

# SEM Exam of Parlex Drilled Hole Samples for GLAST LAT Tracker Flex Cables

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# Background

- In order to examine the condition of the drilled holes for the flexible boards, Parlex Corp. was asked to supply samples of drilled, unplated holes processed with plasma etching and some processed with plasma etching and microetching.
- Two sets were supplied for each treatment, one representative of typical processing (#3 coupons) and one which had been through a water blasting process (#2 coupons) to remove additional contaminants prior to plasma etching. The table on slide 3 indicates the various samples examined and their identification
- Coupon sets produced with plasma etching, and plasma etching with microetching were cut at half-diameters using surgical scissors and both halves of the 6 large diameter holes from each coupon were examined in the Scanning Electron Microscope (SEM) to determine any residual materials present on the exposed foils in the holes. Energy Dispersive Spectrometry (EDS) was used in conjunction with the SEM analysis to identify observed materials.

Table 1  
Sample Identification

Sample ID	Drilled?	Water Blasted?	Plasma Etched?	Micro-etched?
2P	Y	Y	Y	N
3P	Y	N	Y	N
2M	Y	Y	Y	Y
3M	Y	N	Y	Y

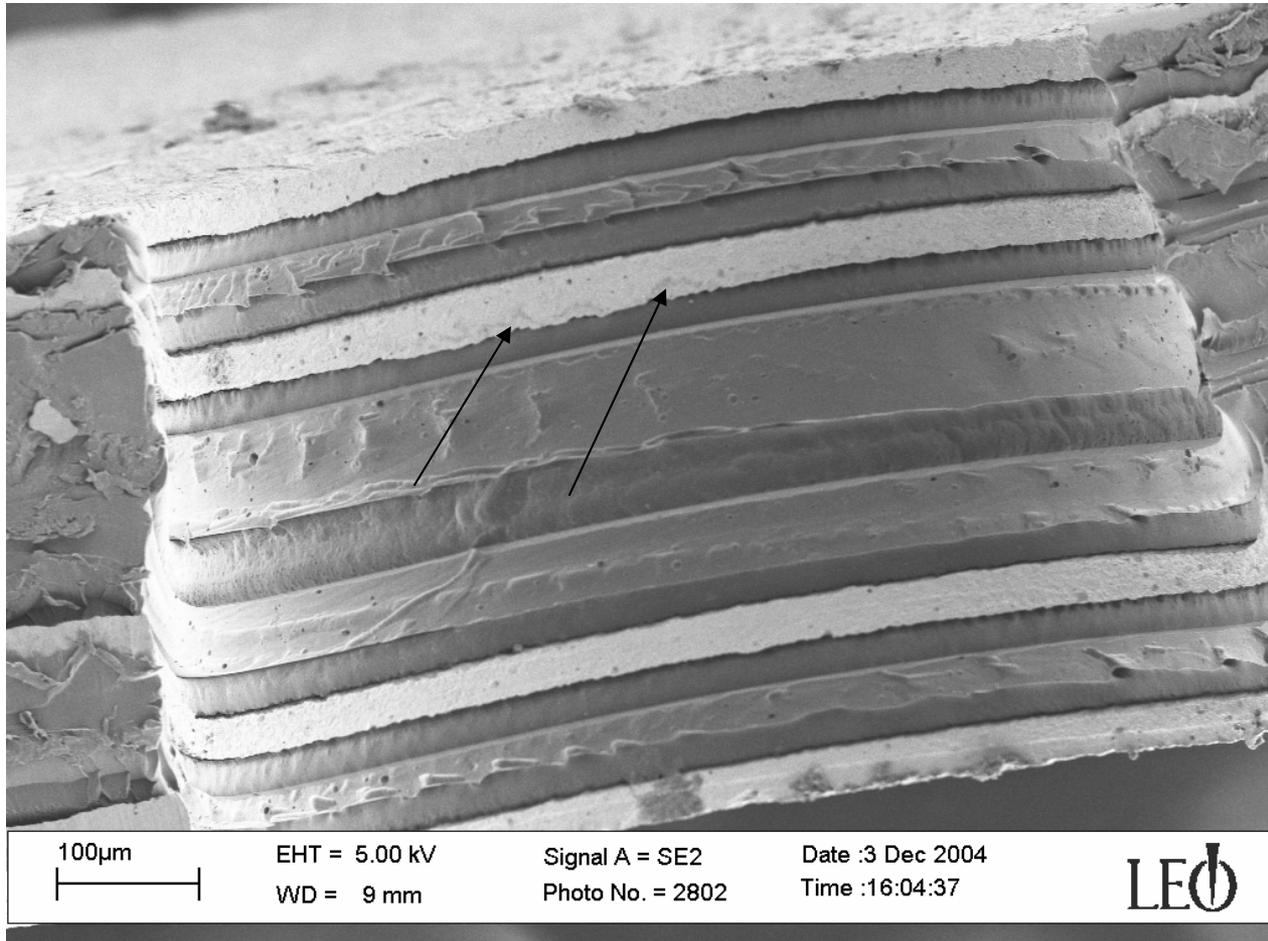
