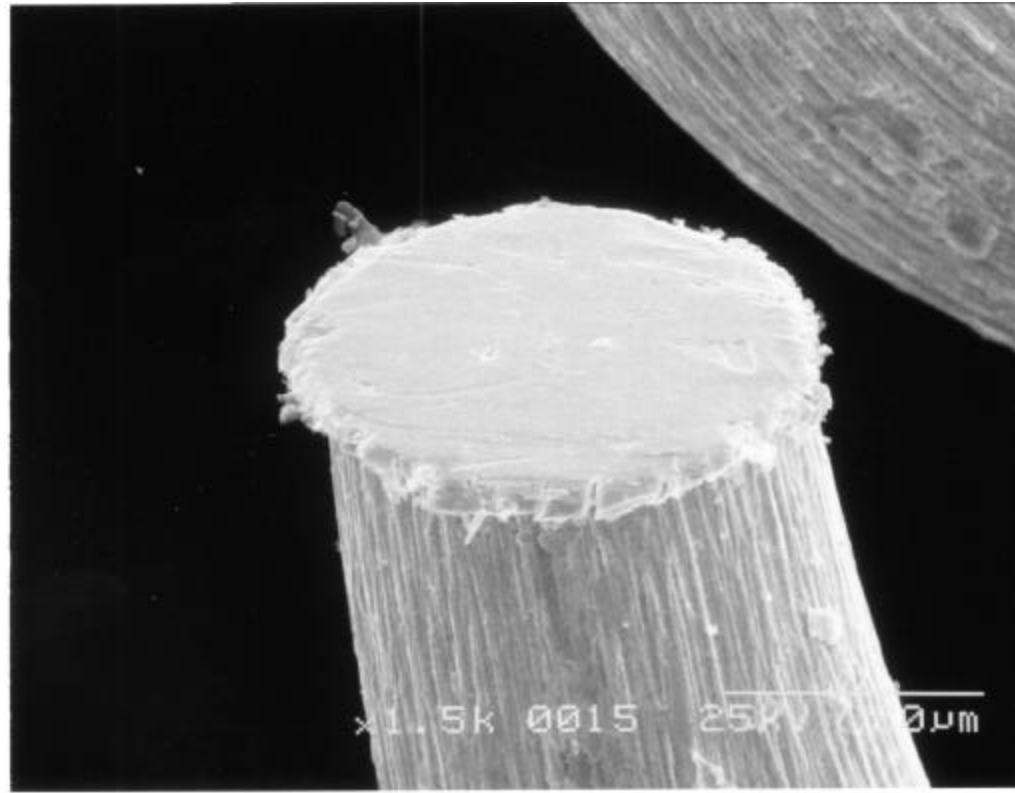
Custom Ceramic SEM Comparison



Baseline

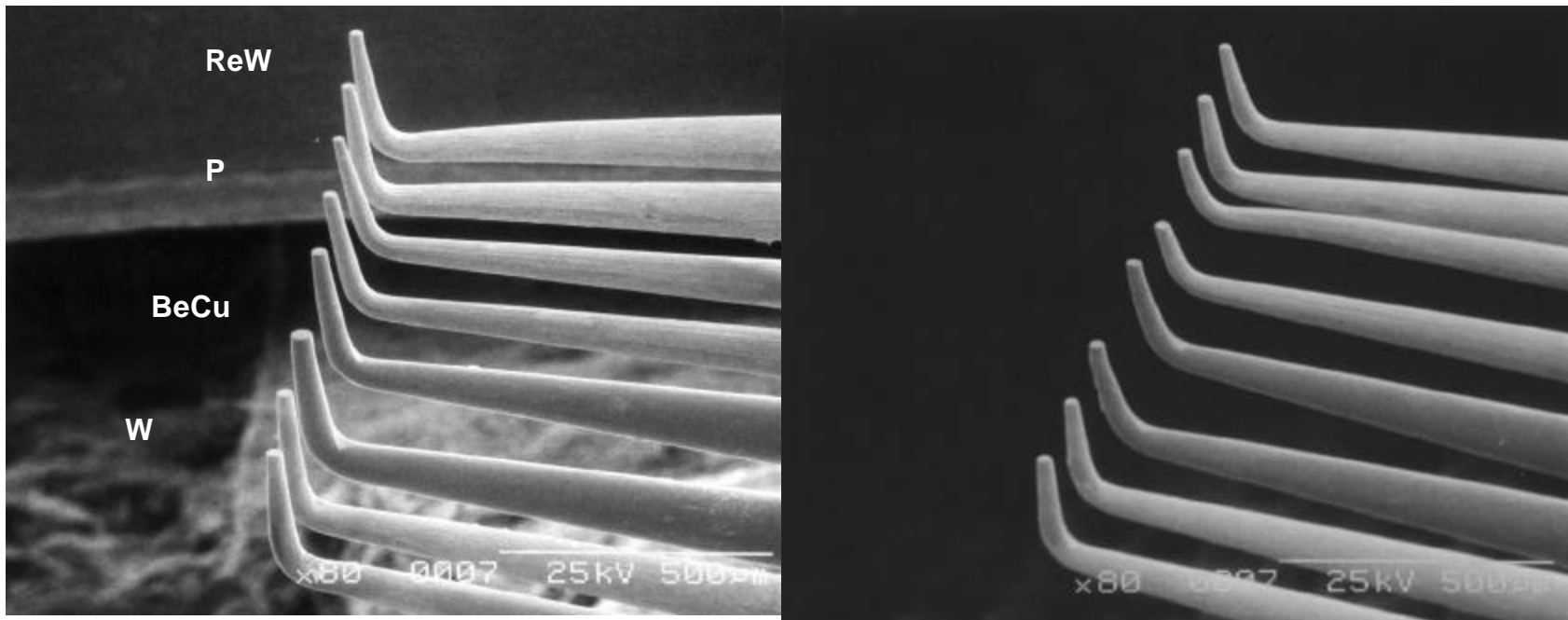
500k Touchdowns

Custom Ceramic Photos



Mushroom Effect

Probe Polish 99 SEM Comparison



Baseline

