XPS2 UPS and Work Function Operating Procedure

Help Resources

XPS knowledge viewer – Complementary Techniques – UPS (U.V. Photo Electron Spectroscopy

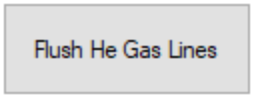
Nexsa G2 User Manual (page 83) and Processing Manual (page 89) provided by Thermo Scientific is located in the Manuals folder on the desktop

Important Notes

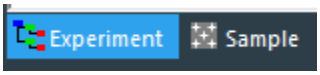
- You must use the Work Function Holder for Work Function Measurements.
  - This holder allows you to provide a voltage bias to the sample
  - To separate the sample cut-off from the spectrometer cut-off, a negative voltage needs to be applied to offset the spectrum to higher kinetic energy
  - There must be a conducting path to the sample surface to get good sample biasing. Use the provided sample clips or copper tape wrapped to the top side of the sample.
- For valence band scans, the Standard Sample Holder can be used because voltage biasing is not needed
- UPS beam size is about 5mm in diameter
- UPS is very sensitive to surface contamination (much lower beam energy than XPS)
  - Typically a large area sputter clean is performed prior to UPS measurements
  - He1 source is 21.2 eV and He2 source is 42.2 eV (typically use He 1)

Procedure

1. Flush He lines (takes 10 min)
   1. Vacuum details
   2. Vacuum Detailed Tab
   3. Click “Flush He Gas Lines”



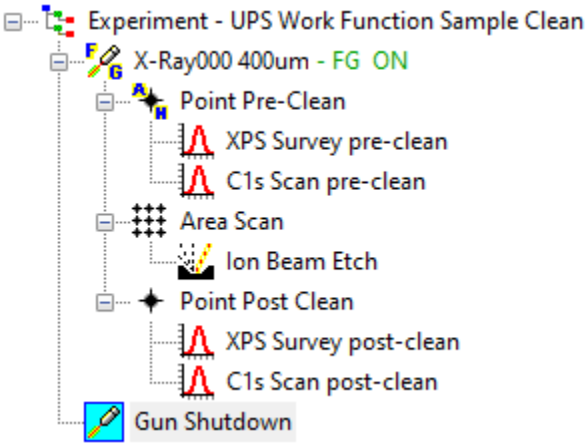
2. Check to see if UV source will turn on
   1. Open UV source menu from bottom task bar and click “Turn On”
   2. If UV source does not come on after a few minutes, repeat steps 1 and 2. Note - it may take several attempts if the UV source hasn’t been used in a while
3. Follow Steps 1-13 in the XPS procedure for loading and positioning your sample
   1. Remember to use the Work Function Sample Holder if you want to do work function measurements

4. Go to the Experiment Section on the software control panel 

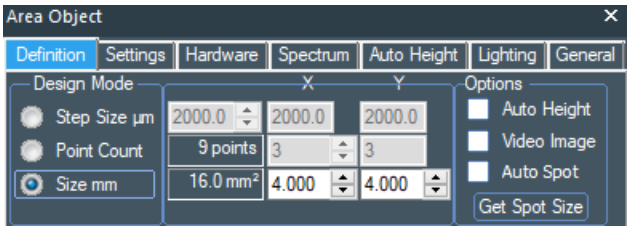
5. Under the file menu select “New Experiment” to build a new experiment from scratch, or select “Open Experiment” to open a previous experiment for editing

Sputter Cleaning a Large Area

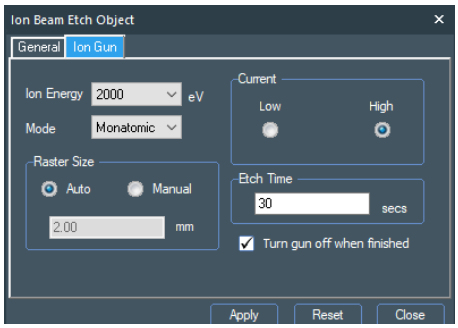
6. An example experiment is shown below for sputter cleaning a large area and checking for C contamination before and after sputtering



