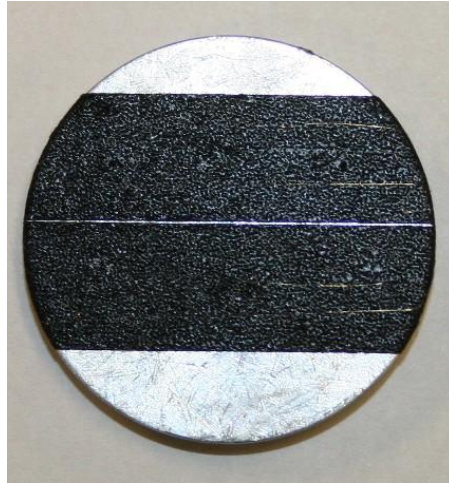


Hall D Wire Characterization

Samples S4-1 & S4-2

1. **Sample preparation:** ultrasonic cleaning in DI water for 45 minutes.
2. **Sample installation:** for SEM inspection wires were installed on a sample holder (diameter=36 mm) on 2 stripes of conductive carbon tape, 2 fragment of each sample per stripe (nomenclature: S4-1a, S4-1b and S4-2a, S4-2b).

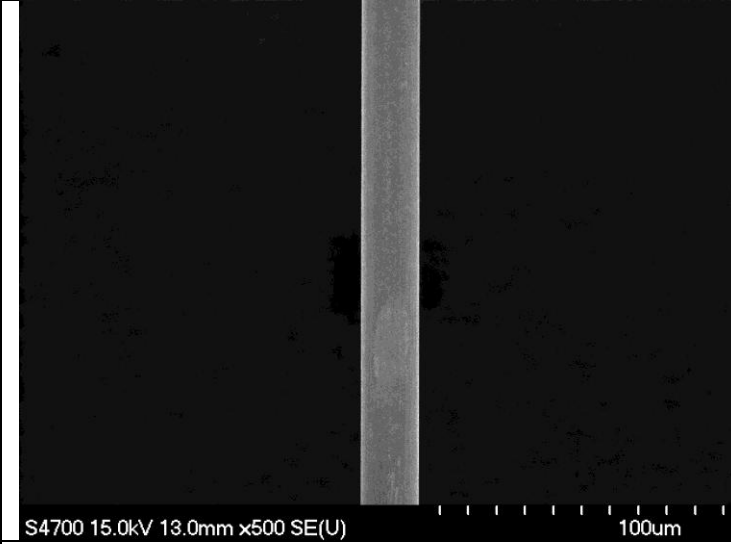
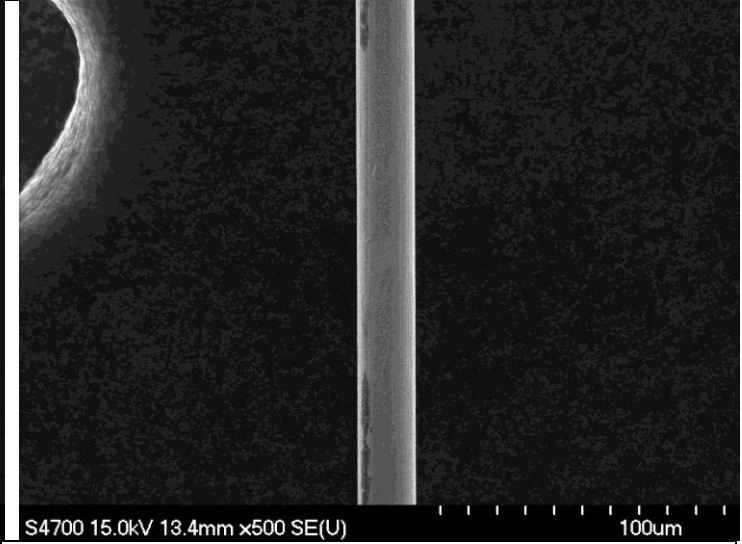
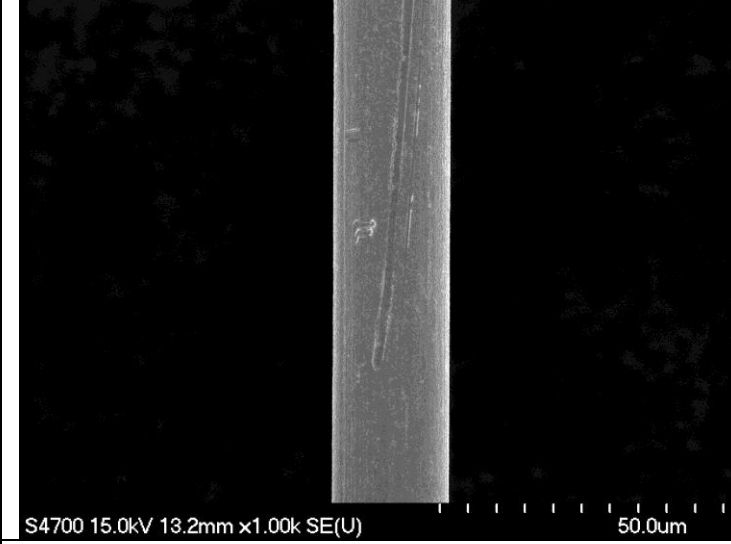
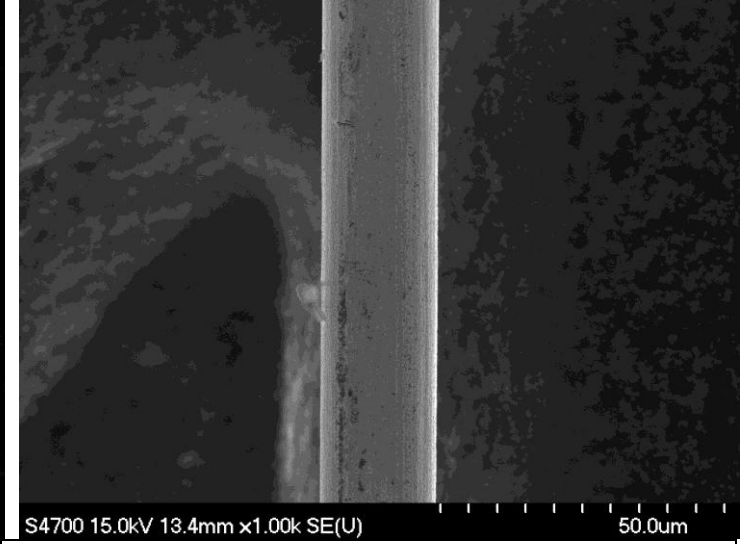


Pic1. Typical sample installation.

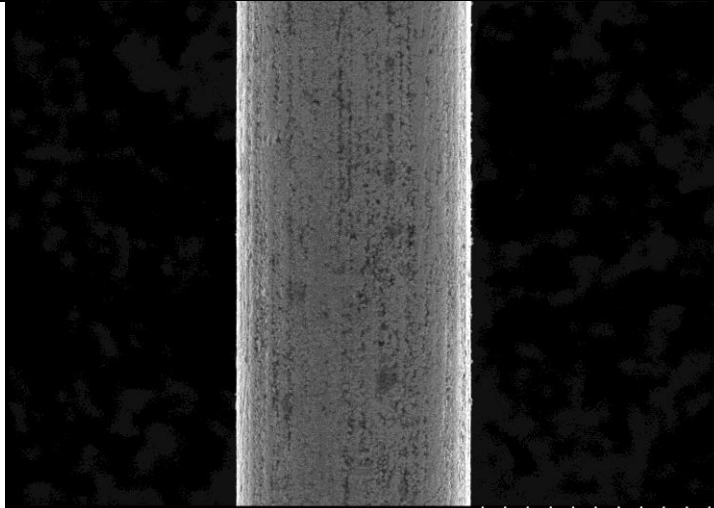
3. **Wire inspection:**
 - a) Each wire fragment was examined along its length (beginning at approximately 5mm from the sample holder edge and ending ~5mm before the opposite edge) at magnification of ~1Kx, at fast scan rate.
 - b) Images at designated magnifications were taken randomly along the sample length;
 - c) Images for the ovality measurements were taken at 4000x magnification in three points of each wire fragment: in the middle (approximately) and close to both ends;
 - d) Measurements of wire diameter, as visible on the images, were done using the Quartz PCI Image Management System, 3 measurements per image;
 - e) Additional images at various magnifications were taken at the points of interest (variations in sample topography, contaminated areas, etc.)
 - f) EDS analysis was performed on the most typical points of interest.