# Observations

- Samples after microetch process (i.e. plasma etched then microetched) displayed oxide rich particles (see slide 9) on sample holes which had not been 'water blasted'—sample holes identified as '3M'. One of the six '3M' holes examined in the SEM contained oxide rich regions which were covering considerable areas on the internal foils (see slides 6-8).
- Samples after microetching with water blasting process, i.e. '2M', added were not found to contain oxide rich regions or particles following SEM exam of 6 holes (both halves of hole examined for all of these). Slide 10 illustrates one such sample area

# Observations

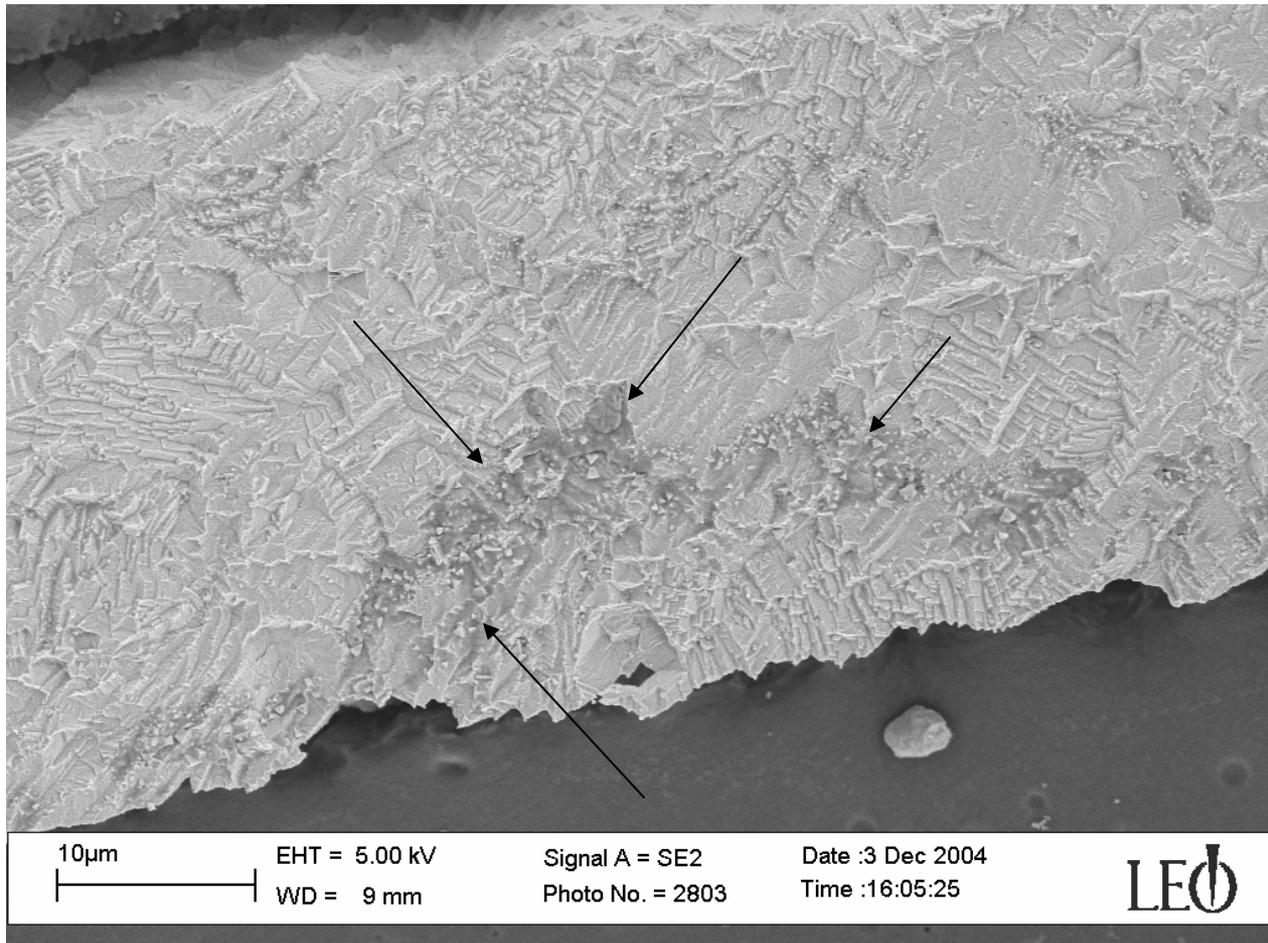
- Plasma etched sample holes both with- and without-water blast process displayed a fibrous network of debris with high Fluorine content (Teflon-like material) see slide 11. Water-blasting process appeared to disperse but not remove these. None of these deposits were present after microetching so it appears the microetch was successful in removing these
- Outermost region of outer foils were found to contain considerable contaminants (see slides 12-13), but this was likely handling and only occurred on those foils at edges of the board surfaces. This finding was discounted as the cause for the failures since the separations observed in the microsections were on the internal foils.

