

Filmetrics film measurement

The following sequence of steps describes the setup and use of the Filmetrics system to measure silicon dioxide films grown on Si substrates. To measure other film/substrate combinations, you will need to modify the procedure for your particular materials. For the most part, the changes are made by defining a new recipe corresponding the structure of your samples.

Start Up

1. Turn on the power to the Filmetrics measurement unit. You should give it at least 5 minutes to warm up before taking any measurements. (15 minutes is recommended.)
2. If the computer is currently running the Mac OS X operating system, reboot into Windows. To do this select “Restart...” from the Apple menu. Immediately press the “option” key and keep it depressed until the OS selection screen appears. Double-click on the Windows option and wait for the system to boot into Windows.
3. Log in as the “ee432” user.
4. Double-click on the “Filmeasure” icon on the desktop to start the program. The program window will fill the entire desktop space. Most of the window consists of a empty graph. There are some controls on the right side of the window.

Recipe

5. Click the “Edit Recipe...” button located on the right side of the window. The recipe dialog box will open.
6. If not already selected, choose the “SiO₂ on Si” recipe from the pop-up menu in the dialog box.
7. Click the “Film Stack...” tab to check the measurement structure. The arrangement should have “Si” (silicon) as the substrate, “SiO₂” in the middle and “air” as the medium. Enter a starting guess for the SiO₂ layer thickness – something close to what you think the thickness should be. Make sure that the number you enter is in the correct units, as given in units pop-up menu. Make sure that only the “d” check box is selected for the SiO₂ layer. This tells the program to use layer thickness as the only variable in trying to match the measured and theoretical curves.
8. Click the “Apply” button and click “OK” to close the recipe dialog box.

Calibration

9. Next click the “Baseline...” button on the right side of the main window. The baseline calibration dialog box will appear.
10. Place your sample under the optical head.

11. Click the “Acquire sample...” button. The instrument will take a quick scan of reflectance from the sample and the program will indicate that it is ready to take the scan from the reference wafer.
12. Slide your sample away off to one side of the stage. Place a bare (no oxide) silicon wafer under the optical head. (There should be a bare wafer stored in a wafer box that you can use for the calibration.)
13. If not already selected, choose “Si” using the pop-up menu as the reference material.
14. Click the “Acquire reference” button. The instrument will take a scan of the reflectance from bare silicon, and the program will indicate that it is ready to take the baseline reference scan.
15. Return the bare silicon wafer to its wafer box.
16. The area under the optical head should be empty. Click “Acquire Background” to obtain a background calibration.
17. Click “Finish” to close the baseline dialog box.

Measure

18. Slide your sample back under the optical head. Position it so that the light is shining on the area of the wafer that you would like to measure.
19. Click the large “Measure” button on the right side of the main window. Within a few seconds two curves should appear on the graph – one is the measured reflectance spectrum and the other is the theoretical curve generated using the film thickness that gives the best fit to the measured curve. For most SiO₂ on Si measurements in EE 432/532, the two curves should be nearly identical.
20. The “best-fit” thickness is displayed in a large font in the “Measurement result” region on the right side of the window. In the “Measurement details” area below that, you can see the “goodness-of-fit” parameter that was calculated as part of the fitting process. The closer this number is 1.00, the better the fit. This gives you more confidence that the “best-fit” thickness is accurate. For most measurement in EE 432/532, the goodness-of-fit parameter will be greater than 0.95 — meaning that the measurements are quite good.
21. To take other measurements on the same wafer, simply move the wafer so that the incident light is shining on another area. Click the “Measure” button to get a new measurement and curve fit. To measure another wafer: remove the current wafer, slide in the new one, position it, and click “Measure”. You do not need to re-calibrate unless you are changing to another type of sample.
22. If desired, you can save a screen-shot image of the graph or you can save the measured reflectance data so that it can be opened in a spreadsheet program later. To save an image, select the “Save Screen to File...” under the “File” menu. Enter a name for the file to be saved, select a location to save the file (the desktop is fine), choose the image type (jpeg,

png, or bmp), and click the “Save” button. To save the data, choose “Save Measured Specrum...” under the “File” menu. Enter a name for the file to be saved, select a location to save the file, choose the data type – .csv (comma separated variables) is probably the most useful — and click the “Save” button. Note that only the *measured* reflectance is saved – the curve fit is not included.

Shutting down

23. Close the Filmeasure window. You do not need to re-boot into Mac OS X unless you need to use that system for other measurement types of measurements.
24. Turn off the power switch on the front of the Filmetrics box.