

Silicon Substrates

This note contains information related to procedures needed to determine native oxide thickness on silicon. The procedure is similar for other semiconductor substrates.

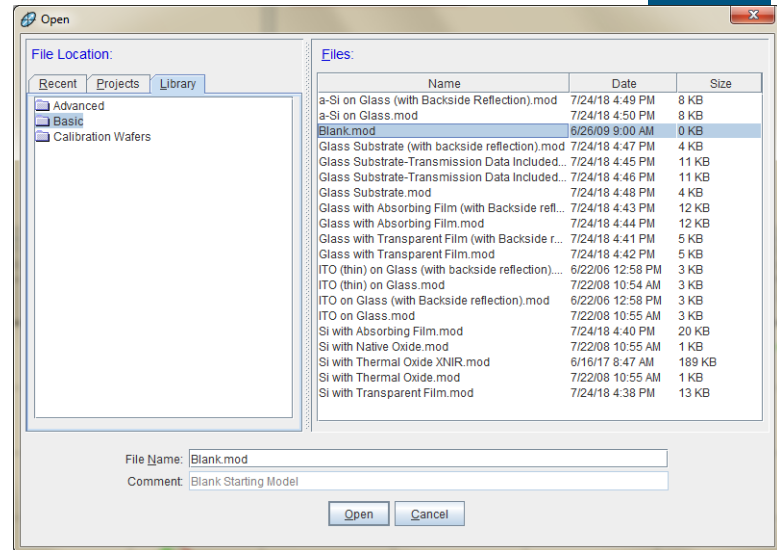
This information can then be used for subsequent analysis of coated samples using the same substrate.

Ellipsometer types	M-2000, RC2, alpha-SE
Software	CompleteEASE
Typical data required	Standard ellipsometric data at 2-3 angles between 50°-75°
Typical model required	Blank.mod
Considerations	Backside reflections



1. Measure sample or open saved data

2. Open “Blank.mod” to start
(New versions of CompleteEASE automatically start with this model loaded. If needed, from the **Model** panel, click ‘Open’. Browse the Library tab, Basic folder to find Blank.mod. Click ‘Open’ to load the model structure into the Model panel.)