# SEM Image Sample #3M with Oxide



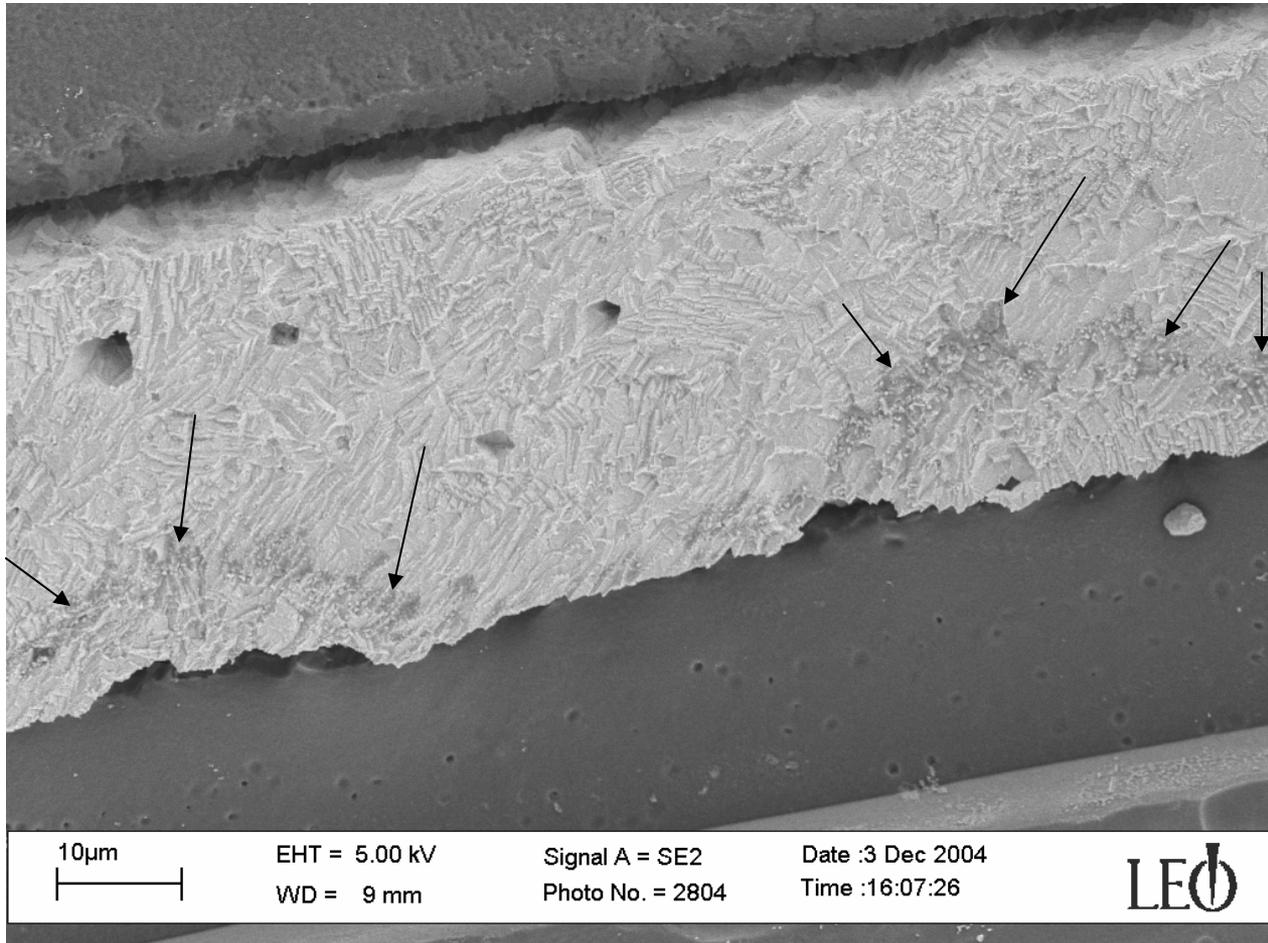
Arrows indicate oxidized regions on inner foils, see slides 7 & 8 for magnified images

