MRB on SLAC NCR 241, 248 Failed Cable Coupons

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Description of the nonconformance

- The main issue is coupon failures with separation between barrel plating and internal layers.
- Secondary issues is cleanliness and handling.
  - These issues have been addressed

NCR 241

- Excessive amount of air bubbles in the acrylic adhesive.
  - Determined not to be a structural problem.
- Dirty flex cables (finger prints, potting material, ink, debris)
  - After testing is completed the product is re-cleaned and inspected 100%

NCR 241 (Cont)

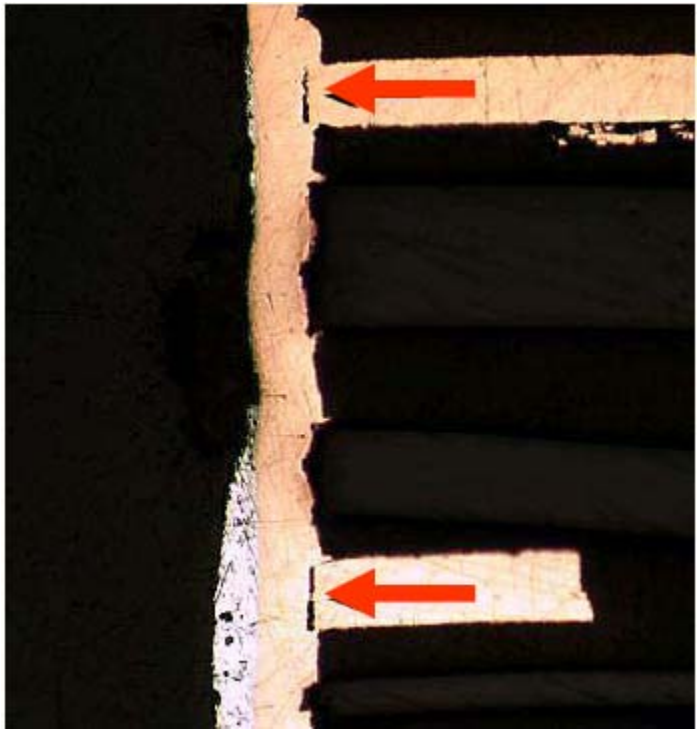
- Micro section exhibited separation
  - Thermal cycle & post electrical tests OK
- Damaged socket rims on Omnetic connectors, J2-J10.
  - SLAC performed a pull test on the worst case sockets, results sockets held position at a 20 grams pull.

NCR 241 (Cont)

- All eight cables exhibit molding separation from the housing (Cristek connector 's)
  - No structural problem, This is OK.
- All eight cables exhibit foreign material on the outside of sockets of the omnectics connector.
  - Cleaned. No electrical or mechanical issues.

1. Description of Non-Conformance NCR 248

- Item: Flex cable LAT-DS-02379 and LAT-DS-00724
- Nonconformance: Coupon tests show separations between barrel plating and internal layers
- Tower A cable flight set has 1 cable with two bad coupons



NCR 248

- 1. Excessive amount of air bubbles in the acrylic adhesive / bonding material in between the flex cable and Omnetics connectors ref: J2 -J10
  - Air bubbles determined to not be a problem
- LAT-DS-02377, C0-017 Failed micro-section evaluation ref: EC No. 50123
  - Thermal cycle & post electrical tests OK

NCR 248 (Cont)

- All eight cables exhibit damaged or deformed socket rims (ominetics connectors)
  - SLAC performed a pull test on the worst case sockets, results sockets held position at a 20 grams pull.

- All eight cables exhibit molding separation from the housing (Cristek connector 's)
  - No structural problem, This is OK.

NCR 248 (Cont)

- All eight cables exhibit foreign material on the outside of sockets of the omnectics connector.
  - Cleaned. No electrical or mechanical issues.
- Exposed solder pads location thermistors C3
  - pads exposed will not affect the product

NCR 248 (Cont)

- micro-sections failed evaluation, coupons failed evaluation
  - Performed over stress & additional testing.
    - Next slide.