Sample S4-1 A, B

I. Images at designated magnifications

S4-1A-1	S4-1B-1
 <p>S4700 15.0kV 13.0mm x500 SE(U) 100um</p>	 <p>S4700 15.0kV 13.4mm x500 SE(U) 100um</p>
Magnification: 500x	Magnification: 500x
S4-1A-2	S4-1B-2
 <p>S4700 15.0kV 13.2mm x1.00k SE(U) 50.0um</p>	 <p>S4700 15.0kV 13.4mm x1.00k SE(U) 50.0um</p>
Magnification: 1000x	Magnification: 1000x

S4-1A-3

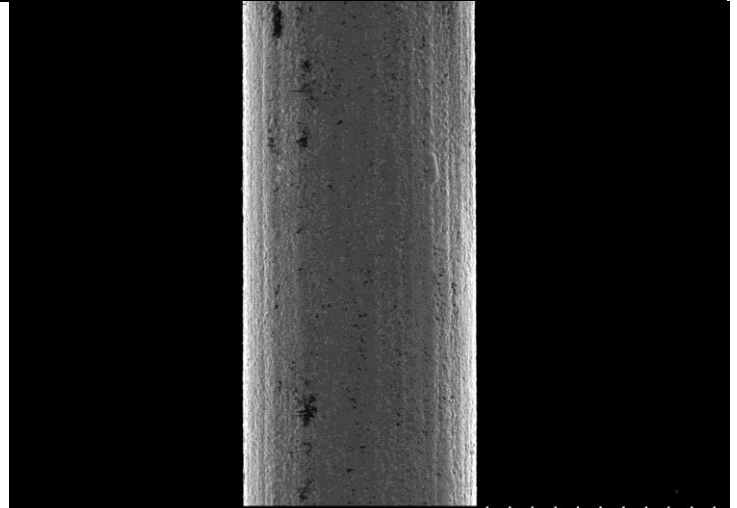


S4700 15.0kV 13.3mm x2.00k SE(U)

20.0um

Magnification: 2000x

S4-1B-3

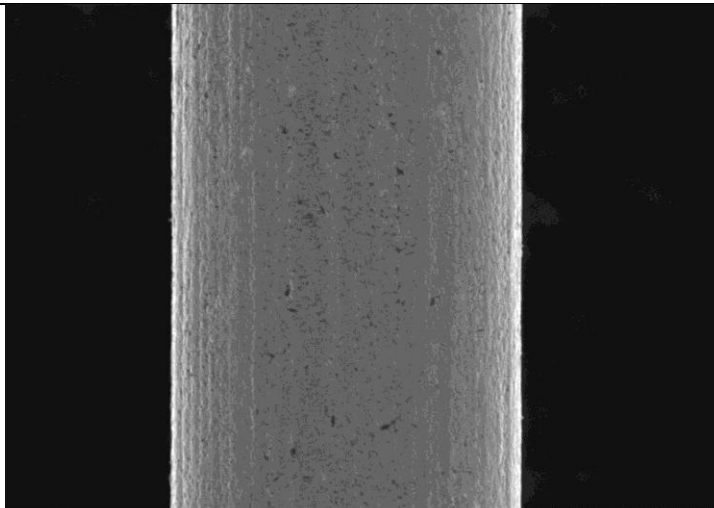


S4700 15.0kV 13.5mm x2.00k SE(U)

20.0um

Magnification: 2000x

S4-1A-4

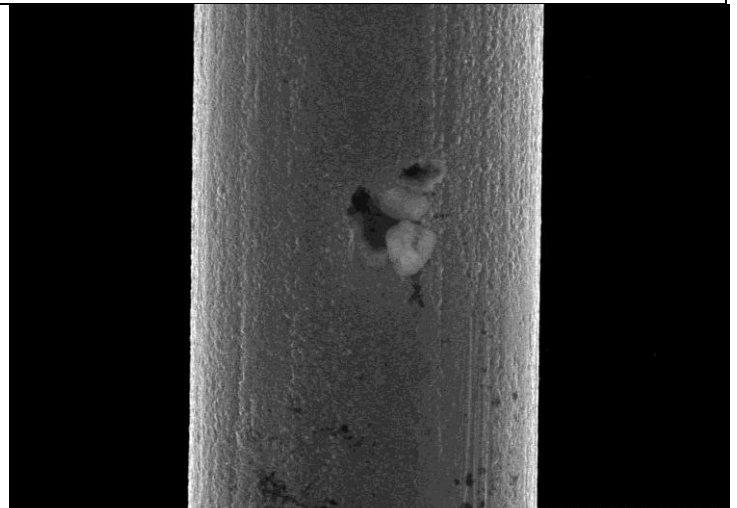


S4700 15.0kV 13.3mm x3.00k SE(U)

10.0um

Magnification: 3000x

S4-1B-4



S4700 15.0kV 13.6mm x3.00k SE(U)