# SEM Image Sample #3M with Oxide



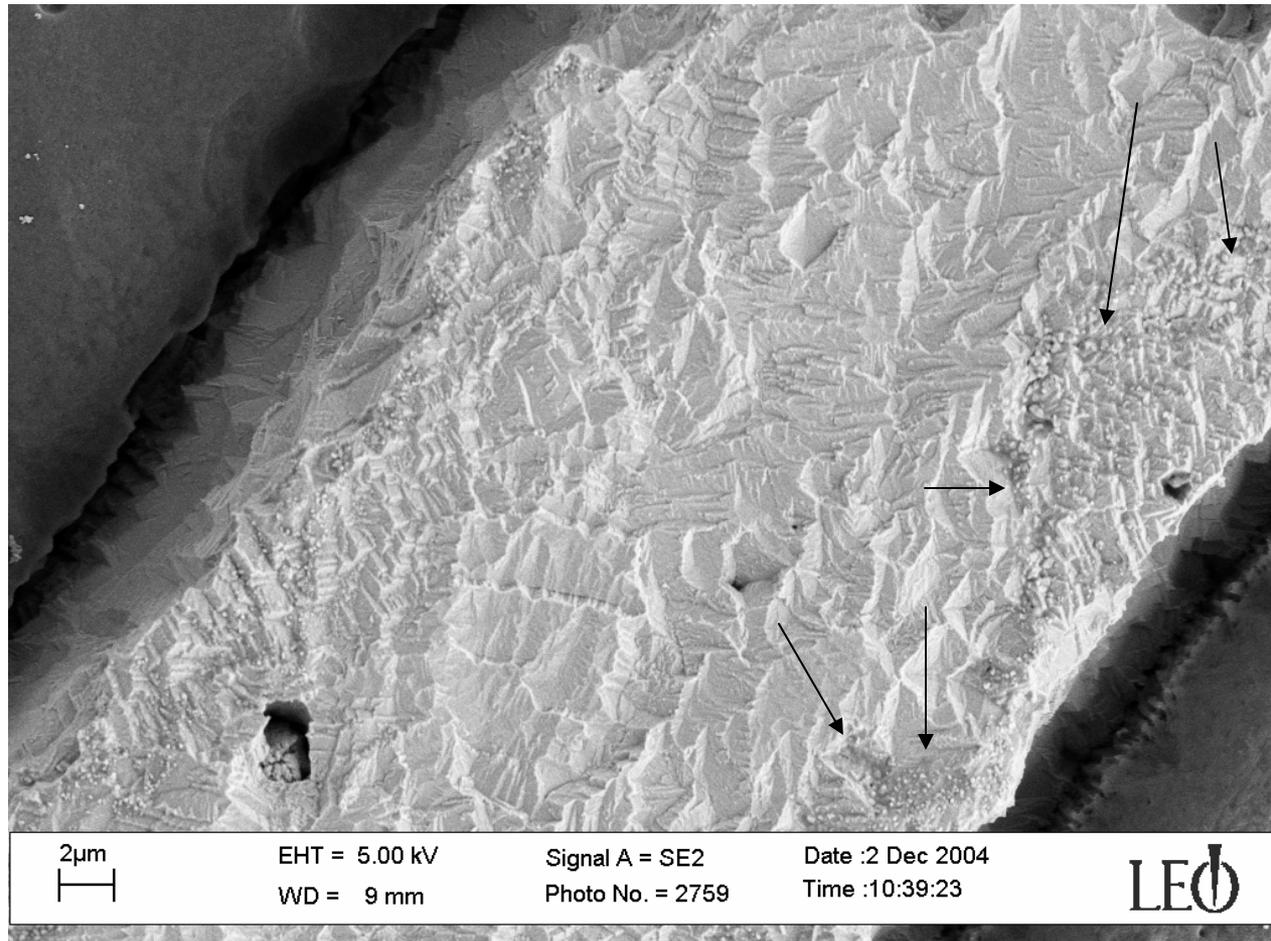
Arrows indicate oxide deposits on inner foils

