GENERAL PROCESS AND OPERATION SPECIFICATION

Dektak XT Profilometer

I. SCOPE

The purpose of this document is to describe requirements and basic operating instructions for the Dektak XT Profilometer. This tool is intended to measure thickness variation to complement deposition or etching processes.

II. SAFETY

A. This machine's detailed safety information can be read in the User Manual.
B. Whenever possible, keep the protection hood down.
C. In the unlikely case of a sudden breach of pressurized gas within the system, move away from the system promptly to avoid collisions from very high velocity particles.
D. Please be careful when interacting with the stylus tip. It can be easily damaged and bludgeoned if not handled properly. If the tip appears damaged in the camera when using the tool, please notify a staff member and do not attempt to fix it yourself.
E. When lowering the tip, the stylus MUST come into contact with your sample. If the stylus misses your sample, the arm will continue lowering until the tip comes into contact with something. This could end up crushing your sample and damaging the stylus. Please keep an eye on the stylus as it lowers to your sample.
F. MOST importantly, do not try to manually move the stage. Use the XY and Theta controls within the software to move the stage to a location you want. You can use fast, but try not to jerk the stage around. Medium stage movement should usually be enough and is worth the extra time to keep the stage motors healthy.

III. APPLICABLE DOCUMENTS, MATERIALS AND REQUIREMENTS

A. For more information about the physical description and operation of the Dektak XT Profilometer, refer to the User Manual located next to the Dektak tool.
B. Also see the Supplemental User Instructions located next to the Dektak tool.

IV. OPERATION

1. Switch on the black power supply
2. Press the on button on the machine's power panel
3. On the computer, open the Vision64 software
4. Click "Ok" when a message about initializing the XY directions appears and let the system initialize.
5. Click "Ok" when a message about the Theta initializing appears.
6. Click Ok when an error message pops up after initialization
    a) If you do not see the message, click the Vision64 software icon on the bottom of the screen to bring the pop up window to the front
7. Load sample
    a) Open lid if you haven't already.

b) Click “Unload Sample” on the toolbar above the Live Video Display to move the scan stage toward you.
c) Load sample carefully onto scan stage and press “Load Sample” to move the scan stage back.

8. Position the sample underneath the stylus tip by manually moving the sample or using the XY direction control
9. Move the stylus down to the sample by clicking “Tower Down.”
    a) This brings the stylus down to make momentary contact with the sample then it will pick up slightly leaving room for the sample to be adjusted as needed.
    b) MAKE SURE the stylus will hit your sample. The arm will lower until the stylus makes contact and could therefore crush your sample if the stylus misses.
10. Adjust the sample by using the Theta control in the bottom right of the program to set the proper angle desired.
11. Adjust the sample by using the XY instrument control located on the top right of the program.
    a) You can control where the stylus is by clicking the red dot and dragging it in the direction you want to move. Set the cursor just below where you want to begin your measurements.
12. On the left window of the Measurement Setup screen, there are settings for length, time, scan type, range, profile, and stylus type all of which you can change.
    a) Length: The distance of your scan.
    b) Time: How long your scan takes.
    c) Scan Type: Choose between a standard scan for step height or roughness measurements or a map scan for 3D imaging.
    d) Range: Determines the y bounds of the measurement graph.
    e) Profile: Specifies the 0 point of your step height graph. Determined by whether you’re measuring an etch, deposition, or have both.
    f) Stylus type: Leave on 12.5 um. If this does not give you fine enough resolution, ask AggieFab staff to switch the stylus for you.
    g) Stylus Force: 1-15 mg range. 1-5 for soft materials like photoresist. 7-12 for stronger materials like SiO2. 10-15 for tough materials like stainless steel.
        1. Higher force lessens the impact of vibrations, but can damage the sample or tip.
    h) MOST IMPORTANT: Keep the Speed under 100 um/s for the safety of the tool.
13. Run measurement
    a) Close lid if haven’t already.
    b) Step off the white vibration pad.
    c) Click “Measurement” play button in the top left of the program and wait for measurement to happen.
14. Analyze your graph.
    a) To measure thickness with the software follow this procedure:
        1. Enter the ‘Data Analysis’ window (top, middle button)
        2. Move the R and M vertical guidelines on the data analysis window to positions on the graph that should be level.

