TopCon SEM/EDS

Warning: This instrument may only be operated by those who have been trained by AAF staff and have read and signed the AAF laboratory policies.

A) Start-up (monitored by AAF personnel):

1) Check that instrument is on and cooling water is flowing
   a) Water on
   b) Push Green Power On button on SM 300 panel
   c) Pumping system turns on. Wait until working Vacuum is achieved (>30min)
   d) While waiting check LN2 in EDS detector (~ 30 min cool down if warm)
   e) Click Short Cut to SM 300a icon (computer on right side turn on optiplex 380 computer if needed)
   f) After 30 min check in Main Controller window if HV is ready
2) Check LN2 of EDS Detector is full
   a) Fill by transferring LN2 from 35L dewer to smaller dewer. You must wear gloves and eye protection
   b) Fill Advanced Analysis Technologies EDS 5L dewer to top.
   c) Replace Insulation cap when finished Filling LN2
   d) If dewer was warmed to room temp, wait > 30 minutes for cool down.
3) Check SEM and EDS computers on [**PASSWORDS SEM** Topcon:MATSEM; **EDS** SEMUSER:4pi
4) Check (note) Spot Size, Beam Voltage…

B) Loading a Sample (Use Gloves)

1) Check Z height/ working distance (WD) : should be 45.
2) Is sample/stub conducting? If not may need to coat with Au/Pd (see later section)
3) Choose correct sample stub for mounting. There is a variety so pick wisely.
4) Load Sample in Chamber
   a) After mounting sample
   b) Push Yellow "AIR" button (SM-300 front panel) to vent chamber
   c) After a chamber vents, hold black handle on sample chamber door with right hand. Depress black button (below sample chamber door).
   d) Slide sample chamber out.
   e) Using gloves remove current sample and mount your sample flush with holder (if possible). All tools for mounting sample should be to the left of chamber.
   f) Make sure sample is in horizontal position.
   g) Sample should be centered in X and Y position (X~ 893, Y~ 367). Check red X and Y alignment marks.
   h) Note mounted sample height (measure distance from top of empty stub to top of sample)
   i) Starting "working distance" will be Z height 45 (see B1) minus distance measured top of sample.

j) Gently slide chamber door back into position
k) Gentle press door to “chamber” in while depressing yellow AIR button
l) Wait 5 minutes - Vacuum gauge should go all way right – In Topcon SM-300 software, message at bottom right should say HV Ready.

C) Operating SEM/Imaging Software User Topcon:MATSEM

1) Topcon SM-300 program should be open (If not – SEM Imaging computer is on right side – OptiPlex 380 Not connected to internet now)
2) Main Controller window has Focus and a Beam window.
3) In Focus Window set:
   a) Spot Size 9 (works for most imaging/EDS)
   b) Magnification 50X
4) In Beam Window set:
   a) Gun KV 15kV
5) In Focus window click SEM button
6) Check Emission Current (In Beam tab) Might need adjustment with Filament slide bar (must be trained) NEVER ADJUST **BIAS** SLIDEBAR
7) Click on Auto Focus and Auto Contrast Brightness (Focus Window)
8) If see sample, focus with Fine Focus _ if not Coarse Focus (pay attention to WD should be 40-50, depends on sample height)
9) Use X/Y controls on chamber to view interesting area (Center X~890, Y~365).
10) After focus, change Z height for a WD of ~12. Do this slowly.
11) Now increase/decrease Magnification as desired.
12) If image moves X or Y while focusing, Wobble adjustment needed (see below).
13) Adjust x/y stigmators for best image.
14) As Mag goes up, the spot size needs to go down (50X - 2000X ~9, > 5000X ~ 8 ???)
15) Take image (after best focus), Click Photo icon in FOCUS Window. Save image in Folder
16) E-mage in EDS program can also be used (type in correct magnification)
17) Click Freeze to unfreeze image.

D) Alignment of Gun (Only adjust after being trained):

1) As spot size is increased/decreased the image brightness should go up/down smoothly.
2) If not 1), or if brightness goes down with increase spot size, need to align Gun.
3) Gun Align is in Beam Window , move X and Y Gun Align slides to maximizes image brightness.
4) Image “Brightness” can be seen directly by clicking WFM in Beam Window (Wave Form)
5) If this does not work, find S Hardcastle.

E) Wobbler (Must be trained first):

1) (At Mag~2000X) If image shifts (x or y) while fine focusing sample, wobble should be adjusted.
2) To get best images, wobble must be adjusted (this takes experience)
3) First set Mag to 2000X and focus on some feature (adjust to best stigmation).
4) In Focus window, press Wobb
5) Image will fluctuate in brightness (fine)
6) If image also shifts in X or Y position, Wobble needs to be adjusted.

7) Wobble is behind and to the right of the Z height knob.
8) Slowly move black knobs 1 and 2 until image no longer shifts. Please be very careful. It is easy to completely mess up the works.
9) Turn off Wobble

F) EDS/EDX (Elemental Analysis)

1) EDS is Left Computer (Optiplex 780) Attached Internet {SEMUSER:4pi}
2) Revolution is EDS Program (Click Icon)
3) If USE Client shows up click OK
4) Select Universal in Mode pull down window.
5) Program shows a Collection Menu
   a) Survey
   b) E-Image – Will take an SEM image of sample. See above to obtain best image
      i) Click E-Image
      ii) Enter magnification
      iii) Image taken
      iv) In Set-up – E-Image – The scans options can be changed – Typical (1024x768 image), Line sync, Image Channel Options (Autoscale, enable, 16 bit dwell 100) save JPEG?
6) EDS In Mode pull-down pick EDS spectra
   a) In EDX Spectra options (top right), choose dwell in SEC then click Camera icon. Spectra will add until dwell time reached.
   b) Click on Options id
   c) Most likely peaks will be not ok
   d) In klm window of spectra (top right): choose open KLMs (right click)
   e) Clicking on elements can help you identify peaks
   f) Click edit elements to remove unwanted peaks and add elements found ok
   g) Now click qnt button to see Quantitative results.
   h) Point scans
      a) In Universal Mode
      b) Click Point in tools
      c) Click points to do EDS (Choose a few??)
      d) Right Click Point and choose Queue EDX Items
      e) All points will be done with Quant.
      f) File Save AS (Export???)
   i) Area Scans Are Similar (only rectangular areas work)

   j) LINE SCANS
      a) In Universal Mode
      b) Click Set-up – Line ScanPoint Pick point density, present time (100ms) channels 512 -
      c) Click Tools /Line
      d) Draw line on image (left click and drag)
      e) Click Set-up button 512 points and 100ms dwell takes ~90 sec)
      f) Right Click on line EDX Line Scan (click)

g) EDX Line SCAN
h) Nonsense elements?
i) Right click lines
j) Edit Line Scan
k) Pick Elements to scan Save
l) After scan ends Save As

G) Shut-Down Procedure

a) SEM Beam – Standby
b) Magnification 2000X
c) Z height on chamber to 45
d) Push Yellow "AIR" button to vent chamber
e) Slide Chamber Out
f) Remove sample
g) Replace sample holder (1/8" hole)
h) Close chamber
i) Push Yellow "AIR" button to pump down chamber
j) FILL OUT SEM/LOG BOOK Time/Name/Prof…