# SEM Image Sample #3M with Oxide



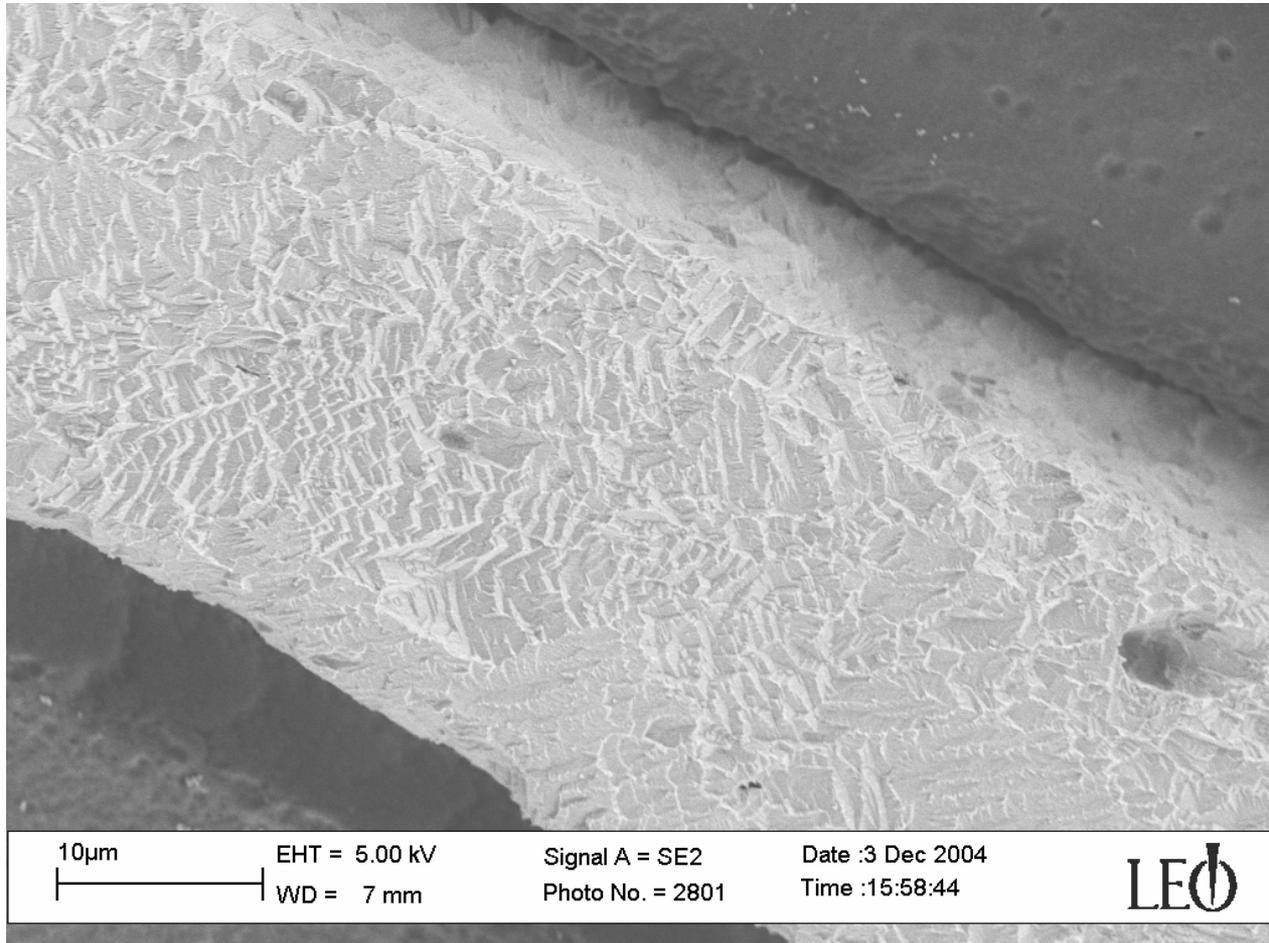
Arrows indicate oxide deposits on inner foils