2. Overstress Analysis & Additional Testing

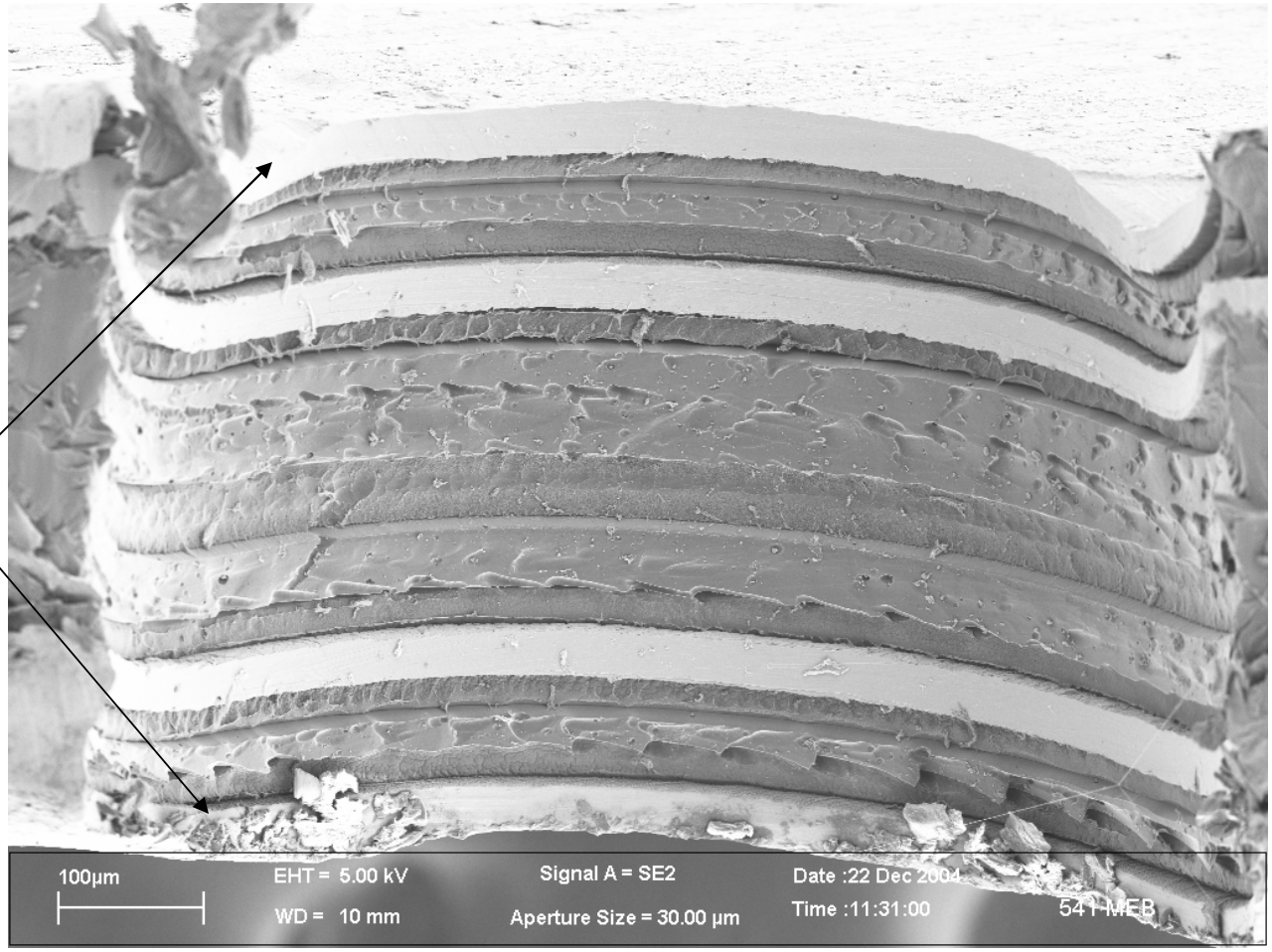
- All cables are fully functionally tested as described in LAT-PS-04643
- Two flex cables were subjected to thermal cycles to evaluate tolerance against thermal cycles and failure modes
  - Test Cable 1: Cable with bad coupon
    - Thermal cycle 1 – 21: -50C to 125 C
      - One via failure on retest after ~ 16 cycles
    - Thermal cycle 22 – 41: -35C to 55 C
  - Test Cable 2: Cable with good coupon
    - Thermal cycle 1 – 25: -50C to 125 C
    - Thermal cycle 26 – 100: -35C to 55 C