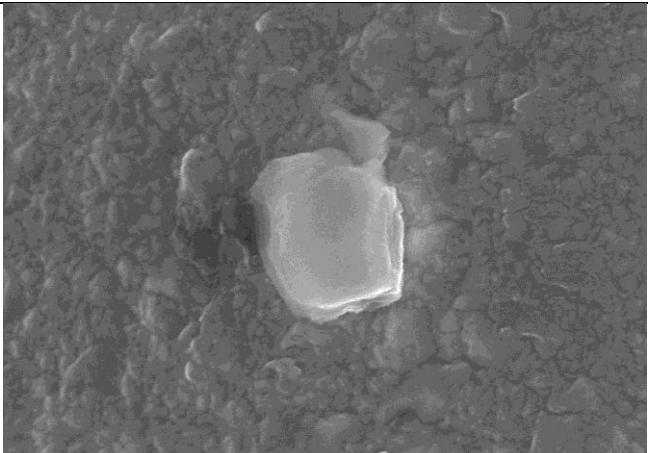
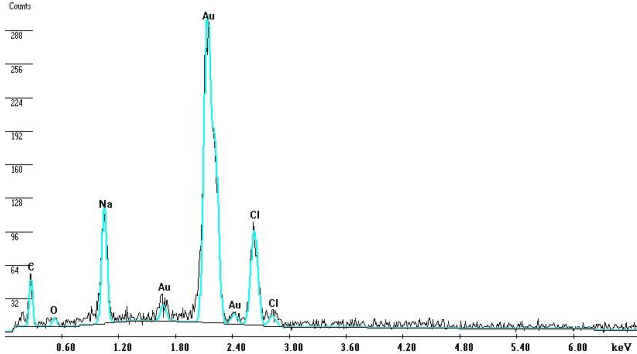
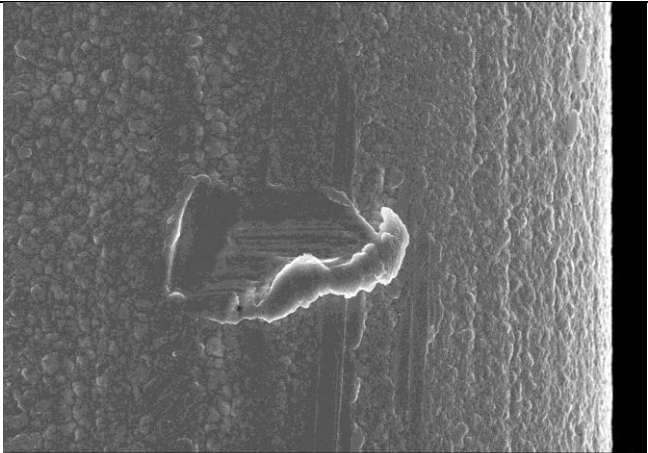
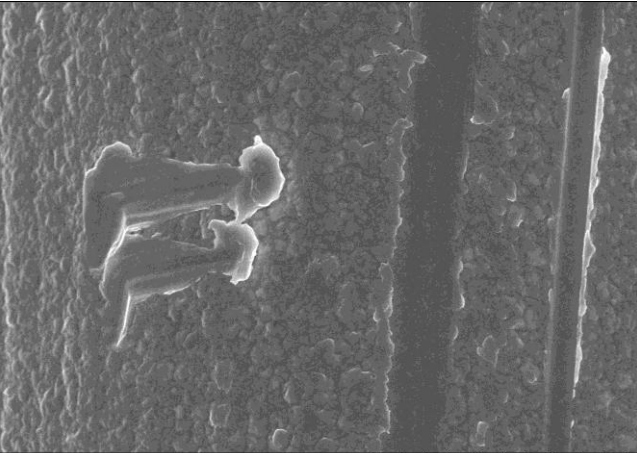
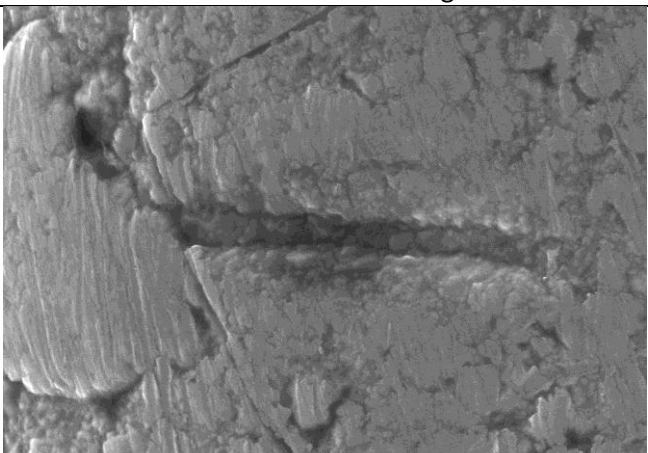
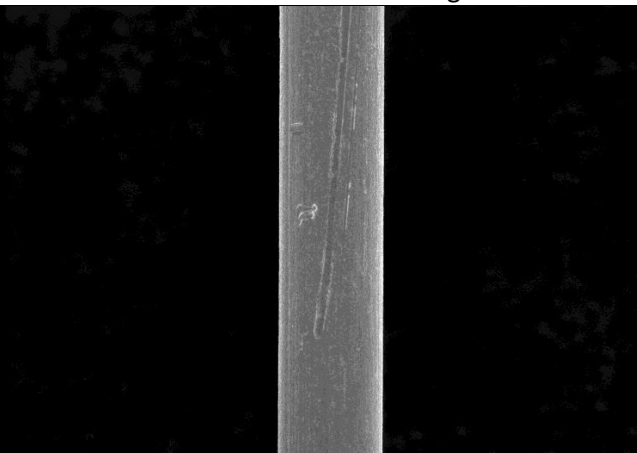
10.0um

Magnification: 3000x

II. Ovality Measurements

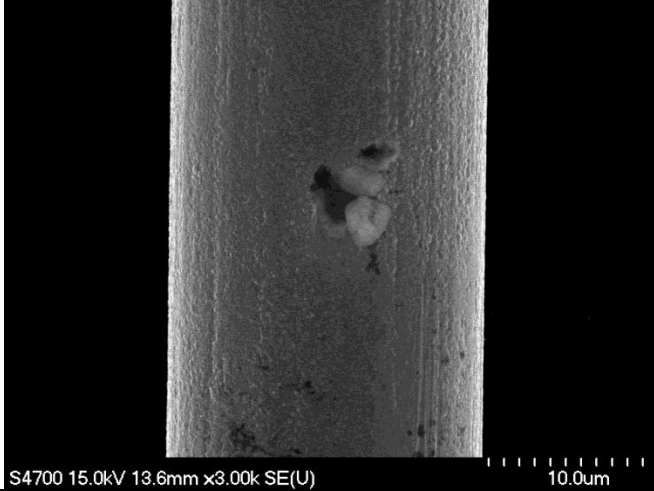
<p>S4-1A-1o</p> <p>20.66µm 20.71µm 20.54µm 9.97µm 10.0µm</p> <p>S4700 15.0kV 13.4mm x4.00k SE(U)</p>	<p>S4-1B-1o</p> <p>20.46µm 20.44µm 20.51µm 10.07µm 10.0µm</p> <p>S4700 15.0kV 13.4mm x4.00k SE(U)</p>
<p>Magnification: 4000x</p>	<p>Magnification: 4000x</p>
<p>S4-1A-2o</p> <p>20.66µm 20.71µm 20.54µm 9.97µm 10.0µm</p> <p>S4700 15.0kV 13.4mm x4.00k SE(U)</p>	<p>S4-1B-2o</p> <p>20.39µm 20.36µm 20.32µm 10.07µm 10.0µm</p> <p>S4700 15.0kV 13.3mm x4.00k SE(U)</p>
<p>Magnification: 4000x</p>	<p>Magnification: 4000x</p>
<p>S4-1A-3o</p> <p>20.74µm 20.74µm 20.66µm 9.95µm 10.0µm</p> <p>S4700 15.0kV 13.3mm x4.00k SE(U)</p>	<p>S4-1B-3o</p> <p>20.76µm 20.76µm 20.76µm 10.02µm 10.0µm</p> <p>S4700 15.0kV 13.5mm x4.00k SE(U)</p>
<p>Magnification: 4000x</p>	<p>Magnification: 4000x</p>

III. Points of Interest

<p style="text-align: center;">S4-1A-3</p>  <p>S4700 15.0kV 13.1mm x40.0k SE(U) 1.00um</p>	<p style="text-align: center;">S4-1A-3</p> <p style="text-align: center;">C:\EDAX\Projects\OlgaforHallID\S4-1a S4-1\4-1a-1 contamination.spc</p> <p>Label A: Contamination</p>  <p>Counts</p> <p>288 256 224 192 160 128 96 64 32 0</p> <p>0.60 1.20 1.80 2.40 3.00 3.60 4.20 4.80 5.40 6.00 keV</p>
<p style="text-align: center;">Magnification: 40000x</p>	<p style="text-align: center;">EDS Analysis. Surface contamination (NaCl?)</p>
<p style="text-align: center;">S4-1A-4 Surface damage</p>  <p>S4700 15.0kV 13.1mm x8.00k SE(U) 5.00um</p>	<p style="text-align: center;">S4-1A-6 Surface damage</p>  <p>S4700 15.0kV 13.2mm x10.0k SE(U) 5.00um</p>
<p style="text-align: center;">Magnification: 8000x</p>	<p style="text-align: center;">Magnification: 10000x</p>
<p style="text-align: center;">S4-1A-7 Surface damage</p>  <p>S4700 15.0kV 13.4mm x25.0k SE(U) 2.00um</p>	<p style="text-align: center;">S4-1A-5 General view of damaged area</p>  <p>S4700 15.0kV 13.2mm x1.00k SE(U) 50.0um</p>
<p style="text-align: center;">Magnification: 4000x</p>	<p style="text-align: center;">Magnification: 4000x</p>

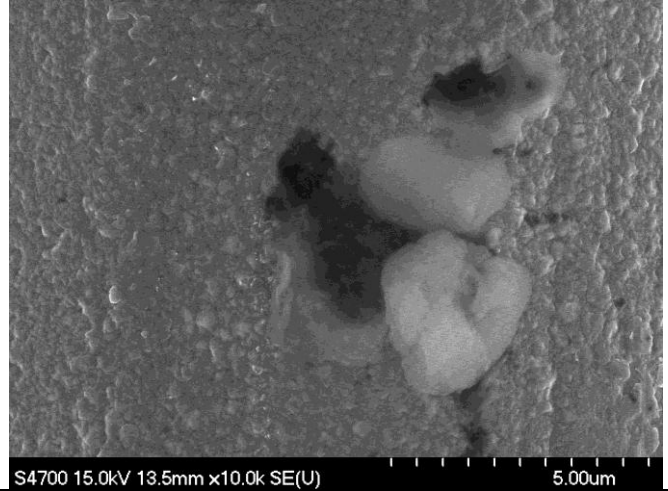
Note. No **W** was indicated by EDS scan in the damaged area (detection limit ~ 1%).