1 Million Touchdowns

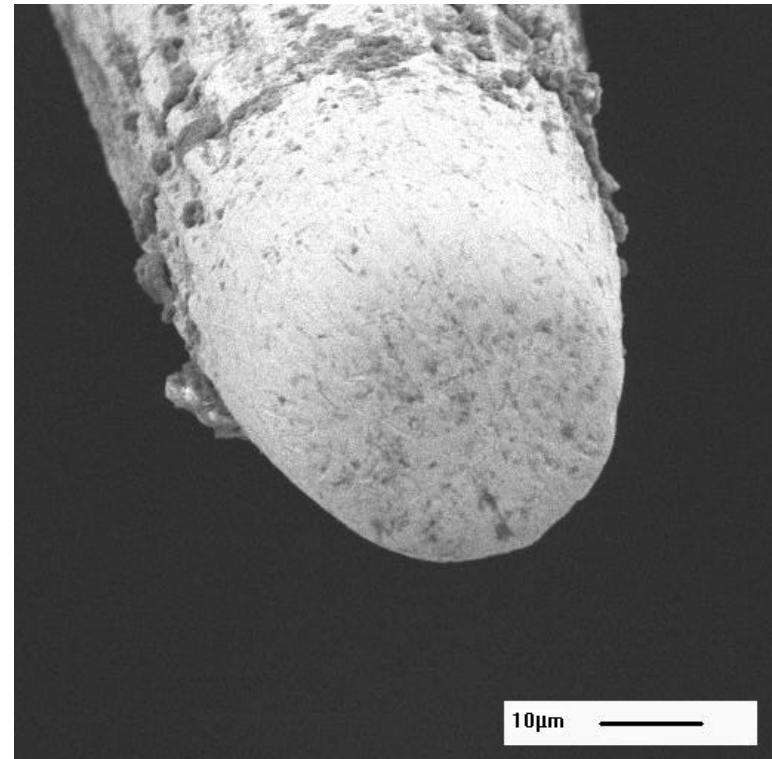
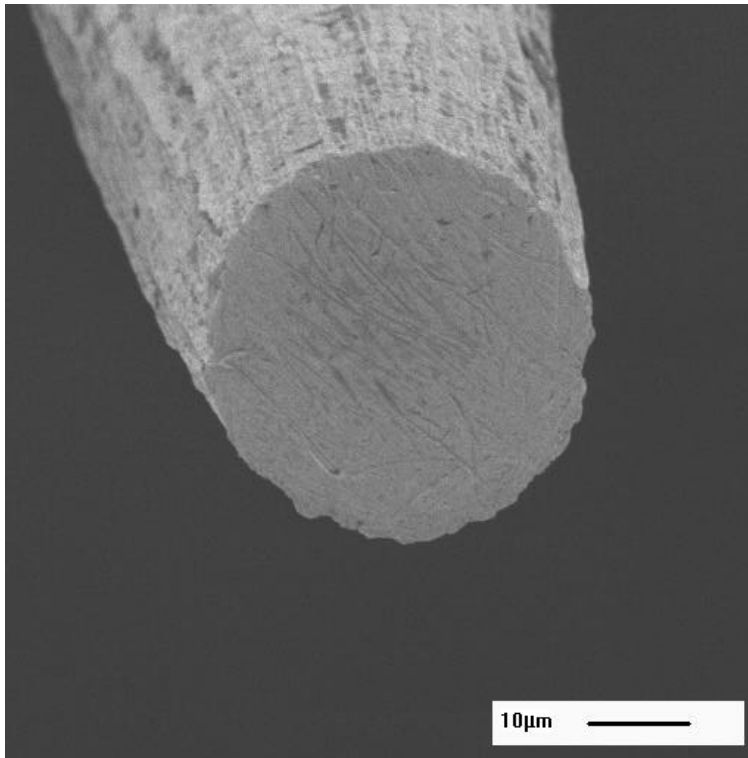
Durability Conclusions

- ReW and W Most Durable
- P and BeCu Much Less Durable
- Tungsten Carbide and Ceramic Less Destructive Than Any Lapping Film
- Probe Polish Least Destructive

Reshaping Tests

- On Going Research
- Goals
 - Reshaping Materials for Each Common Probe Materials
 - Control the Shape
 - Cost Effective Option to Extend Probe Card Life