# SEM Image of Sample # 3M



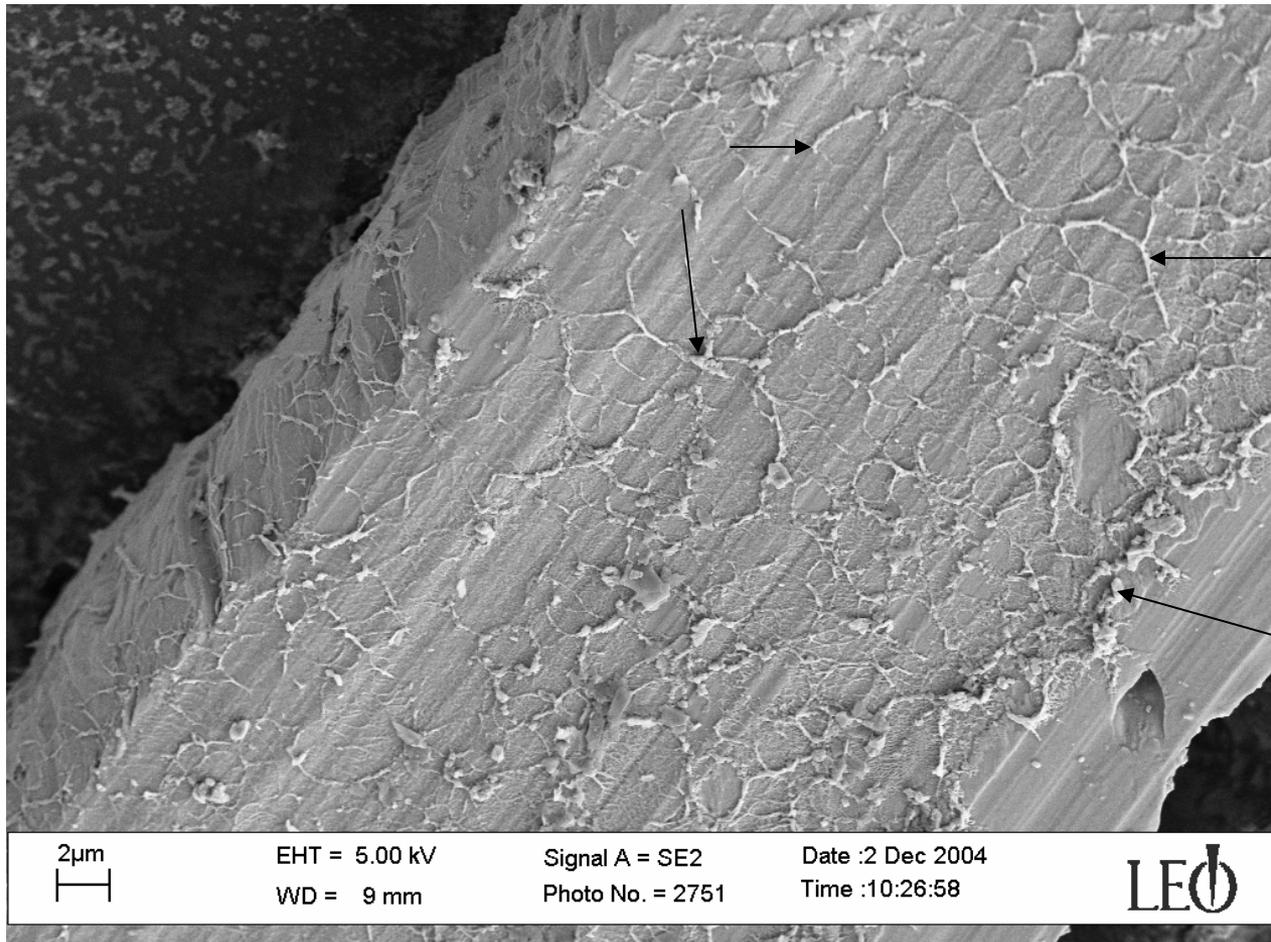
Arrows indicate regions of oxide particles on inner foils after microetching