S4-1B Environmental contamination



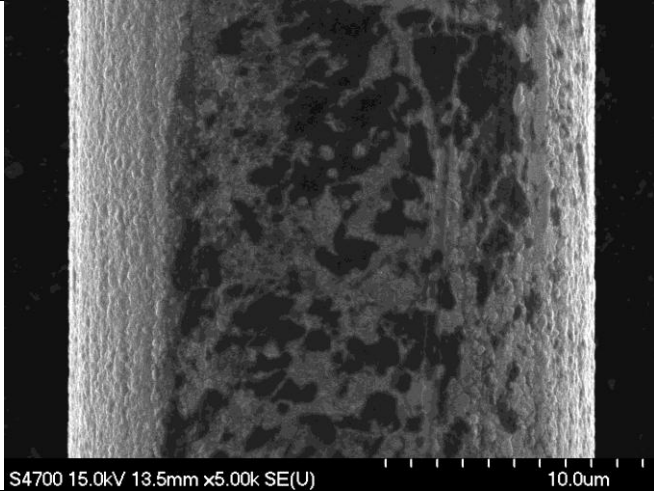
Magnification: 3000x

S4-1B Environmental contamination



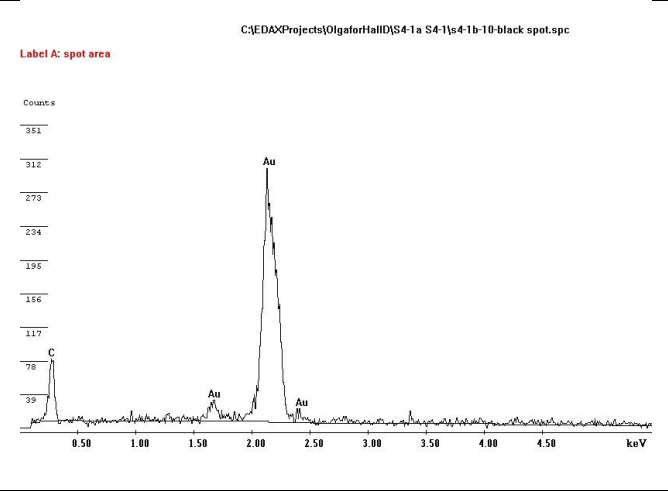
Magnification: 10000x

S4-1 B Black spot (carbon contamination)



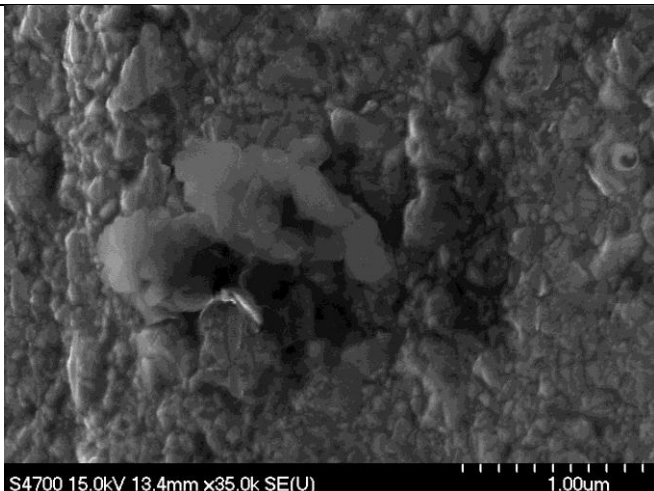
Magnification: 5000x

S4-1 B Black spot (carbon contamination)



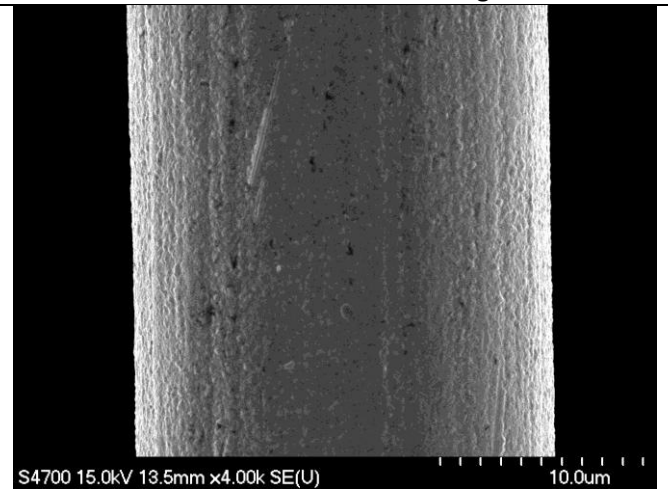
EDS Analysis of black spot region (at 130Kx)

S4-1B Environmental contamination



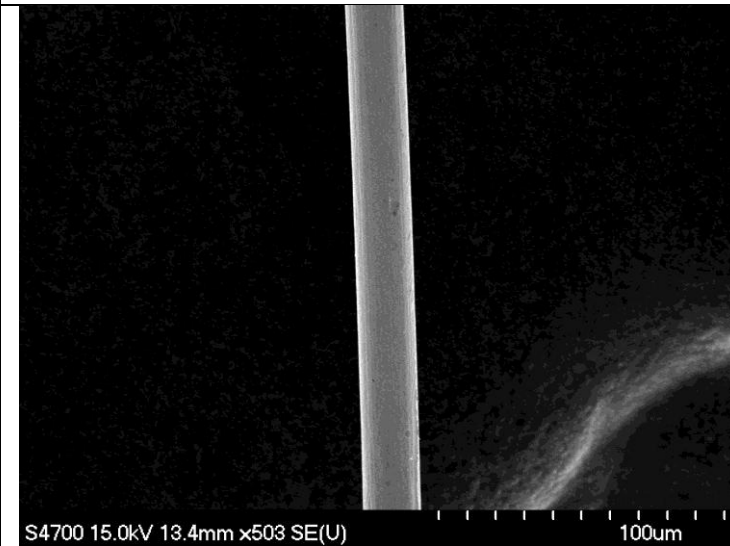
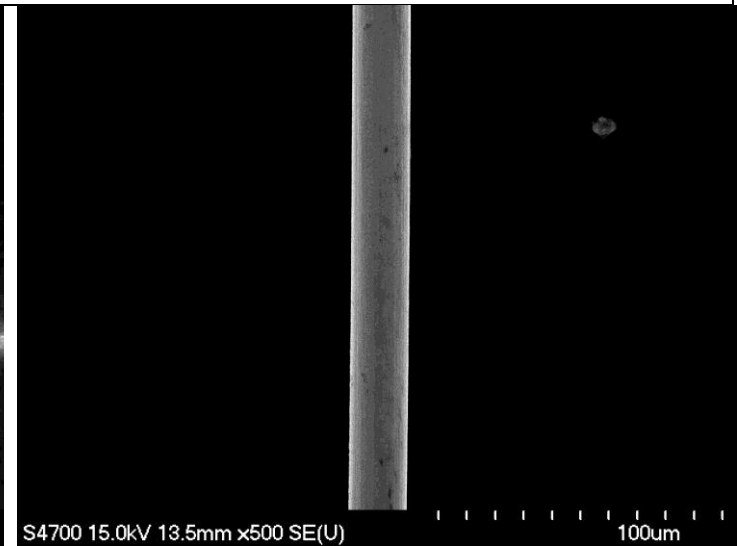
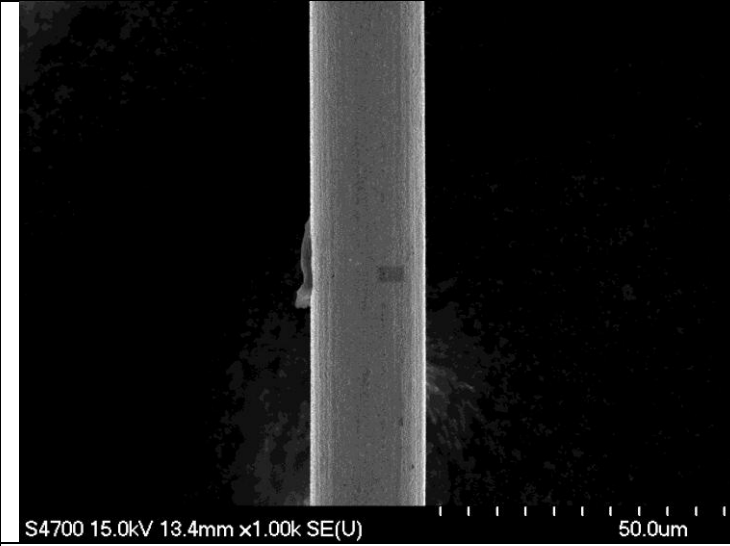
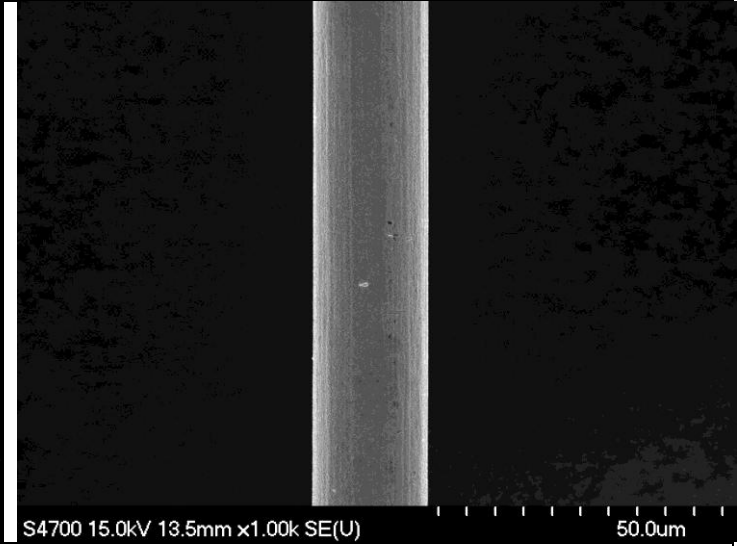
Magnification: 35000x