Coupon Testing
Goddard (Diane Kolos)

- In process coupons were sent to Goddard. Comparisons are made with & without water blasting holes. The four in process steps are:
  - After drill no plasma
  - After plasma, no micro etch
  - After micro etch no deposition
  - After deposition

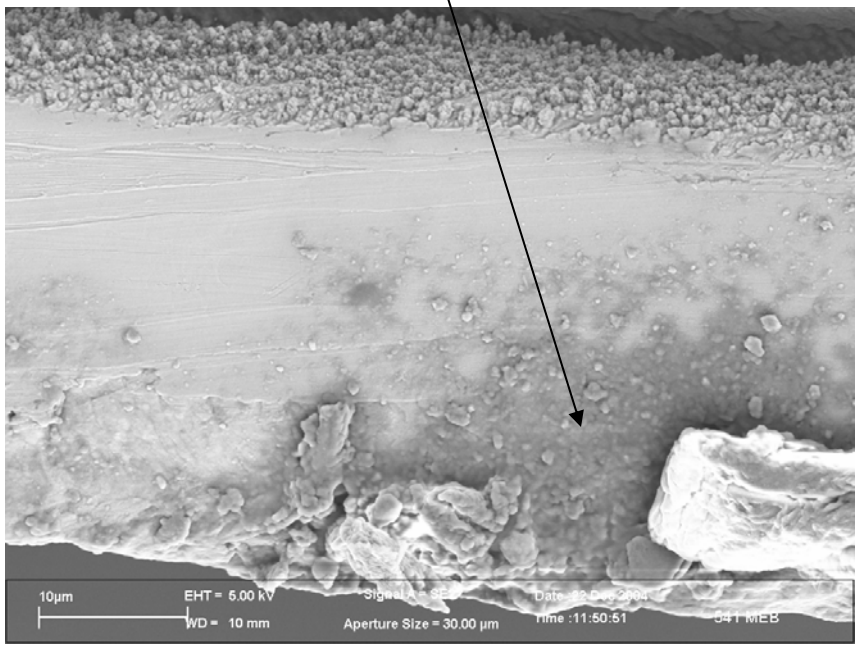
Specimen 3P
Post-Plasma, No Water Blast

Note debris only on one outer foil.