# SEM Image Sample #2M—No Oxides



Water blasted inner foils show no oxide contamination after microetching

# SEM Image Sample # 2P—teflon deposits

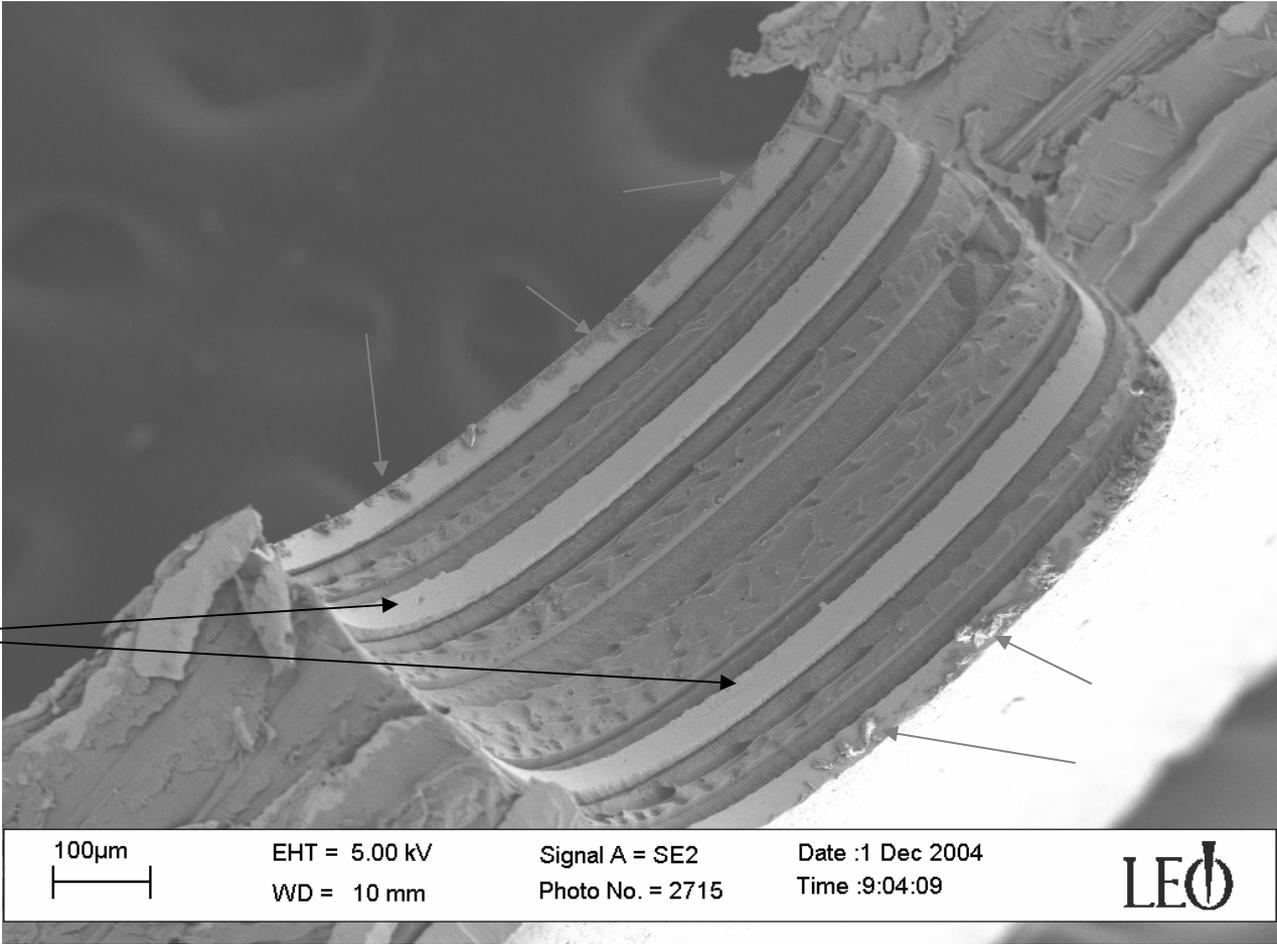


Surface deposit on inner foils, EDS analysis indicated high F content

Note: Microetching appears to have removed this contaminant

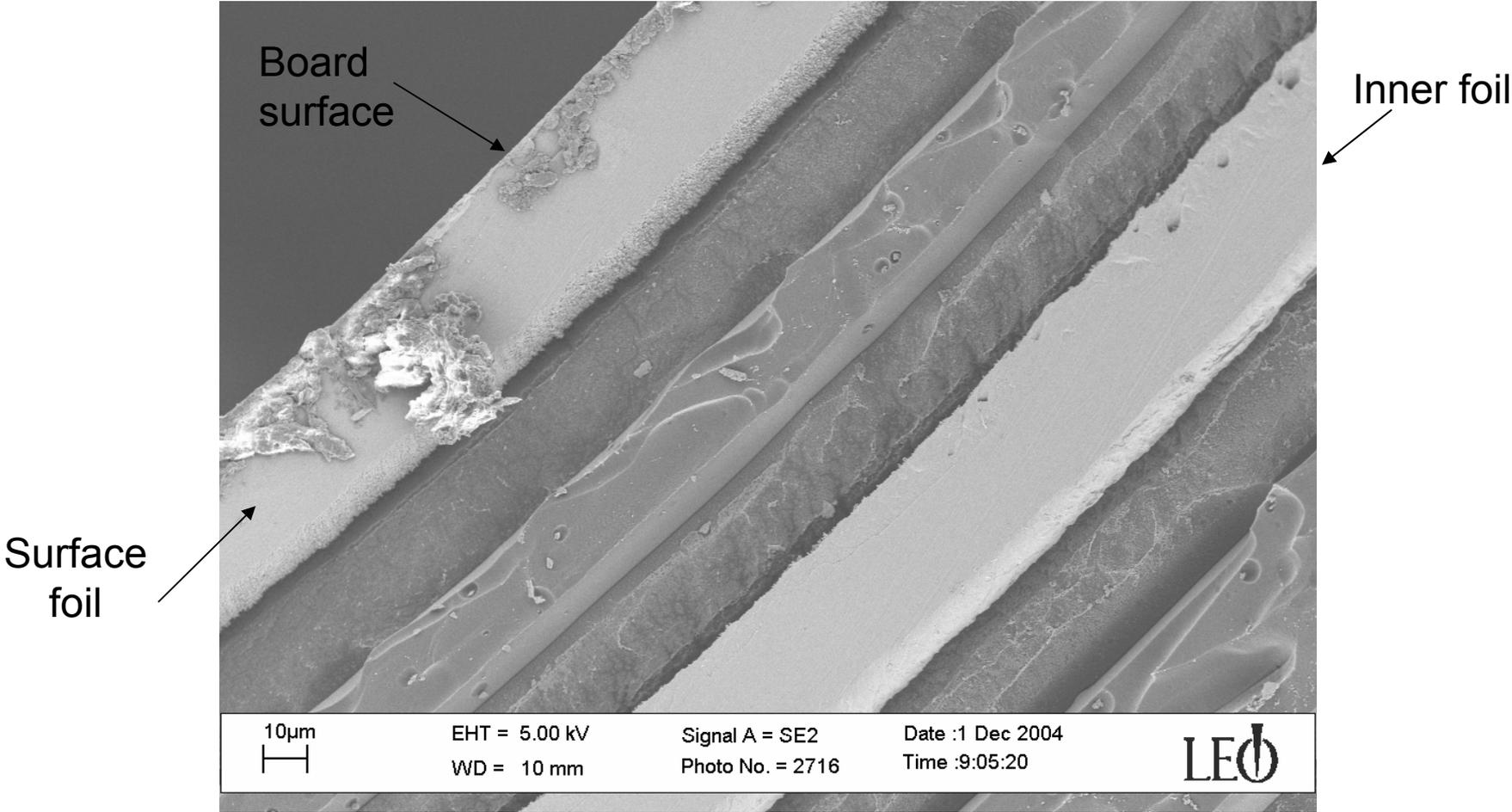
# SEM Image of drilled hole Sample #3P

Inner foils



Contamination on outer foils indicated with white arrows, note absence of material on inner foils

# SEM Image of drilled hole Sample #3P



Note smooth foil surface on typical processed foils, contamination of outer foils at board surface

# Conclusions

- Based upon these samples, the oxide present after the typical processing (including plasma etching and microetching) fits well with the defects observed in the coupons. These contaminated regions were random in the examined holes but the areas of oxidation were quite large when present and the contamination was present on the inner foils. Coupon sections also exhibited large, randomly scattered defects.
- Based upon the relatively small sample population, the water blasting operation appears to have resulted in drilled holes which are oxide-free. The absence of the random oxidation particles found on most areas of the 'typical processed', microetched foils reinforces the fact that the water blasting was effective in lowering the contamination level present on the drilled foils prior to electroless copper plating.

# Recommendation/Follow On Exam

- Thermal stressed sections of the copper plated holes which were produced with these unplated holes are in preparation. These will be cross-sectioned to see if the water blasting process appears to show improvement over the typical processing in these samples as well.
- If cross-sections show signs of improvement using the water blasting process, recommend that additional coupons be produced with many through holes to check product for absence of separations. This larger sample population would reinforce the findings from the drilled unplated holes.