

Ocean Optics Nanocalc Thin Film Reflectometer

Standard Operating Procedure

Faculty Supervisor: Prof. Robert White, Mechanical Engineering (x72210)

Safety Office: Peter Nowak x73246 (Just dial this directly on any campus phone.)

(617)627-3246 (From off-campus or from a cell phone)

Tufts Emergency Medical Services are at x66911.

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Warnings:

The optical probe tip is fragile. Make sure you do not touch it by accident.

Do not put anything wet or sticky in the reflectometer. Make sure your photoresist has been baked! Make sure there isn't anything on the back of your wafer!

1.0 Material Requirements:

1.1 Equipment: substrate, wafer tweezers

1.2 Personal Protective Equipment: nitrile gloves, safety glasses

2.0 Procedure:

Turn on the tool:

1. Turn on the computer.
2. Turn on the main power switch on the Nanocalc.
3. Turn on both the halogen and the deuterium light sources.
4. Turn on the shutter.
5. Wait 5 mins. for the light sources to warm up.
6. Log in to the computer, and run the "Nanocalc" software.

Taking a reference measurement:

(you must do this every time you start the program)

1. Load the <100> silicon reference wafer onto the stage. Position the fiberprobe tip approximately 5 mm above the surface, and check that the fiberprobe is oriented orthogonal to the wafer surface.
2. Click on the black square next to the "Continuous" label at the top of the screen. It should turn red, and the tool is now continuously acquiring.
3. Click the "Reference" button. It should also turn red.
4. After a second or so, a spectral measurement should appear.
5. Adjust the integration time parameter at the top of the screen to have the spectrum lie mainly between 0.2 and 0.8 magnitude (fraction of maximum scale). An integration time of 150 ms or so is normal.
6. Once you have a good integration time set so you have a well-scaled spectrum, click the "reference" button again to store the spectra (the button turns dark again).
7. Click the red square next to the "Continuous" label to stop continuous measurement. It should turn dark.
8. Return the reference wafer to its box.

Making a measurement:

Note: There is a test wafer at the tool with various thicknesses of silicon dioxide. The thicknesses of the various regions are documented. You may use this test wafer to practice taking measurements, and make sure you are using the Nanocalc correctly. Please be careful not to drop and break the test wafer.

1. Put your sample onto the stage.
2. Go to the bottom right of the screen, and click "edit structure".

3. In the dialog box, add the various layers you have in your structure from the database in the tool. You may also place limits on the minimum and maximum possible thickness of each layer. The more layers you have, and the larger the range, the more difficult it will be for the tool to take a good measurement.

Note: If you have a new material not in the database, you need to know its index of refraction. You can enter the index of refraction of your material to override the default value for a different material on the front panel. **DO NOT SAVE OVER ANY MATERIAL MODELS THAT ARE ALREADY IN THE DATABASE!!** If you do that, then everyone in the future will be in trouble because you altered the index of refraction for some stored material.

4. Click “OK” to exit the edit structure dialog box.
5. Click the “measure” button. After a second, you should see a measured spectrum appear.
6. Click the “analyze” button. The tool will adjust the thicknesses of the various layers in your structure to attempt to match the measured data. It will overlay a black line on the data to show the best match. It will display the thicknesses of the various layers.
7. If the match between model and data appears pretty good, your layer thicknesses are likely to be close to correct. If it appears to be a poor match, the tool was not able to determine the layer thicknesses correctly.

Shut Down:

1. When you are all finished with your measurements, close the Nanocalc software.
2. Turn off the Deuterium and Halogen lamps, and turn off the Nanocalc box.
3. Shut down the computer.

If at any time you feel unsure about how to use the tool, please stop work and contact a qualified user or faculty advisor. Please don't forge ahead when you are unsure, you may end up damaging the tool.

Report all accidents or tool issues to Prof. White at x72210, r.white@tufts.edu.