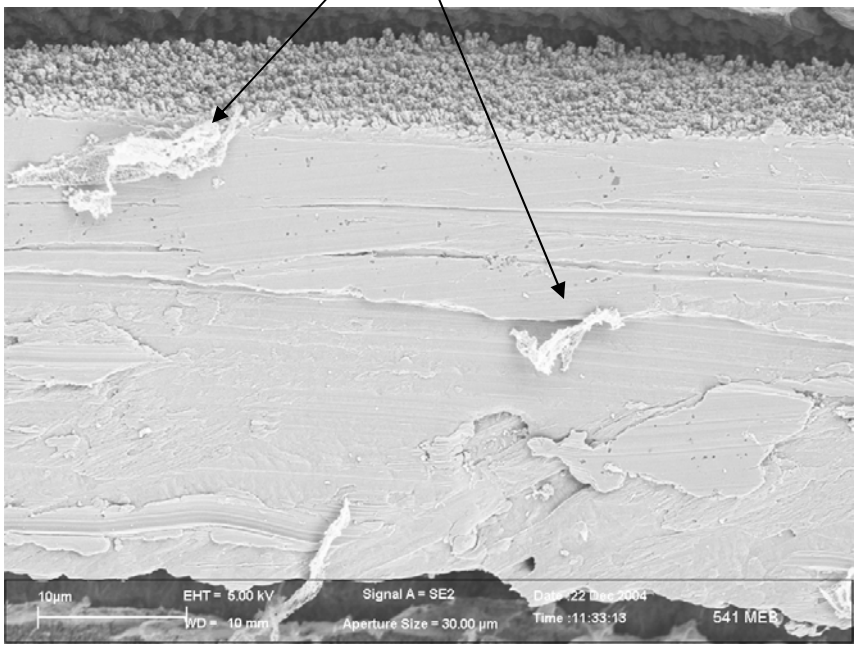


Specimen 3P
Post-Plasma, No Water Blast

Debris (organic)



Debris (contains F)

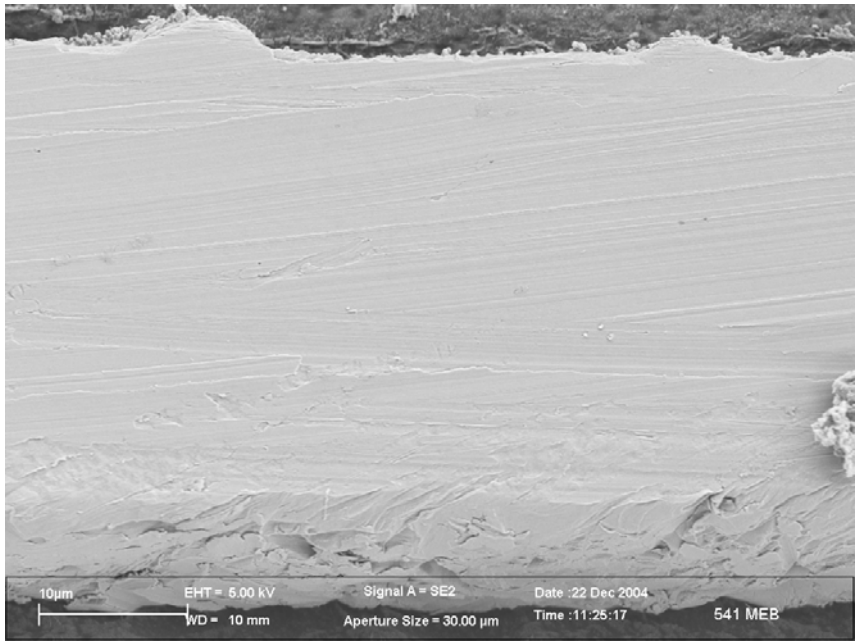


Outer Foil at bottom of Image on slide 1.

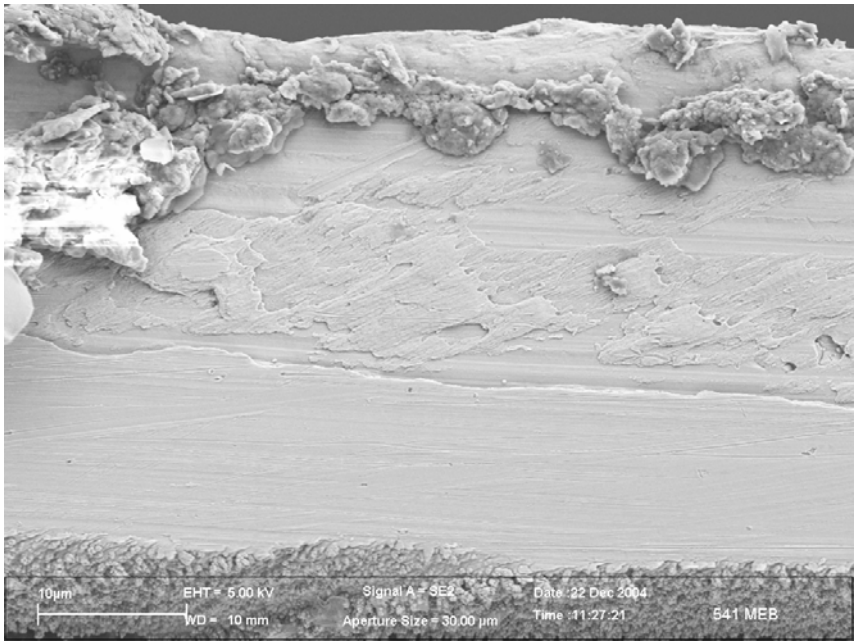
Inner Foil Near Top of Image

Specimen 4P
Post-Plasma, Post-Water Blast

(Little or no Fluorine-bearing Debris)



