Ellipsometer
Horiba UVISEL

Warning: This instrument may only be operated by those who have been trained by AAF staff and have read and signed the AAF laboratory policies.

Login:

Computer User name: Chris Yuan Password: 123456

Sample positioning and initial startup:

1. Open DeltaPsi2 software
2. Turn on light source and wait 15 min to let it stabilize
3. Place your sample on the stage and switch on the autocollimator illumination
4. Look through the eyepiece of the autocollimator and align the crosshairs so that the center overlap by adjusting two knobs underneath the stage
5. Click the "manual measurement" icon  to open the "Views" screen.
6. Toward the bottom of the window, just above the "New spectroscopic" button; enter "450" (unit is nm) as the wavelength. Press Enter.
7. Adjust the height of the stage by turning the height adjustment knob underneath the stage. Turn the knob back and forth until the S0 reaches a maximum
8. On the "Views" screen, click "S0 Adjustment" or manually change the High Voltage so the S0 is between 60-80 mV.

Data Acquisition:

9. In left-hand selection menu, expand the acquisition routine, then double click the “XXXX”.
10. Change the acquisition parameters if required (Spectral range, angle of incident, step size)- (Refer to User manual pages 42-55)
11. Click "Run". A window will pop-up and say that "Views will be closed". Click "Ok".
12. Enter your sample name and any comments you need. Click "Ok"

13. The ellipsometer will then run your sample and you will see a window with various spectra.
14. After all of the tests are completed, turn off the autocollimator illumination and the light source.

Model Fitting:

15. Click on "Create a new model" icon 

, or open an existing model you created before. Make sure "User Library" is selected and then click on the "Spectroscopic Model" button.
16. First, build a model of your substrate and your material. The purple bar is your substrate.
17. In the left-hand selection menu, expand "Application Library" --> Materials". Find your substrate material in *.dsp or *.ref files and drag it to the purple bar on the right (refer to Appendix I). If your substrate is a mixture of two or more materials, you may drag other materials into the same purple bar. Try to define the percent composition as close as possible (50% and 50% is the default composition for a two-material model).
18. Build your sample material. Choose another material from the "Materials" menu and drag it anywhere in the gray area above the purple substrate. Again, you can add more materials to this first layer and define the percent composition. You can also add more layers by dragging more materials from the menu on the left to the gray area above your sample model.
19. To the left of the purple bars, each layer will be defined starting with the substrate ("S"), your first layer ("1"), second layer ("2"), and so on. A default thickness of 1000 Å will be given for each layer as an initial guess.
20. To fit the model to the data, check the box to the left of the thickness, and an "F" will appear.
21. If your substrate and/or your layer(s) are porous, you can add "Void_asp.ref" from the "Materials" on the left. In the model, void space is treated like a chemical material.
22. Next, you need to add your data to the model. In the left-hand selection menu, expand "Results" --> "Acquisition Data" --> "(date)" --> "NonameX". Choose the run that you want to model. Drag your run to the gray bar that is above your model and to the left of the trash can.
23. The angle of incidence of the light (the angle between the analyzer and your sample, as well as the modulator and your sample) should be 70.6 degrees. If

your sample is not smooth and you expect that your run will not be exactly 70.6 degrees, the AOI can also be fitted if the box to the right of "AOI" is checked.

24. Under "Modeling description" toward the bottom of the screen, click "Edit...". Under the "Modeling conditions" tab, you will probably want to select "Experimental file full spectral range". This will fit your model to the spectral range that you defined in the initial "Acquisition Routine" window before your run. However, if you want to use a smaller range, you can use a "User defined spectral range". Click "Ok".
25. To get a first optimal guess of the unknown parameters, press the simulation button to see whether the calculated graph matches closely to the measured one. The simulation option is a fast way to check whether a model is approximately correct or not.
26. Click "Fit". You will now see a window that shows the parameters that you wanted to find. If the fit (X2) is not good enough, you can close this window and modify your model.
27. After each fit, click on Update above the graphic displayed in the model window. When you click on update it asks for writing on the sample file or you can rename and select a new path for your updated dispersion file. **NOTE: Never rewrite the updated dispersion files on the default "Materials".**
28. Data Exporting: use "Save graph to a file" to save the graph window in TIFF format, or other option for text format.

Appendix I: Material file types:

1- Reference (*.ref): These files contains tabulated values of optical constants (e.g. n, K,…) as a function of wavelength taken from literature. Optical properties in these files are fixed and cannot be adjusted.
2- Dispersion Formula (*.dsp): The dispersion formula is correlating the optical constants on wavelength using an analytical formula. A dispersion file is used when a reference file for a material is not available or if the reference file does not lead to a food fitting results (For more details refer to User manual page 87-109)

Main dispersion formula	Materials family	Materials examples
Lorentz oscillator	Transparent and weakly absorbing dielectrics	Oxides (SiO_2, SiON, Al_2O_3, HfO_2, MgO, ZrO_2), polymers, organics
Drude oscillator	Metals	Al, Ag, Cr, Cu, Ti
New amorphous, Tauc Lorentz	Semi-absorbing dielectrics and semiconductors	SiN, a-C, oxides (TiO_2, Ta_2O_5, ZnO), AlN, photoresist
Kato-Adachi, Adachi-New Forouhi	Crystalline semiconductors	AsGa, InP, InAs, HgCdTe, InGaP, ZnTe, CdTe