Arizona State University NanoFab

FILMETRICS F20 STANDARD OPERATION PROCEDURE

Rev D

Table of Contents

1.0 Purpose / Scope

1.1 Our Filmetrics F20 uses spectroscopic reflecting light, then analyzes this light over a range of wavelengths. The thicker the film, the more oscillations. The amplitude of the oscillations will help determine by the refractive index *n* and extinction *k* coefficients of the films and substrate. Single layer or multilayer films on substrates can be measured and analyzed. Typically, the F20 will measure thickness values between 150Å and 50um. The large spot size is about 1.5mm diameter.

1.2 This measurement device will be able to measure visible light from 400nm to 850nm wavelengths.

2.0 Reference Documents

2.1 Filmetrics F20 manual from Filmetrics.com. The PDF document is available on the computer desktop.

3.0 Equipment/Supplies

3.1 Clean silicon reference wafer.

3.2 Tweezers to handle wafers

3.3 Light is supplied by a tungsten-halogen bulb that generates light from 375nm to 3000nm.

4.0 Safety

4.1 Follow all safety procedures outlined in the NanoFab Handbook

4.2 Follow safety and handling procedures when working with vacuum systems and source materials.

4.3 Do not attempt to repair the tool under any circumstances. Submit a service request and contact ASU NanoFab staff.

5.0 Baseline Calibration

5.1 Ensure the light is on at the front of the Filmetrics light source detector unit. Ensure the light bulb has been on for at least 5 minutes.

5.2 Ensure the Filmetrics "FILMeasure" software is open or double click on the icon.

5.3 Performing the Baseline calibration.

Note: It is recommended to perform Baseline calibrations every 20-30 minutes due to potential drift of the data.

5.3.1 Place a clean Silicon sample and place under the F20 fiber optic detector on the sample stage.7x

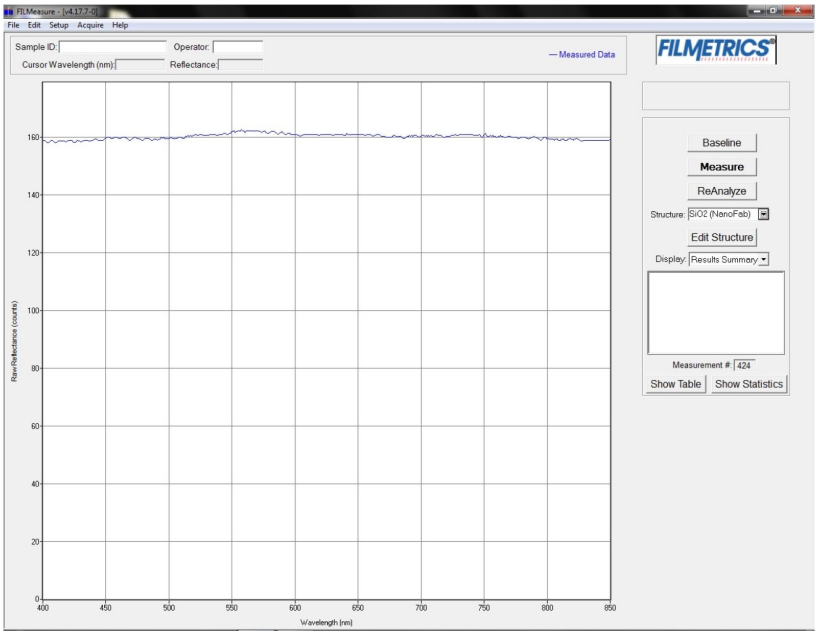
5.3.2 Depress Baseline button on the right margin display.

5.3.3 Take Reflectance Reference: Step One: Set your Reference Material. In most cases it will be Silicon.

5.3.4 Depress OK. Take Reference reading.

5.3.5 Setup: The Dark Scan could be taken with no sample on the sample stage. The tool is looking for a loss of light reflection. Depress OK.