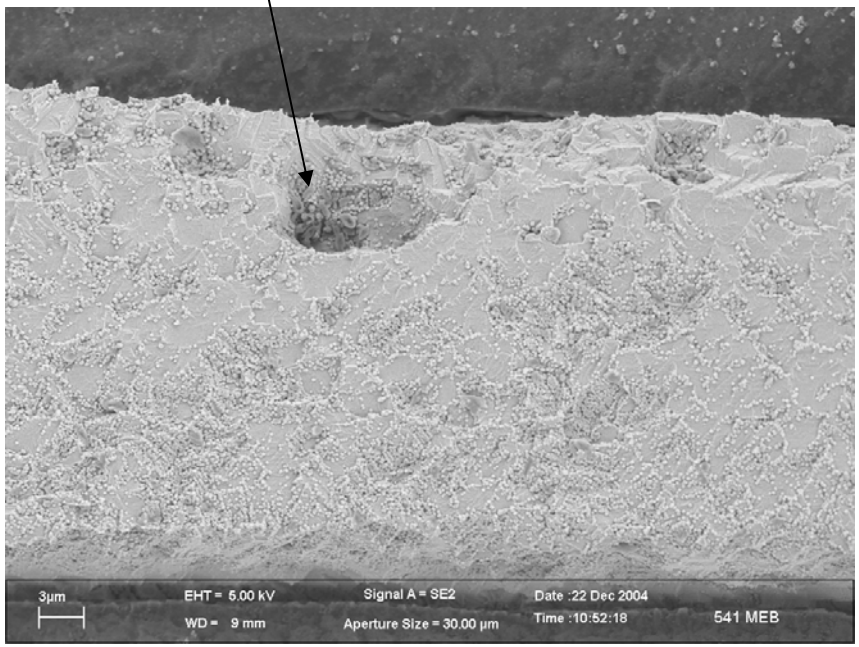
Inner Foil, near top of image in slide 3.



Outer foil, near top of image in slide 3

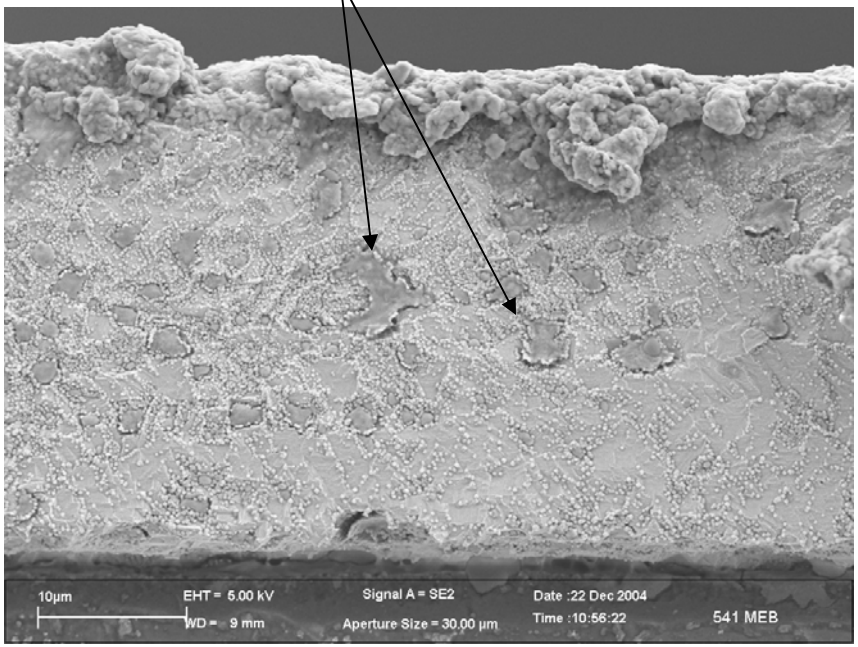
Specimen 5M
Post-Microetch, No Water Blast

Material in depression contains
S and Na (in addition to Cl)



Inner Foil, near top of image in slide 5.