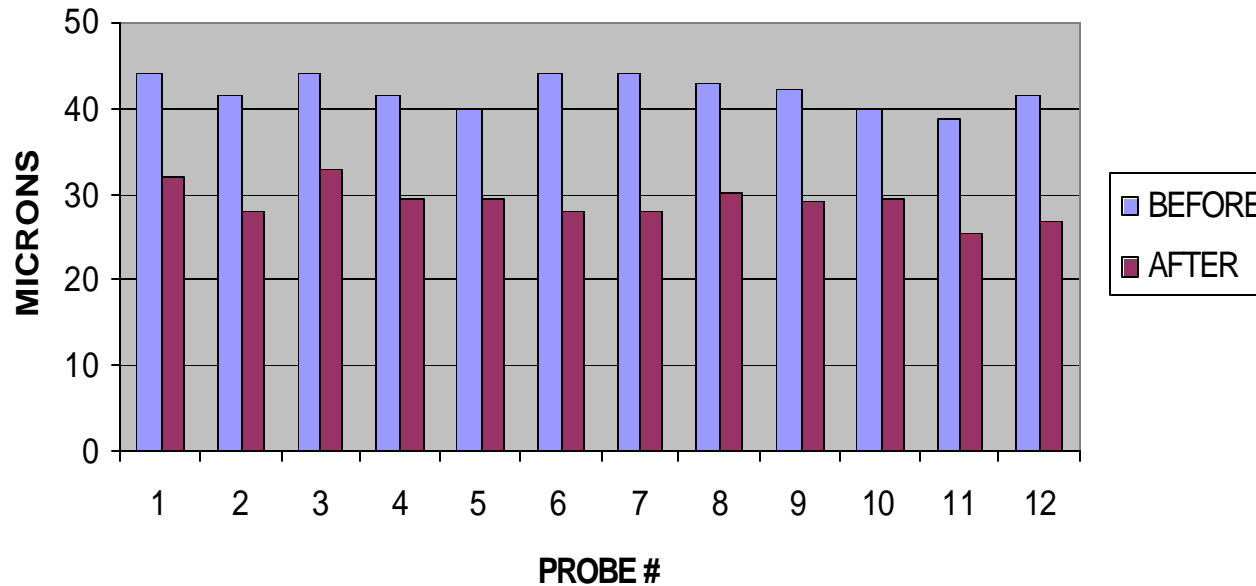
BEFORE/AFTER



W Probe, 6000 Touchdowns

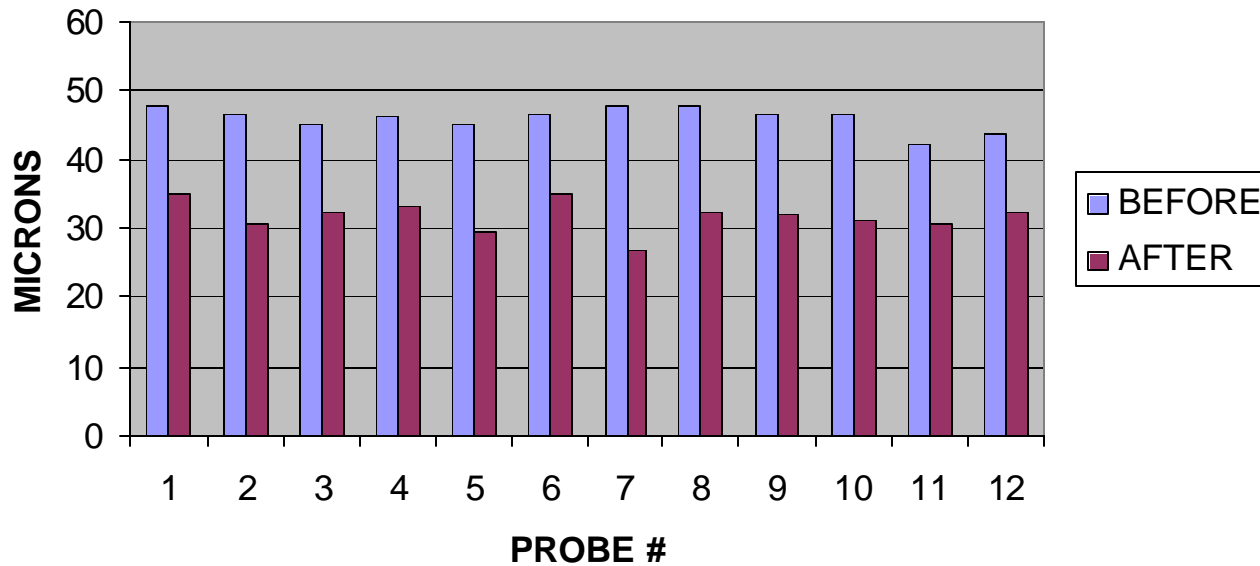
“X” DIAMETER CHANGE

TUNGSTEN PROBE RESHAPE



“Y” DIAMETER CHANGE

TUNGSTEN PROBE RESHAPE

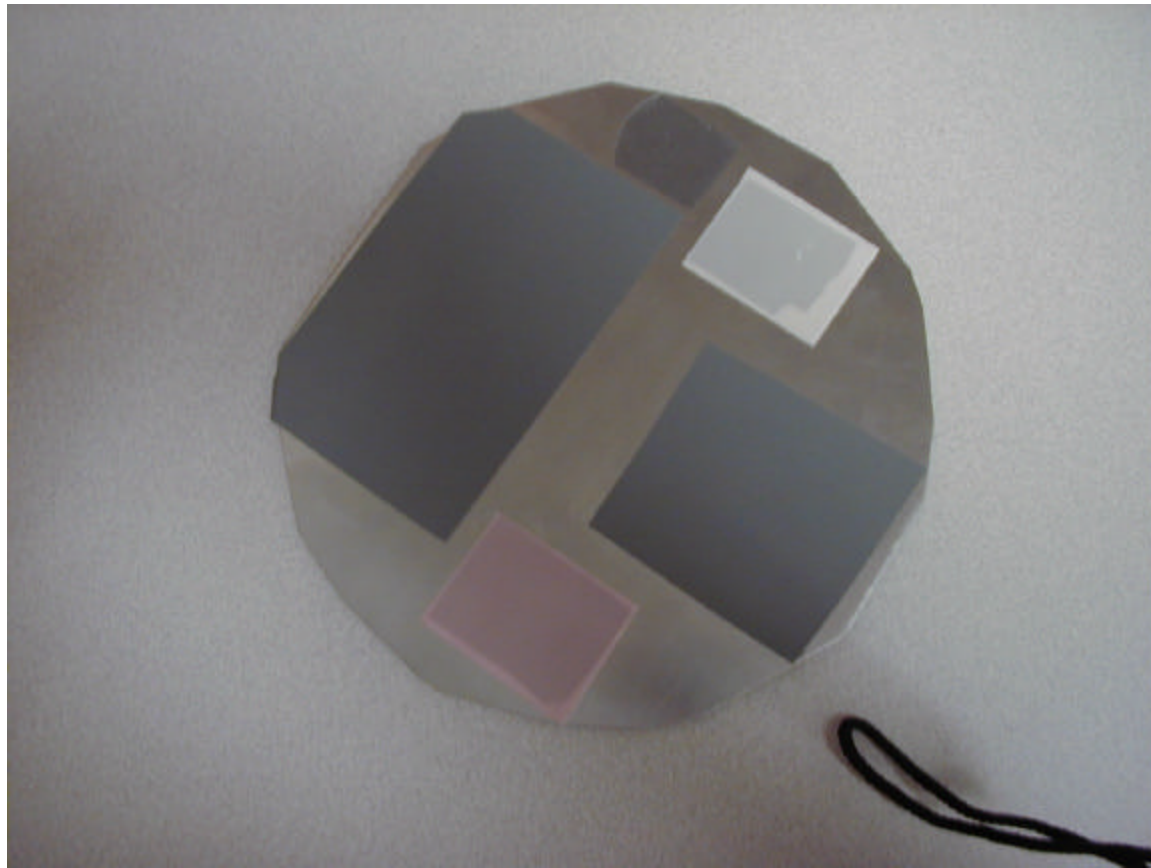


Reshaping Recipe

The screenshot displays a software interface with a main data table and a dialog box. The table lists various parameters for different edges and pads, including C.Fos, Algs Err X, Algs Err Y, Trajectory, Tip Diam X, Tip Diam Y, Linkage, Gram Force, Wire Check, Ref Coord X, and Ref Coord Y. The dialog box, titled 'Run Tip Cleaning Recipes', shows a 'Recipe File' dropdown set to 'Reshape Recipe' and a 'Units' dropdown set to 'Micros'. It also contains a table with columns: 'CleanMethod', 'CleanMaterial', 'CleanDD', 'CleanCycles', and 'Clean'.