S4-1B Minor surface damage



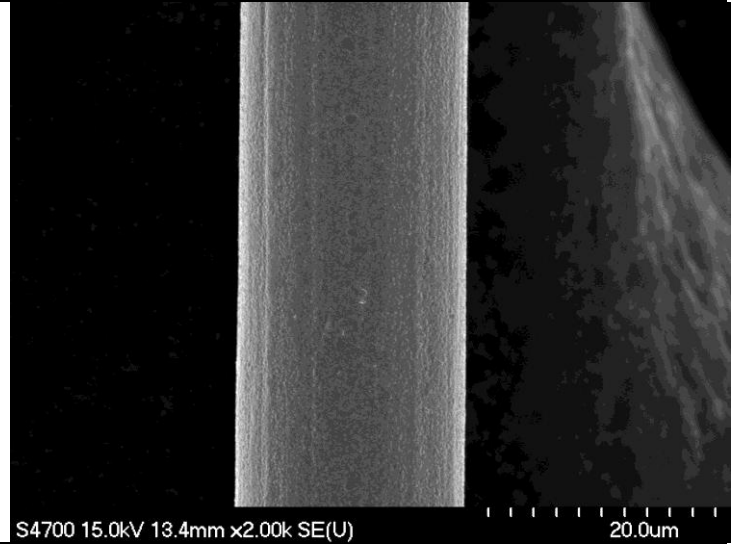
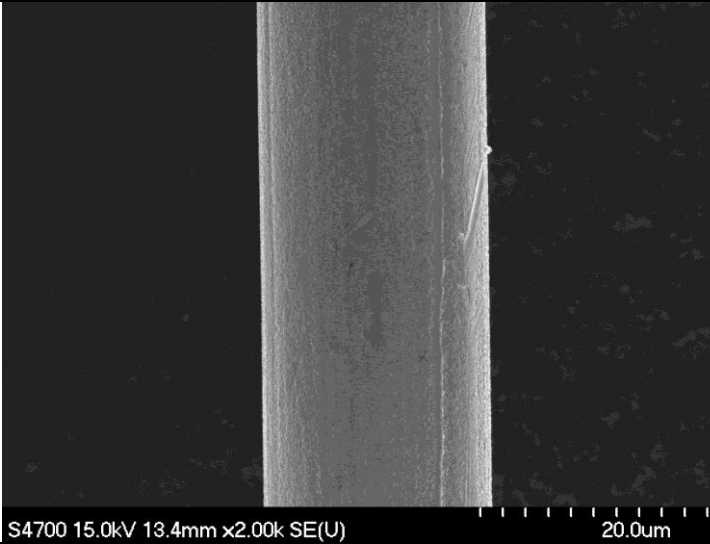
Magnification: 4000x

Sample S4-2 A, B
Images at designated magnifications

S4-2A-1	S4-2B-1
 <p>S4700 15.0kV 13.4mm x503 SE(U) 100um</p>	 <p>S4700 15.0kV 13.5mm x500 SE(U) 100um</p>
Magnification: 500x	Magnification: 500x
S4-2A-2	S4-2B-2
 <p>S4700 15.0kV 13.4mm x1.00k SE(U) 50.0um</p>	 <p>S4700 15.0kV 13.5mm x1.00k SE(U) 50.0um</p>
Magnification: 1000x	Magnification: 1000x

S4-2A-3

S4-2B-3

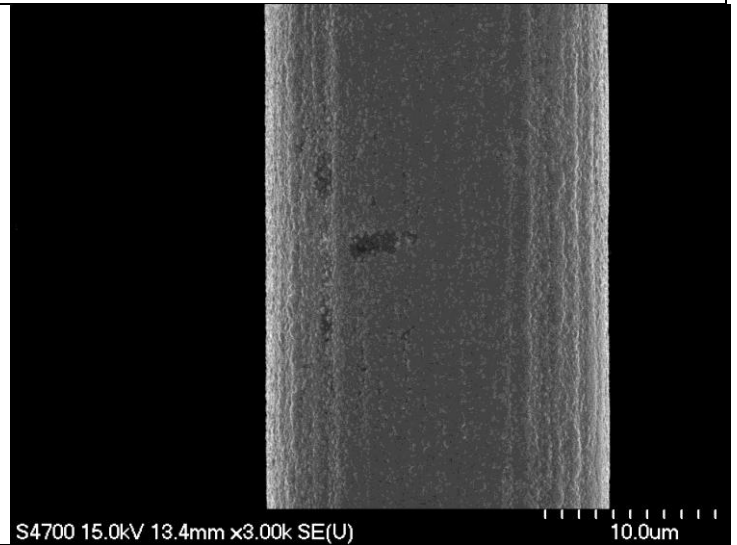
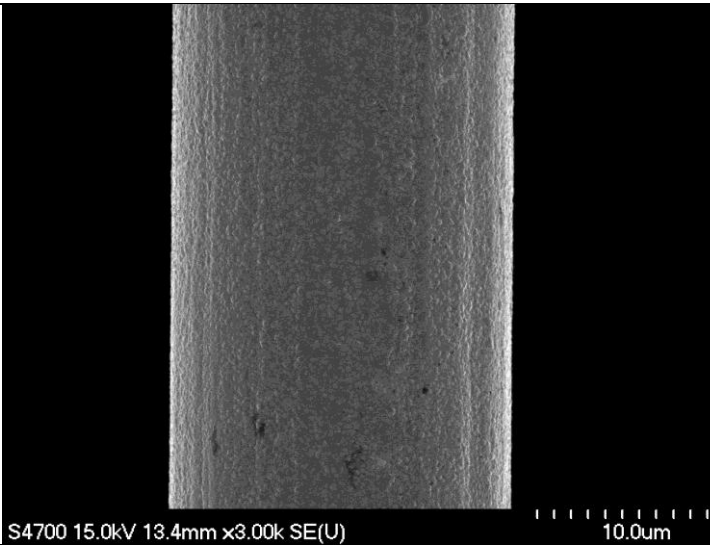


