FILMETRICS THIN FILM MEASUREMENT SYSTEM SOP

UNIVERSITY OF LOUISVILLE
Micro/Nano Technology Center

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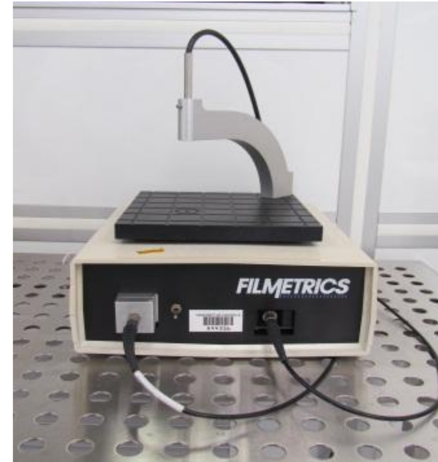
General Theory of Operation



The Filmetrics system illuminates a sample with a tungsten-halogen white light source from 400 nm to 3000 nm with an effective measurement range from 10 nm to 850 nm. This is supplied via a fiber optic cable from the ***light source output*** port. The light reflected by the sample is then captured and fed back to the Filmetrics unit via another fiber optic cable to the spectrometer input port. The reflectivity spectrum of the sample is compared to an internal mathematical reflectivity spectrum for the given sample. A calculated curve is then fitted to the measured curve and the corresponding thickness of the calculated model is reported.

Procedure

The Filmetrics system is on whenever it is plugged in to AC. The switch on the front panel is for the light source only.

1. Login into your FOM account, login to the tool.
2. Turn on the computer and power **ON** the light source by flipping the light source switch up.

NOTE: The light source should be allowed to stabilize at least 10 minutes before the baseline is taken.

3. Open the **FILMeasure** software. If the software reports problems at this point, it is likely the parallel cable is not attached or the Filmetrics system is not powered on.
4. Take a Baseline measurement.

Take a baseline measurement by first clicking on the **Baseline** button on the main screen. A dialog box will appear to guide you through the process. The first step will consist of a baseline reflectivity measurement using a bare piece of silicon which is found near the Filmetrics. The second step will be a background measurement for dark subtraction of the reference at an inclined angle. Please make sure Silicon is selected as a reference material on this dialog box and it matches the reference you are measuring.

5. Make the Test Measurement.

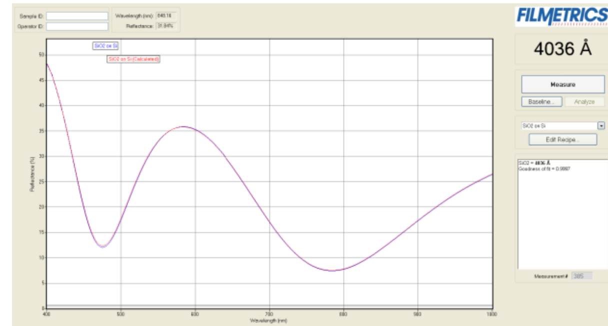
Make the measurement by placing test sample on the stage, select the film structure to be measured, in this case **"SiO_2 on Si"** and click on the Measure button. FILMeasure will then acquire the reflectance spectrum and calculate the corresponding thickness.

If the measurement was successful, the minima and the maxima of the calculated reflectance (the red line on the graph) will coincide in wavelength with the minima and the maxima of the

measured reflectance (the blue line on the graph). In most cases they will not overlap, but will be separated in amplitude.

The measurement results of the test sample should be the same or be very close to the known thickness of the SiO2 layer that is written on the box.

NOTE: If the calculated (red) and measured (blue) minima and maxima do not coincide, then the measurement was not successful, and the Baseline measurement must be redone.



6. Make the Measurement.
   a. To start the measurement by placing your sample on the stage, and make sure that sample is flat.
   b. Select the film structure to be measured, from the dropdown box on the main screen. To edit the structure, click the Edit Structure button to open the dialog box. Check to see that the film sequence matches that of the actual sample. If not, different films can be selected.
   c. Enter the ***best guess for the thickness*** of the film to be measured, and check that only the selected layer thickness is being measured.

      There are several specifications that can also be entered and modified: the name of the film structure, the number of films in the structure, the specifications of individual films such as refractive index (n), extinction coefficient (k) and roughness, type of the incident medium and substrate type.

   NOTE: If the structure to be measured does not exist, a new structure must be defined.

   d. Click the **Measure** button. The panel on the right hand side will indicate the thickness of the sample layer. Make sure that the calculated (red) and measured (blue) minima and maxima do match.
7. When you are done with the measurement
   - Power **OFF** the light source by flipping the light source switch down
   - Close the software
   - Turn off the computer
8. Log off from your session in the FOM.

Additional Info:

Measurements of the index of refraction (***n***) and extinction coefficient (***k***) is possible, as well as measuring multiple layers. The curve fitting and solution search parameters can also be tuned and additional sample types can be added to the Structure menu. For these situations, it is best to refer to chapter five of the Filmetrics manual for specific information.