3. Press the data leveling refresh button.
    a. Note: This will change the original measurement values
4. To measure the change from one step to the next, move R and M to positions on the graph that you would like to know height difference. At the bottom of the screen under 'Cursor Status', Total Profile lists this height difference.
5. You can click and drag the box underneath the R and M to use an average of heights rather than a single point. If this is done you will have to look at the Average Step Height (ASH) to the right of the screen for your "true" step height difference.

b) If you notice your graph is angled upwards or downwards, this means your sample is not level which is not ideal. This can be fixed the following way:

1. Open lid
2. Turn the stage leveling knob either clockwise or counterclockwise depending on sample's situation and run another measurement.
3. Repeat this process until the graph displays a level sample.

15. You can toggle between the "Data Acquisition" tab and the "Data Analysis" tab to view different graphs of the same measurement. "Data Acquisition," by default, gives µm vs. µm and "Data Analysis" gives A vs. mm.
16. To take another scan, return to the Measurement Setup tab and repeat the processes outlined in this manual.
    a) Use the XY stage control to find your new location and press "Measurement" when your settings are finalized
17. If you want to save your data:
    a) Right click on the measurement graph
    b) Click "Export Data" to export the numeric data values to a CSV file
    c) Use snipping tool to save an image of the graph
    d) You will need a **virus free** USB to save the data to
18. When finished measuring, click on the "Measurement Setup" tab and click "Tower Home" to raise the stylus back up.
19. Unload the sample using "unload Sample" and "Load Sample"
20. Close the lid
21. Close down the Vision 64 Software
22. Turn off the Machine's power panel by pressing the black button on the power panel and then switch off the power supply box.

NORMAL OPERATION

SIGNATURES AND REVISION HISTORY

a. Author of this document: Mitchell Roselius
b. Author Title or Role: Student Technician
c. Date: 1/22/2020
d. Revision: Revision C
e. Revision notes: Added: film stress measurement procedure, film roughness measurement procedure, operation warnings (see Safety D-F).

Approvals:

Technical Manager Signature:_____

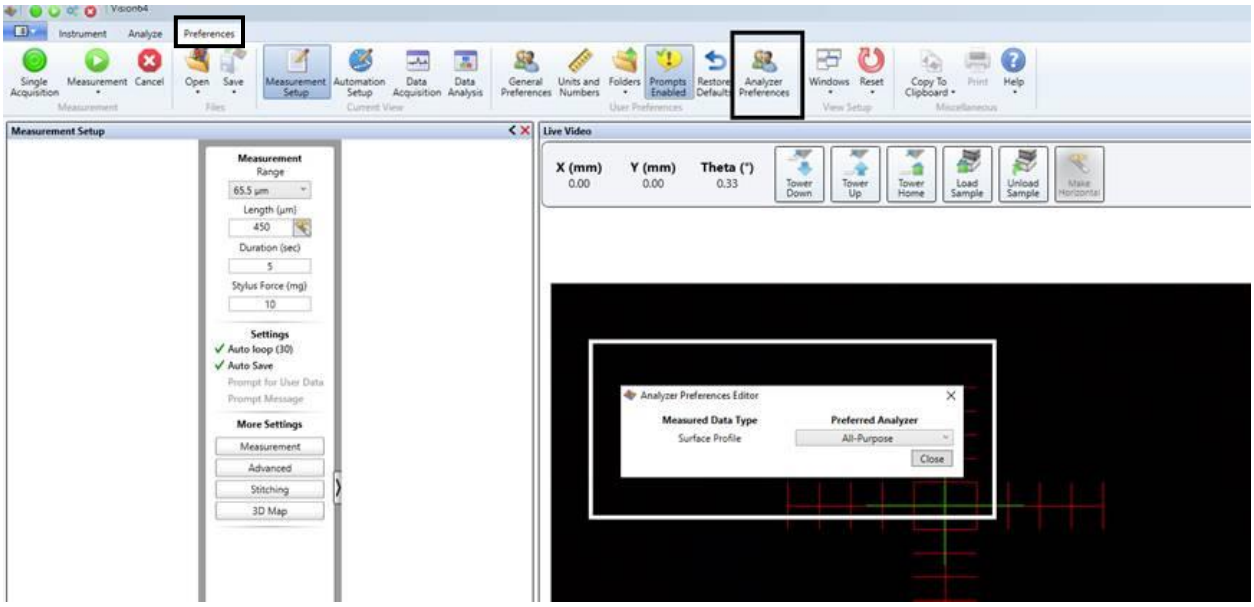
Date: _____

Revision History:

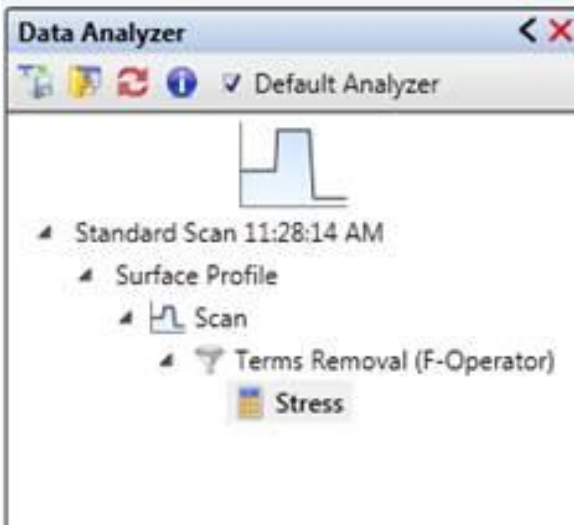
Revision	**Author**	**Date**
Original Issue	A. Shammai	
Rev A	Evan Richards	
Rev B	Mitchell Roselius	8/9/2019
Rev C	Mitchell Roselius	1/22/2020

Appendix A – Stress Measuring

1. Make sure you save a pre-deposition measurement and post-deposition measurement
    a. Run a standard scan across 80% of your wafer trying to avoid the 10% near each edge
    b. Save the recipe used so that each measurement will be the same recipe
    c. Make sure the wafer is placed flatly on the metal platen so there is nothing to affect the measurement
2. Change “Preferred Analyzer” to All-Purpose
    a. Select the preferences tab
    b. Click Analyzer Preferences
    c. Make sure All-Purpose is selected instead of quick analyzer
    d. A warning will pop up, but continue after ensuring you have saved any previous data



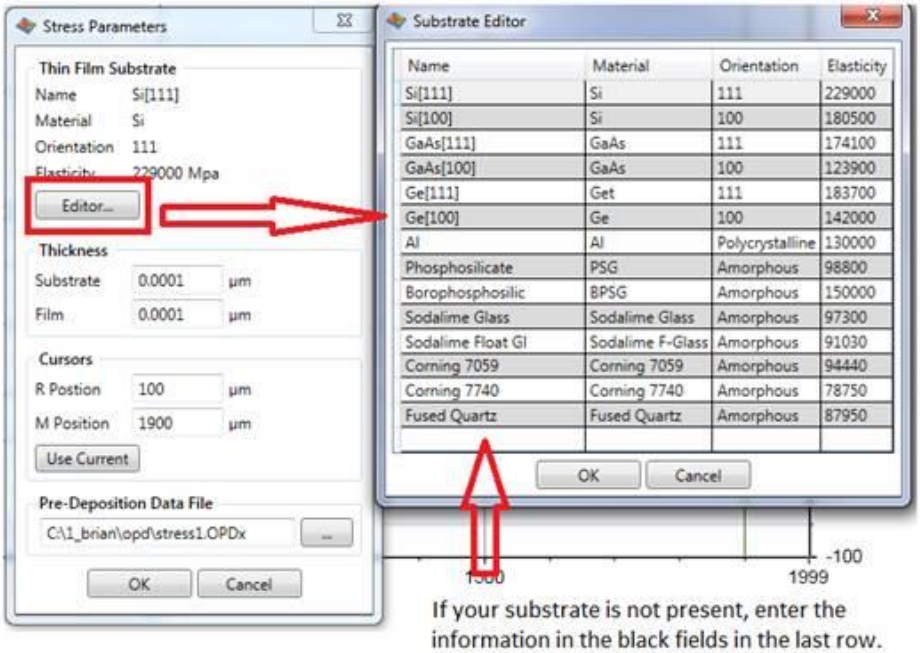
3. Add the Stress node to the data analyzer tree



4. Right click on the stress node and select Edit Settings

5. Enter your substrate and film thickness

Enter the Substrate editor to select your desired substrate.