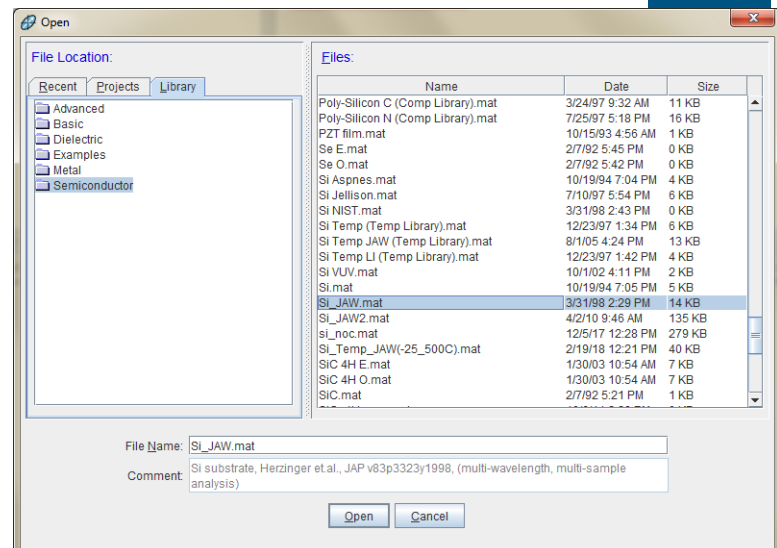


3. Click on “none” to open material file library

Substrate = none

4. Browse Library tab, Semiconductor folder to find si_jaw.mat

5. Click “Open” to add the material file to the model structure

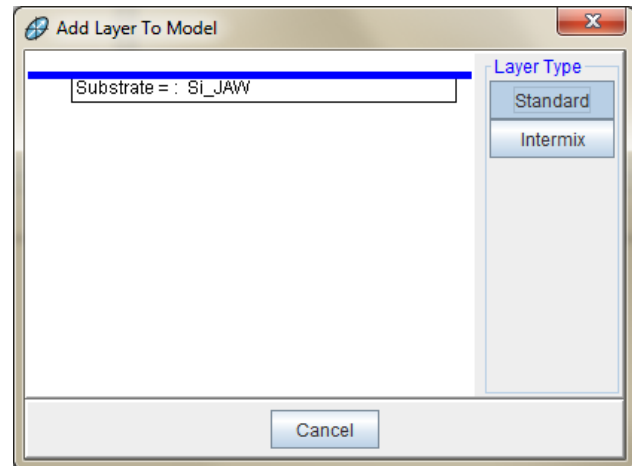




6. Click the Layer Command “**Add**” to add layer(s)

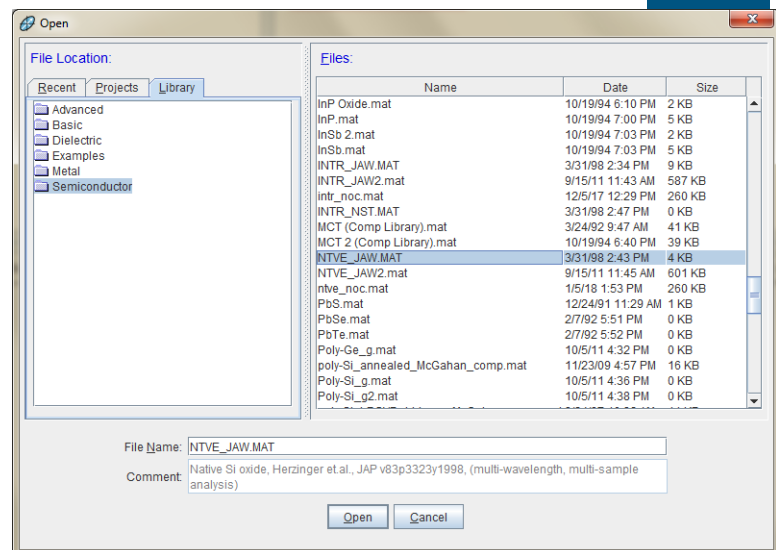
Layer Commands: **Add Delete Save**
 Include Surface Roughness = **OFF**
 Substrate = **Si_JAW**

7. Use mouse to position blue bar above substrate and click once



8. Browse Library tab, Semiconductor folder to find ntve_jaw.mat

9. Click “Open” to add material to model structure



10. Right-click “0.00nm” to make the native oxide thickness a fit parameter

Layer # 1 = **NTVE_JAW** Thickness # 1 = **0.00 nm**
 Substrate = **Si_JAW**

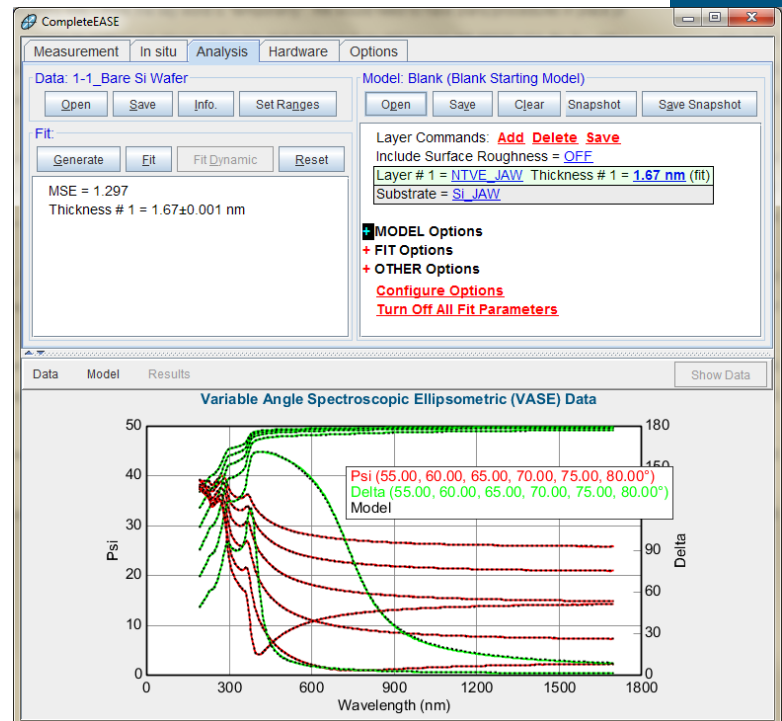
Layer # 1 = **NTVE_JAW** Thickness # 1 = **0.00 nm (fit)**
 Substrate = **Si_JAW**