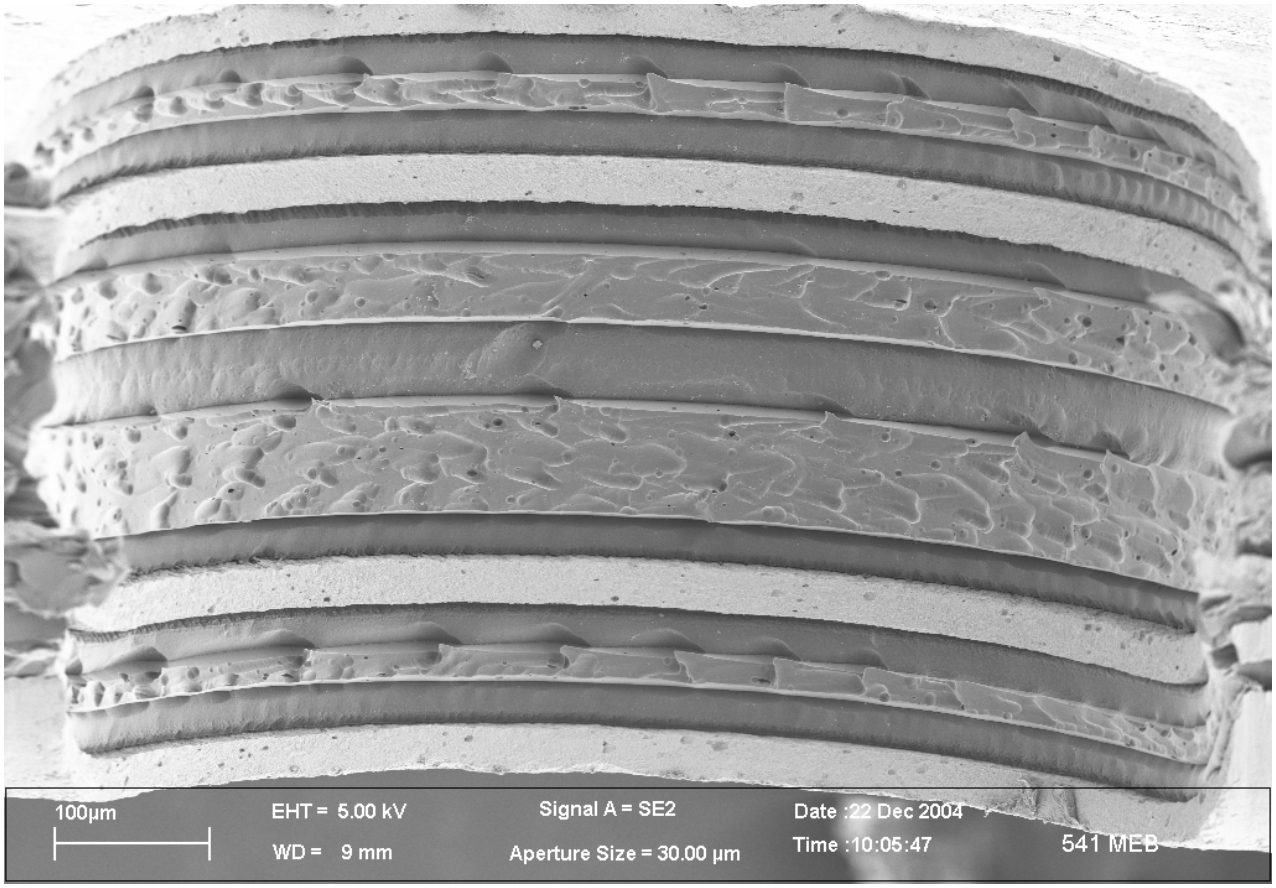
Plaques of organic contamination



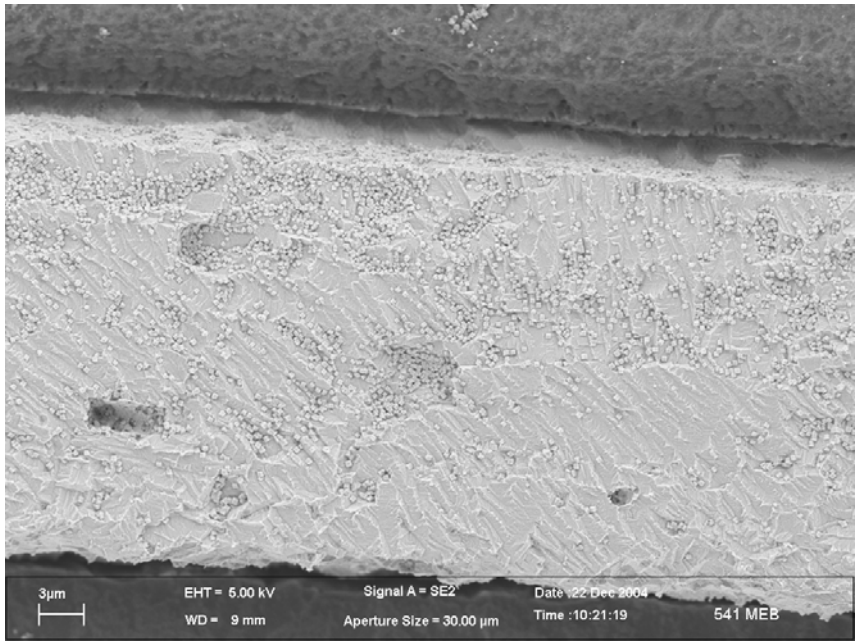
Outer Foil, near top of image in slide 5.

Specimen 6M
Post-Microetch, Post-Water Blast

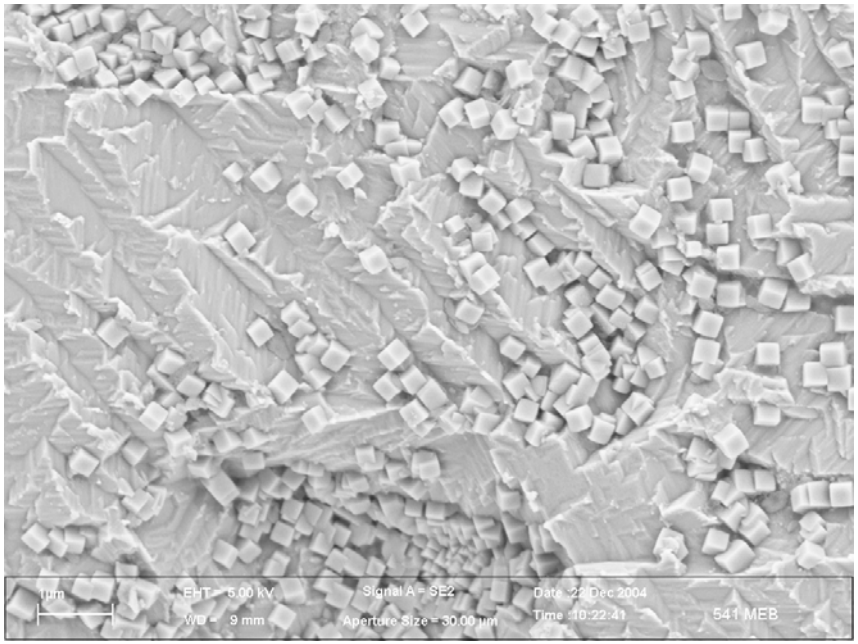
Copper surfaces have extensive chlorine contamination (not visible in this image, see slide 9).



Specimen 6M
Post-Microetch, Post-Water Blast



Inner Foil, near top of image in slide 7.



Higher magnification view showing cubic, chlorine bearing crystals on surface.