Magnification: 2000x

Magnification: 2000x

S4-2A-4

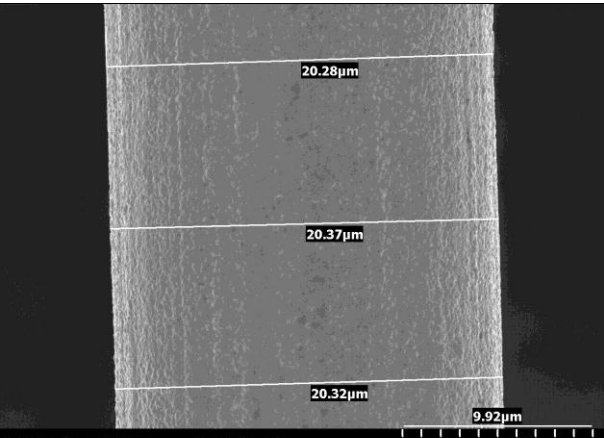
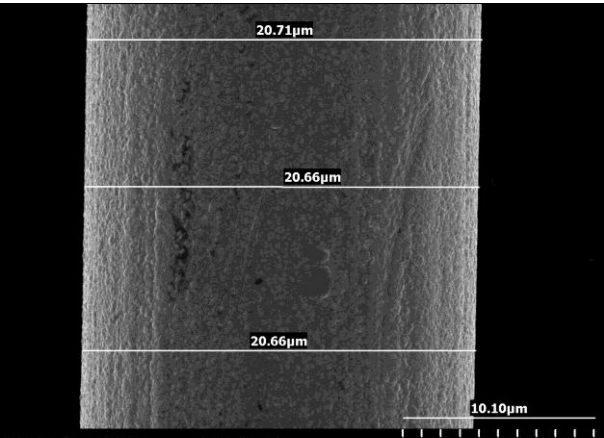
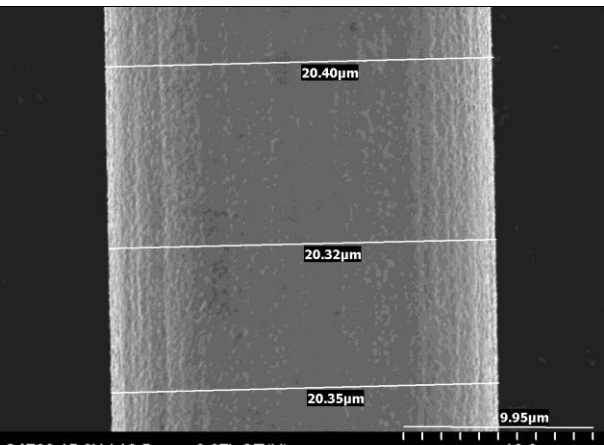
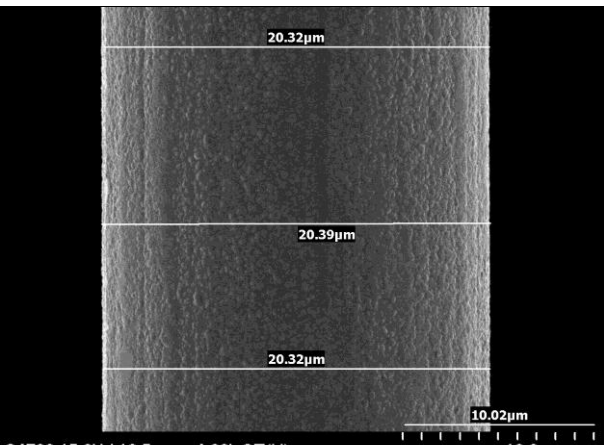
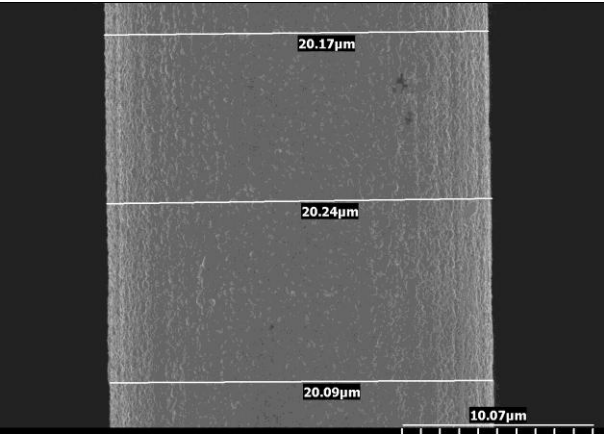
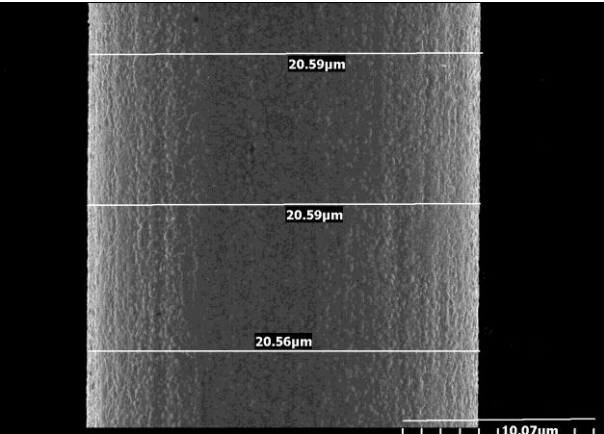
S4-2B-4