Edge	Tracs	Pad Name	Pad #	Dir #	C.Fos	Algs Err X	Algs Err Y	Trajectory	Tip Diam X	Tip Diam Y	Linkage	Gram Force	Wire Check	Ref Coord X	Ref Coord Y	Remarks	
B6	B6	1	1	1	0.101	0.0	0.7	-22.7	30.0	29.9	4.3	4.0	MR	-13495.0	2340.0		
B7	B7	2	2	1	0.200	0.4	-0.6	-13.4	30.3	29.5	3.0	3.2	MR	-13852.5	3345.0		
B7	B7	3	3	1	0.556	7.3	7.0	6.4	42.0	34.0	6.2	7.1	MR	-13800.0	3315.0		
B8	B8	4	4	1	0.676	-4.5	4.0	-17.3	17.1	15.9	0.7	2.2	MR	-13809.0	3340.5		
B8	B8	5	5	1	0.550	4.3	-6.7	-15.4	12.3	20.0	3.6	2.3	MR	-14094.5	3345.0		
B8	B8	6	6	1	0.402	3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	MR	-14100.0	3340.0	
B9	B9	7	7	1	0.033	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	MR	-14450.0	3317.5	
B15	B15	8	8	1	0.882	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	MR	-17719.0	-48.5	
A16	A16	9	9	1	0.473	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	MR	-17719.0	-266.5	
B16	B16	10	10	1	0.167	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	MR	-17719.0	-644.5	
A17	A17	11	11	1	0.364	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	MR	-17719.0	-614.5	
B17	B17	12	12	1	0.734	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	MR	-17719.0	-767.0	
A24	A24	13	13	1	0.047	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	MR	-14803.0	-4019.5	
B24	B24	14	14	1	0.340	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	MR	-14567.0	-4019.5	
A25	A25	15	15	1	0.110	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	MR	-14391.5	-4125.0	
B25	B25	16	16	1	0.372	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	MR	-14175.5	-4120.0	
A26	A26	17	17	1	0.799	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	MR	-13965.0	-4140.0	
B26	B26	18	18	1	0.308	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	MR	-13772.0	-4127.5	
A27	A27	19	19	1	0.534	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	MR	-13576.5	-4148.0	
B27	B27	20	20	1	0.306	-4.9	4.0	-22.7	17.7	18.4	2.0	3.0	MR	-13135.0	-4115.0		
B33	B33	21	21	1	0.071	3.5	1.4	15.0	10.2	15.9	5.2	4.0	MR	-10165.0	-812.5		
A8	A8	22	22	1	0.390	-2.6	-7.7	-22.2	17.5	20.1	5.3	4.7	MR	-10147.0	-519.5		

Reshaping Plate



Tip Cleaning Window

The image shows a software dialog box titled "Probe Tip Cleaning". It contains several input fields and buttons. The "Overdrive" field is set to 75.0 Microns. The "Pattern" dropdown is set to "Tip Reshape". The "Cleaning Material" dropdown is set to "Probe Form". The "Total Travel" and "Segment Travel" fields are both set to 0.0 Microns. The "Angle" field is set to 0.000 Degrees. The "Cycles Requested" field is set to 6000. The "Cycles Completed" field is set to 0. The "Status" is "Ready". At the bottom, there are three buttons: "Sand", "Done", and "Help".

Overdrive:	75.0	Microns
Pattern:	Tip Reshape	
Cleaning Material:	Probe Form	
Total Travel:	0.0	Microns
Segment Travel:	0.0	Microns
Angle:	0.000	Degrees
Cycles Requested:	6000	
Cycles Completed:	0	
Status:	Ready	

Conclusion

- The Cleaning Recipe Must be an Integral Part of the Overall Test Program
- Different Probe Materials Accumulate Debris at Different Rates
- Surface Roughness Effects Debris Accumulation

Conclusion

- Material Used in Cleaning Dramatically Effects Probe Card Life
- Reshaping Probes can Extend Probe Card Life