3. Suspected Root Cause

- Suspected root cause of coupon and micro section failures is contaminants in via holes before plating.

4. Impacts to Inventory

Cable Assy P/N Flex Ckt P/N	DS-02377 DS-00584 C0 (4X)	DS-02378 DS-00723 C1 (4X)	DS-02379 DS-00724 C2 (1X)	DS-02380 DS-00725 C3 (1X)	DS-02381 DS-00726 C4 (1X)	DS-02382 DS-00727 C5 (1X)	DS-02383 DS-00728 C6 (3X)	DS-02384 DS-00729 C7 (3X)
ASSY S/N	011	001	001	001	001	001	001	001
FLEX S/N	0019	0038	0014	0012	0011	0013	0031	0079
ASSY S/N	12	002	002	003	003	002	002	002
FLEX S/N	0031	0026	0010	0013	0016	0011	0038	0078
ASSY S/N	16	003	004	004	006	003	004	003
FLEX S/N	0044	0053	0044	0019	0033/35	0020	0050*	0105
ASSY S/N	17	004	005	005	007	004	005	004
FLEX S/N	0040	0051	0042	0017	0044	0027	0051*	0100
ASSY S/N		005	003	006	008	005	006	005
FLEX S/N		0052	0043	0022	0046	0024	0049*	0102
ASSY S/N		006	tbd cnr	007	009	007	007	006
FLEX S/N		0049	0045	0028	0045	0035	0043*	0103
ASSY S/N		007	004		007	008	008	007
FLEX S/N		0055	0044		0044	0037	0048	092
ASSY S/N		008	005		008	007	009	008
FLEX S/N		0043	0042		0046	0035	0044*	093
ASSY S/N		009	003		009	008	010	009
FLEX S/N		0042	0043		0045	0037	0052	099
ASSY S/N		010	tbd cnr				011	010
FLEX S/N		0054	0045				0064	108
ASSY S/N							012	
FLEX S/N							0059	
ASSY S/N							013	
FLEX S/N							0057	
ASSY S/N							011	
FLEX S/N							0064	
ASSY S/N							012	
FLEX S/N							0059	
ASSY S/N							013	
FLEX S/N							0057	

NCRs Tower A & B

Cable Assy P/N	DS-02377	DS-02378	DS-02379	DS-02380	DS-02381	DS-02382	DS-02383	DS-02384	pending
Flex Ckt P/N	DS-00584	DS-00723	DS-00724	DS-00725	DS-00726	DS-00727	DS-00728	DS-00729	passed
	C0	C1	C2	C3	C4	C5	C6	C7	failed
Tower A									
ASSY S/N	16	003	004	004	008	007	011	003	* = Coupon
FLEX S/N	0044	0053	0044	0019	0046	0035	0064	0105	Failure
Status/Loc	NCR 241	NCR 241	NCR241*	NCR 241			NCR 241	NCR 241	
Tower B									
ASSY S/N	17	004	005	005	009	003	010	010	
FLEX S/N	0040	0051	0042	0017	0045	0020	0052	108	
Status/Loc	NCR 241,248*	NCR 241,248	NCR 241,248*	NCR 241,248	NCR 248	NCR 241,248*	NCR 241,248	NCR 241,248	

5. Corrective Action

- Panels are water blasted to clean out via holes in panels before plating.

6. Effectiveness of Corrective Action

- Two coupons were tested at Goddard.
  - One coupon was protected from the water blast process
  - Second coupon had the water blasting treatment.
  - Both coupons passed.
    - The expectation was for the non-water blasted coupon to fail.
  - Goddard will finish testing more in process by 1/7/05

7. Recommended Disposition

- Tower A: Use as is
- Tower B: Install flight set (pre water blast process) with
  - 1 cable has 2 bad coupons
  - 2 cables have 1 bad and 1 good coupons
  - Leave NCR open until after environmental test
- Tower 1: Install flight set (pre water blast process) with all good coupons
- Tower 2 and beyond: Install flight set with all good coupons
  - Mixture of pre- and post- process change