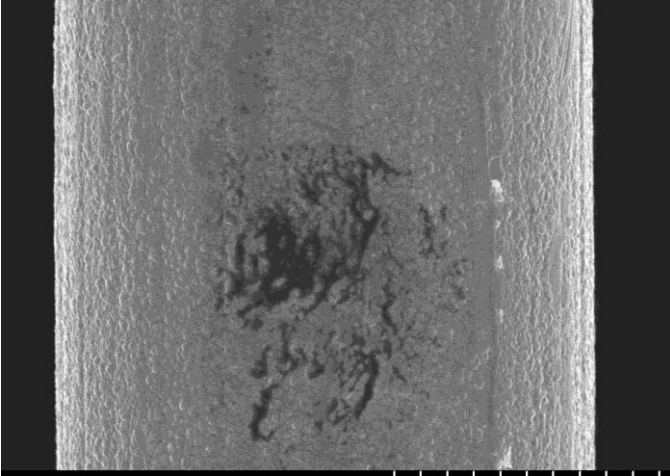
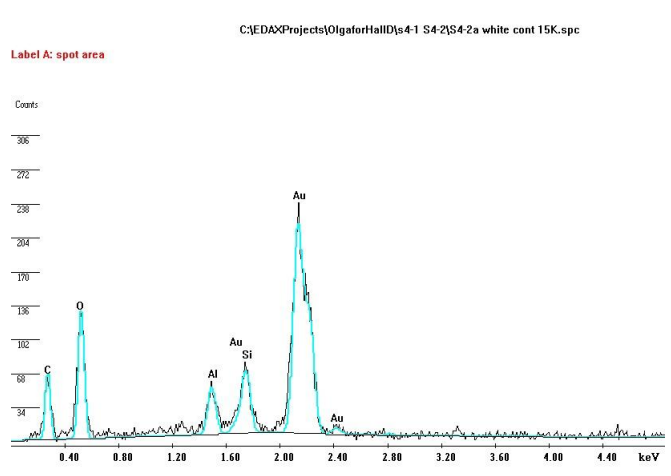
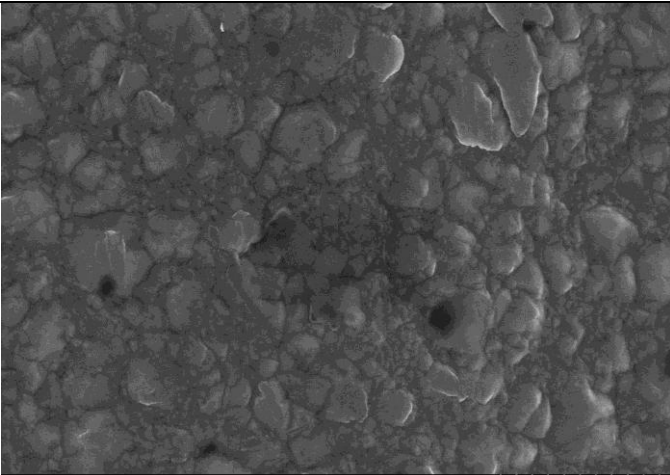
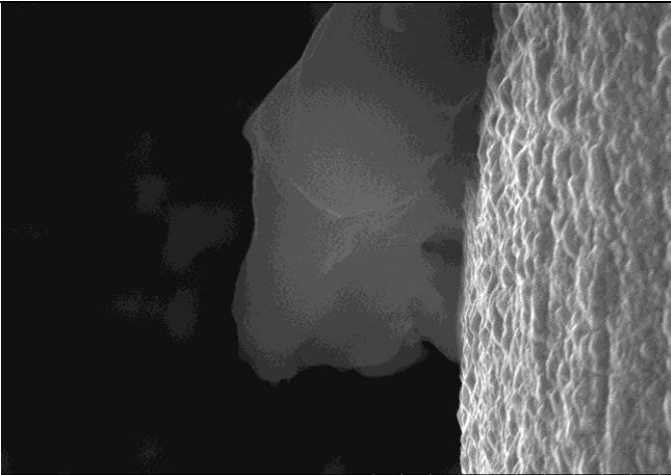
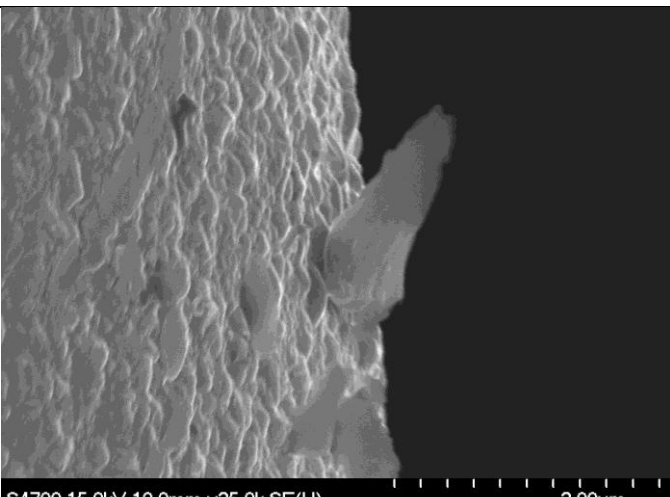
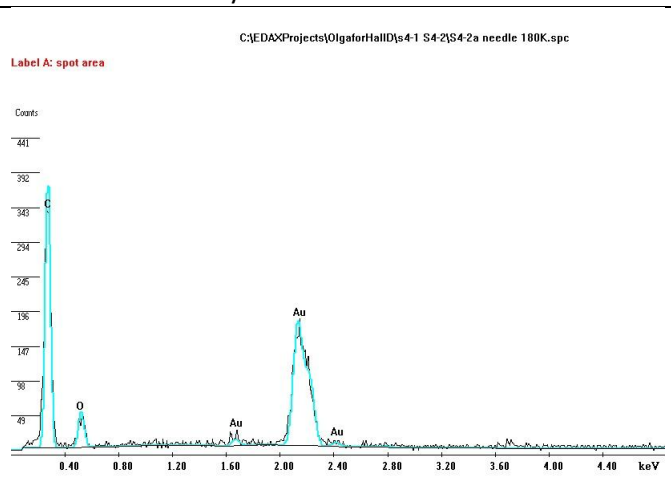
Magnification: 3000x

Magnification: 3000x

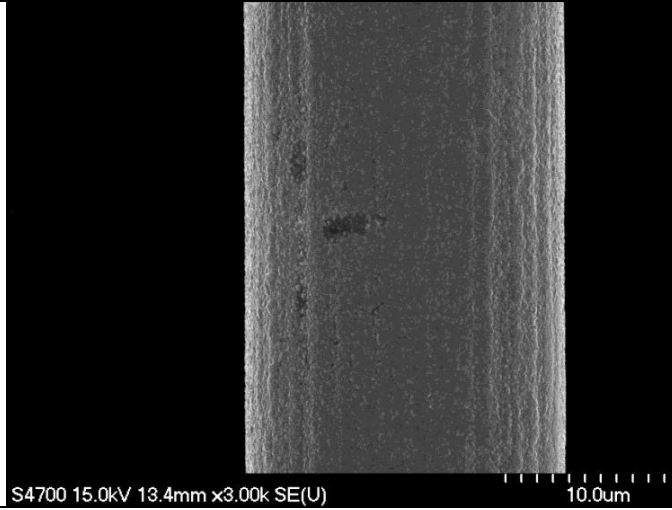
II. Ovality Measurements

<p>S4-2A-1o</p>  <p>S4700 15.0kV 13.2mm x3.99k SE(U)</p> <p>10.0µm</p>	<p>S4-2B-1o</p>  <p>S4700 15.0kV 13.5mm x4.00k SE(U)</p> <p>10.10µm</p>
<p>Magnification: 4000x</p>	<p>Magnification: 4000x</p>
<p>S4-2A-2o</p>  <p>S4700 15.0kV 13.5mm x3.97k SE(U)</p> <p>10.0µm</p>	<p>S4-2B-2o</p>  <p>S4700 15.0kV 13.5mm x4.00k SE(U)</p> <p>10.0µm</p>
<p>Magnification: 4000x</p>	<p>Magnification: 4000x</p>
<p>S4-2A-3o</p>  <p>S4700 15.0kV 12.9mm x4.00k SE(U)</p> <p>10.0µm</p>	<p>S4-2B-3o</p>  <p>S4700 15.0kV 13.5mm x4.00k SE(U)</p> <p>10.0µm</p>
<p>Magnification: 4000x</p>	<p>Magnification: 4000x</p>

III. Points of Interest

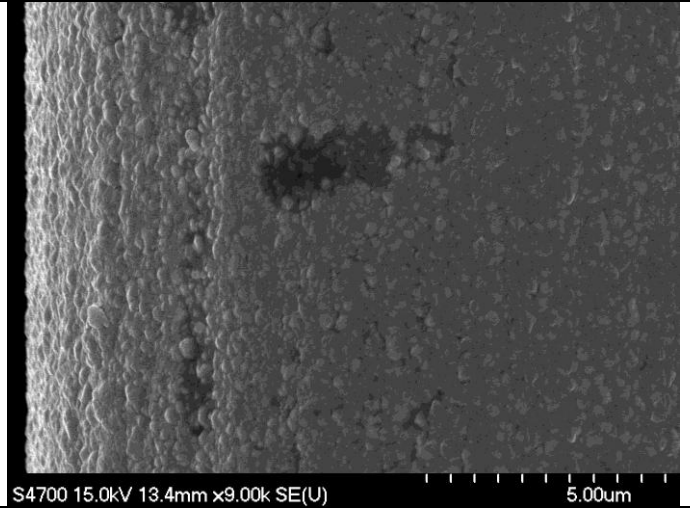
<p style="text-align: center;">S4-2A-6</p>  <p style="text-align: center;">Magnification: 30000x</p>	<p style="text-align: center;">S4-2A-6</p> <p style="text-align: center;">C:\EDAXProjects\OlgaforHallID\s4-1 S4-2\S4-2a white cont 15K.spc</p> <p>Label A: spot area</p>  <p style="text-align: center;">EDS Analysis. Surface contamination (white spot)</p>
<p style="text-align: center;">S4-2A-6 Surface structure (high mag, white at low mag)</p>	<p style="text-align: center;">S4-2A-4 Flake-like contamination. Environmental.</p>
 <p style="text-align: center;">Magnification: 30000x</p>	 <p style="text-align: center;">Magnification: 18000x</p>
<p style="text-align: center;">S4-2A Needle-like contamination. Environmental.</p>	<p style="text-align: center;">S4-2A EDS analysis of needle-like contamination</p>
 <p style="text-align: center;">Magnification: 25000x</p>	<p style="text-align: center;">S4-2A EDS analysis of needle-like contamination</p> <p style="text-align: center;">C:\EDAXProjects\OlgaforHallID\s4-1 S4-2\S4-2a needle 180K.spc</p> <p>Label A: spot area</p>  <p style="text-align: center;">Magnification: 180000x</p>