5.3.6 The F20 is now ready to make measurements. The screen will show raw reflectance.



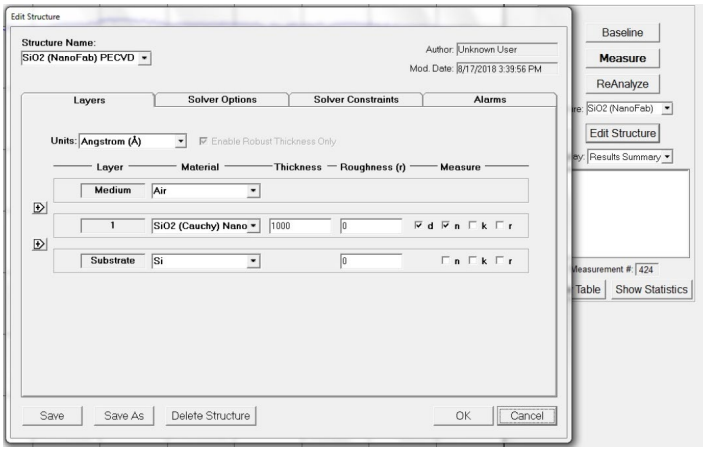
6.0 Measurement Procedures

6.1 Place your sample wafer on the sample stage under the fiber optic beam.

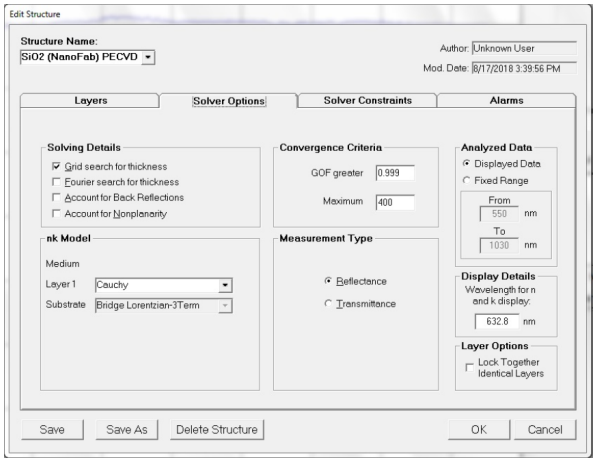
6.2 Select the Structure pull down menu and select your intended Recipe.

6.3 Depress OK to Do you want to load another Recipe.

6.4 Select the User Recipe you intend to use to model your measurement.
6.5 Select Edit Structure button to view Structure selection.
6.6 Edit Structure Layers Tab.
6.6.1 Ensure the intended material layers on the recipe are correct or require updating.
6.6.2 Enter an approximate film thickness if known.
6.6.3 Checking the Fit boxes ensures the parameters is considered for the fitting of the data. This will include D (Thickness), *n* and *k* and R (Roughness).
6.6.4 Select or deselect Fit boxes or options ultimately to improve the Goodness of Fit (GOF) value



6.7 Edit Structure Solver Option Tab.
6.7.1 The Grid method searches the entire allowed thickness range to find best initial thickness.
6.7.2 The Fourier search for thickness analyzes the oscillations present in the spectrum and determines the film thickness.
6.7.3 Measurement Type will remain Reflection.
6.7.4 Analyzed Data: The wavelengths of the spectrum used for measurements are adjustable from beyond 400-850nm.