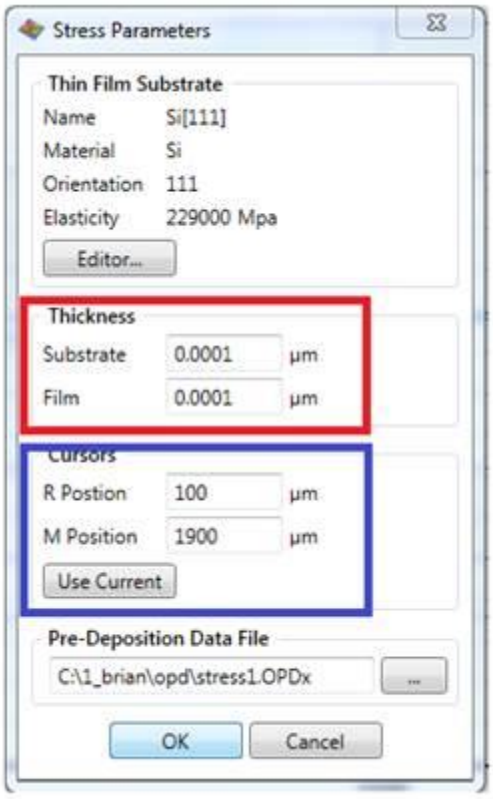


If your substrate is not present, enter the information in the black fields in the last row. You can also edit existing fields by right clicking them.

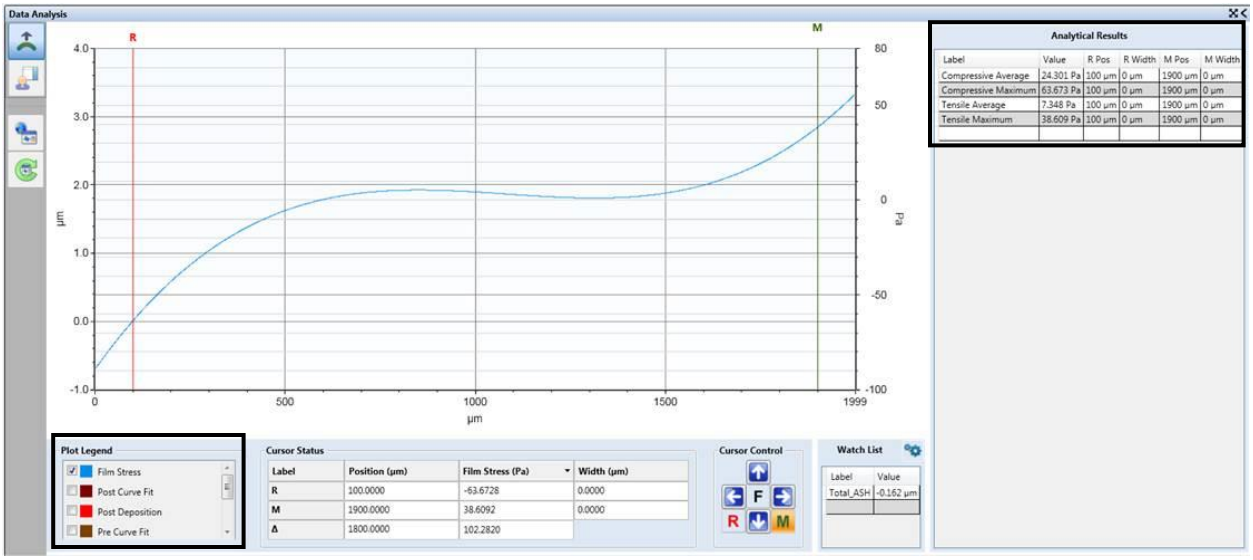
6. Enter the cursor positions or select use current if your R and M values are already set

Enter Substrate and Film thickness

The area between R&M cursors is the area Vision will calculate stress.
"Use Current" will populate the fields with current location of your R&M cursors.



7. Click Ok and the Vision software will display multiple plots.
    a. You can uncheck all plots except “Film Stress” to see the stress value plot
    b. It will also display Compressive Average, Compressive Maximum, Tensile Average, and Tensile Maximum



8. **IMPORTANT**: Before ending your session, be sure to return the “Preferred Analyzer” to quick analysis since most users use this setting

Appendix B – Roughness Measuring

The process of roughness measurement and step height measurement are very similar. Follow the guidelines outlined earlier to take a step height measurement and return here when complete.

1. On the right hand side of the Data Analysis tab is a selection of analysis modes. Most people leave it on step height, but you can change it to roughness to gather roughness data.
2. Right click on the "Analytical Results" section or click the gear icons near the title.
3. Select the variables you're interested in calculating
    a. Leaving the mouse over a variable will eventually show what that variable is.
    b. You can select multiple variables at once including ASH
4. Select "Calculate"
    a. The values will now be shown in the "Analytical Results" section and list the R and M position.
    b. These are static values, so you will have to recalculate if you move your R and M points to a new location or take a new scan
    c. Data leveling and averaging your R and M values function the same way as it does for step height