11. From the Fit panel, click 'Fit'

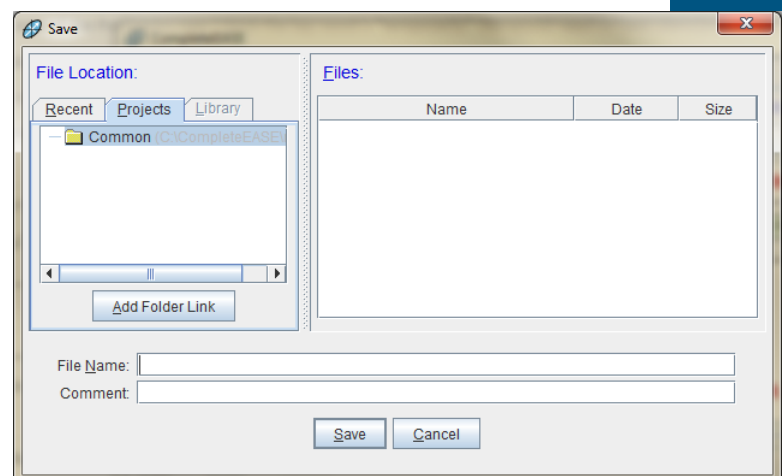
12. Evaluate result by considering:

- Do the model generated curves visually match the experimental curves?
- What is the MSE value?
- Is the native oxide thickness result physically reasonable?



13. If the result is acceptable, save the model with a unique name for subsequent analysis of coatings on same or similar substrates

(From model panel, click 'Save'. Use Recent or Projects tab to locate desired folder.)





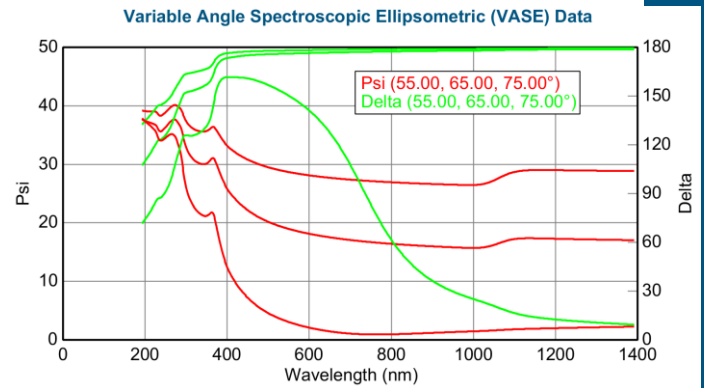
Backside reflections

If substrate is double side polished, reflections from the substrate backside may be present in the data.

Backside reflections will cause a step in the data near the substrate material's bandgap. Detection of these reflections will depend on the spectral range of your ellipsometer.

When this occurs, you can exclude this region from your analysis or account for backside reflections in your model.

To include this effect in your model, expand +MODEL Options, turn ON "Include Substrate Backside Correction", and enter substrate thickness into the model.



Layer Commands: [Add](#) [Delete](#) [Save](#)

Include Surface Roughness = [OFF](#)

Layer # 1 = [NTVE_JAW](#) Thickness # 1 = [1.67 nm](#) (fit)

Substrate = [SI_JAW](#) Substrate Thickness = [0.5000 mm](#)

- MODEL Options

Angle Offset = [0.00](#)

Include Substrate Backside Correction = [ON](#)

Transmission SE Data = [OFF](#) Reverse Direction = [OFF](#)

Back Reflections = [5.000](#)

% 1st Reflection = [100.00](#)

Model Calculation = [Ideal](#)

+ FIT Options

+ OTHER Options

[Configure Options](#)

[Turn Off All Fit Parameters](#)