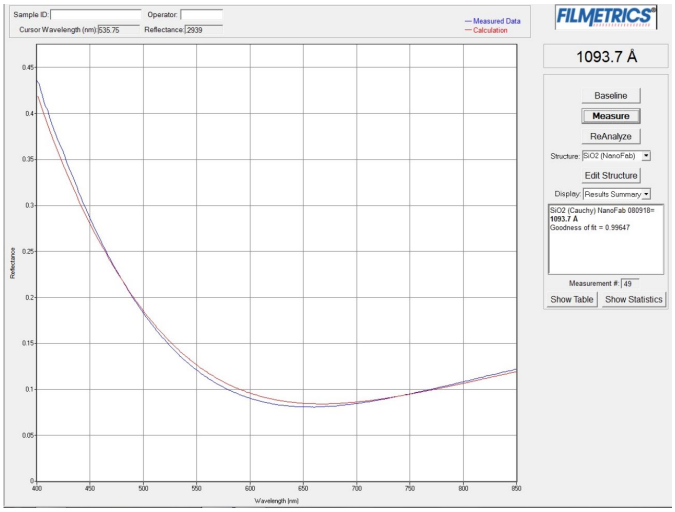


6.8 Please do not Save changes to the current Recipe.

6.9 Depress the Measure button to display reflectance and evaluate the thickness values and GOF parameters.

6.10 Depress the ReAnalyze button when trying different analysis settings on a previously acquired spectrum.

6.11 The displayed spectrum displays the measured data (Blue) and calculated model (Red) reflections. The measured data and the calculated will be close if the selected recipe matches the film.