S4-2B-5 Surface imperfection



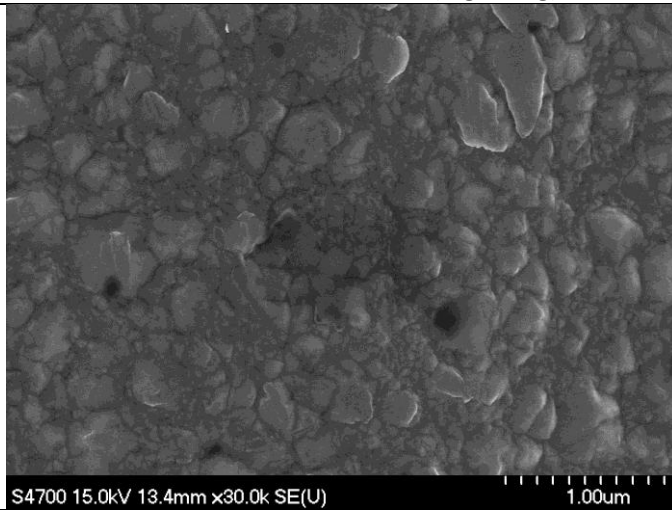
Magnification: 3000x

S4-2B-6 Surface imperfection: some grains of coating are sticking out



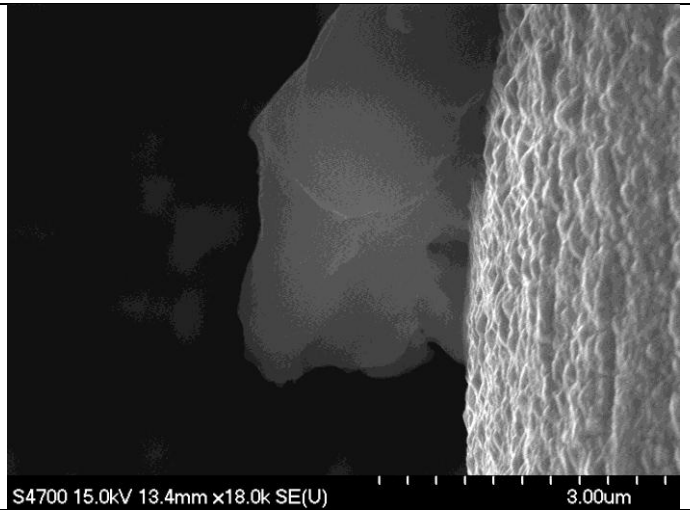
Magnification: 9000x

S4-2A-6 Surface structure (high mag)



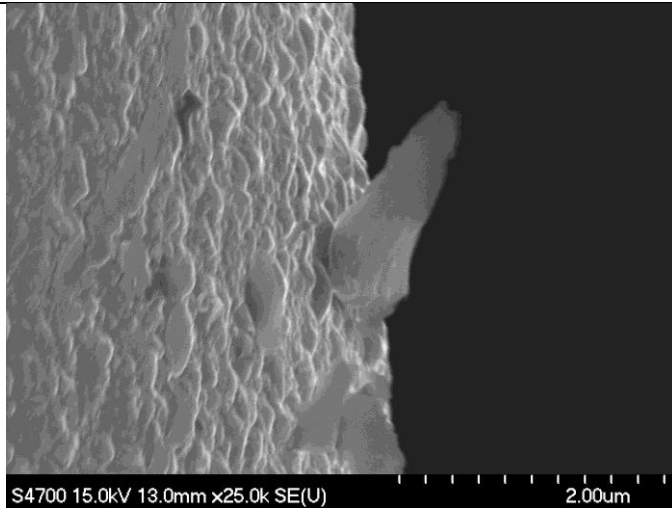
Magnification: 30000x

S4-2A-4 Flake-like contamination. Environmental.



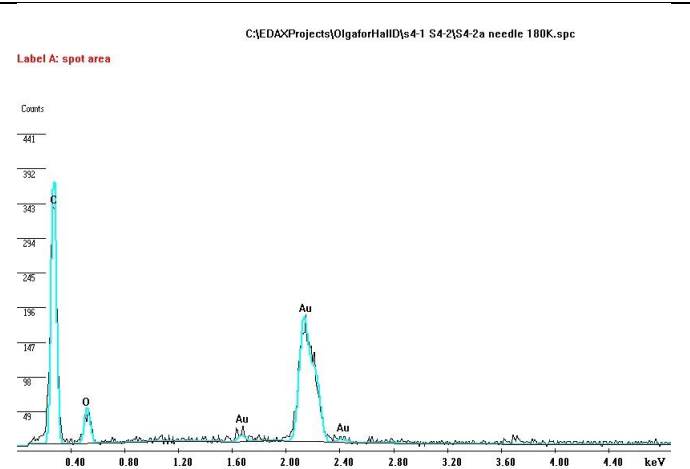
Magnification: 18000x

S4-2A Needle-like contamination. Environmental.



Magnification: 25000x

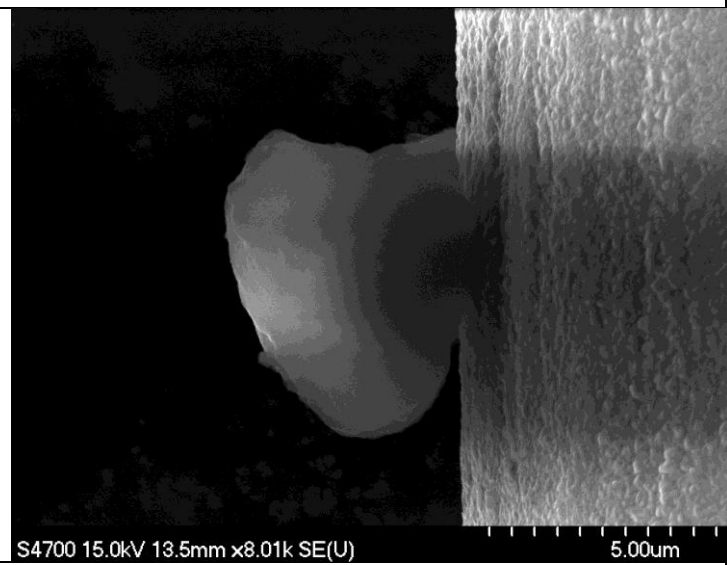
S4-2A EDS analysis of needle-like contamination



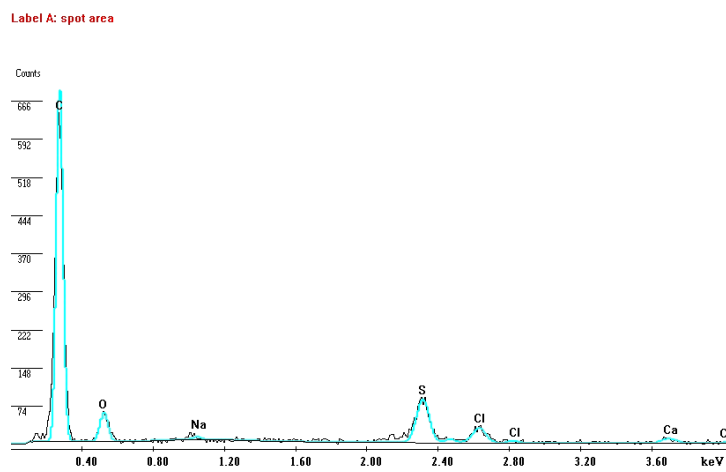
Magnification: 180000x

S4-2B-2 Flake-like contamination

S4-2B-2



C:\EDAXProjects\01gaforHallD\s4-1 S4-2\S4-2b flake.spc



S4700 15.0kV 13.5mm x8.01k SE(U)

5.00um

Magnification: 30000x

EDS Analysis. Surface contamination (flake).
Environmental.