- X-Ray Gun 400um FG ON
- Point with Auto Height
- XPS Survey and C1s (Pre Etch check)
- Area Scan – Auto Height Not Checked
  - click and drag the corners of the grid to cover a large area of the sample (cover entire camera view) or chose size = 4mm x 4mm
  - Choose step size = 2000um



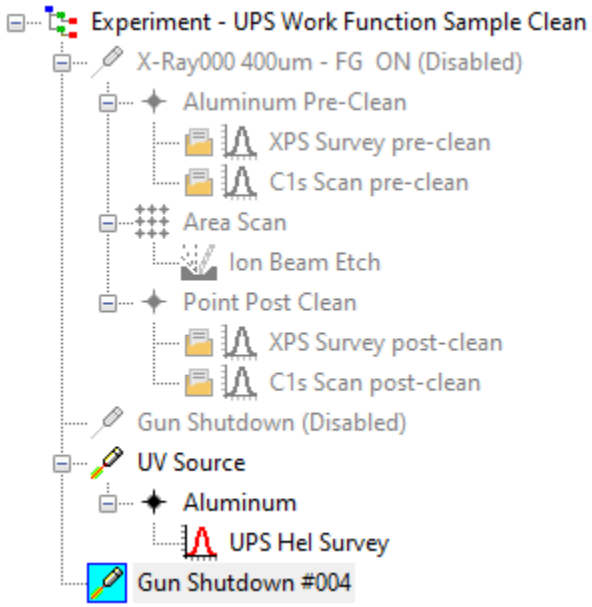
- Ion Beam Etch
  - Option 1 (Typical): Monatomic, 2000eV, high current
  - Option 2: Cluster source, 6000eV, Cluster size 150
  - Etch time = 30 sec
  - Uncheck Turn off gun when finished
  - Raster size = 2mm



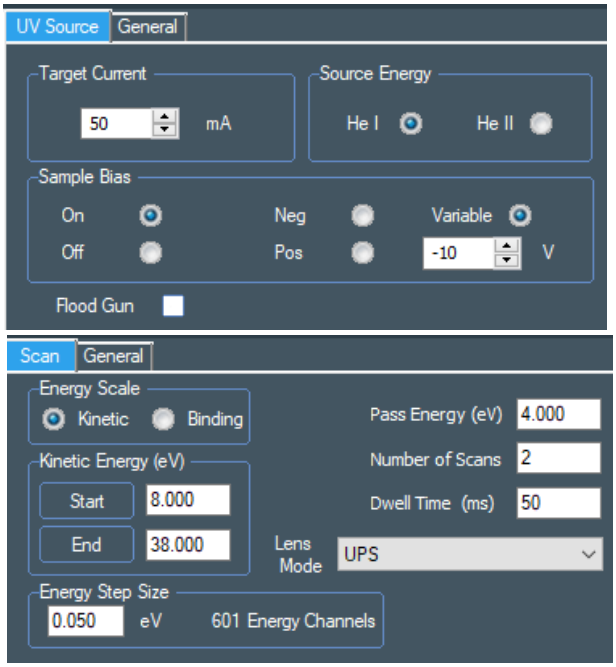
- Then repeat XPS survey and C1s scan to verify contamination removed.
- Repeat if needed

UPS Measurement

7. Disable previous parts of the experiment and verify all sources are off (X_Ray, Ion, Flood) - Or start a new Experiment (and give it a different name)



8. UV source
    - He1
    - 50mA
    - Sample Bias
        - On
        - Variable
        - -10V
9. Point (rename to sample name) – uncheck Autoheight
10. UPS He| Survey from Multiple Spectrum
    - Pass Energy 4
    - Number of scans 2, Dwell time 50
    - KE Energy Start: 8
    - Kinetic Energy End: 38
    - Step size 0.05eV



Data Processing – Work Function Calculation

The work function analysis tool is designed for the calculation of the surface work function from UPS spectra acquired from a negatively biased sample.

1. Highlight the UPS spectrum of interest and select the work function button
2. Enter or verify the correct value for the bias voltage that was used (-10V)
3. The Work Function will be automatically calculated