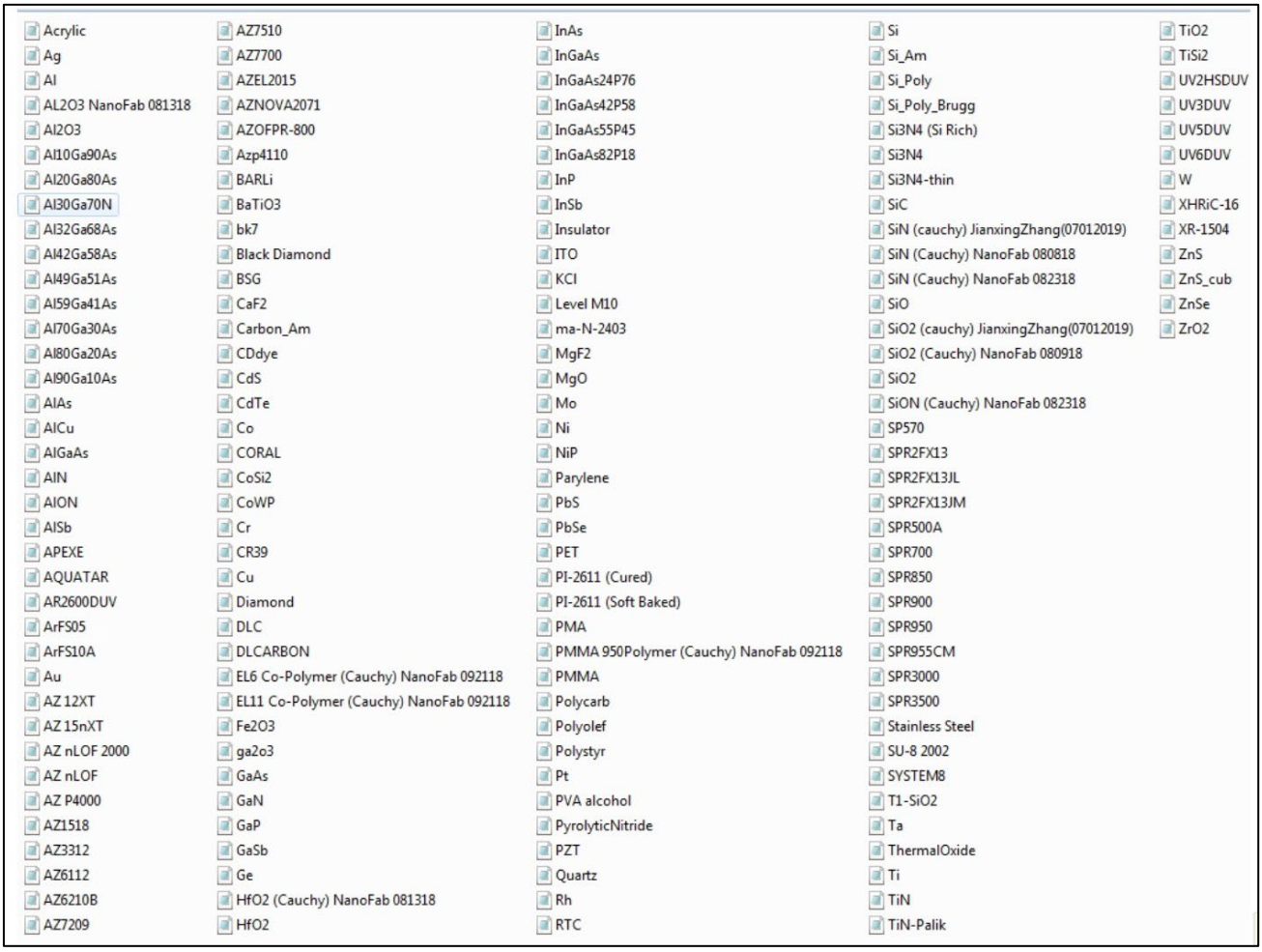


6.12 Recommendations for improved accuracy.

6.12.1 Restricting the wavelength can be helpful if n and k are not accurate over the whole wavelength range.

6.12.2 Slight amounts of surface or interface roughness may be present that will decrease the accuracy of the measurements.

7.0 Current Materials types

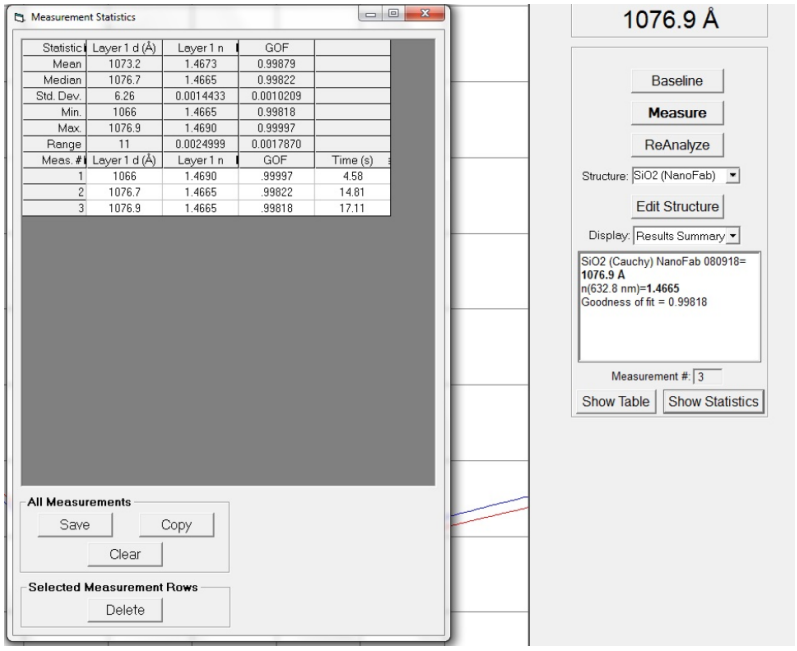


8.0 Measurement Statistics

8.1 On the right column is a button labeled Show Statistics. Select this box to open the window containing data.

8.1.1 Mean, Medium, Std. Dev., Min, Max, Range row values.

8.2 Followed by a table of values with headings, Measure #, Layer 1 d(A), GOF commands at the bottom are Save (to CSV), Copy, Clear or selected rows to delete.



9.0 Revision History

Effective Date	Originator	DESCRIPTION OF REVISION	Issue
05/05/09	Name	Initial Release	A
	Staff	Rev B	B
04/21/15	Wayne Paulson	Rev C update & fit new SOP format	C
08/16/19	Jaime Quintero	Checklist format	D