

# **VASE SYSTEM OPERATIONAL INSTRUCTIONS**

- 1. All users must first be authorized to use the system by Prof. Hall. Unauthorized users will face disciplinary action.**
- 2. All users are required to complete relevant entries in the logbook when using the system. Failure to do so will result in disciplinary action.**

# VASE SYSTEM OPERATIONAL INSTRUCTIONS

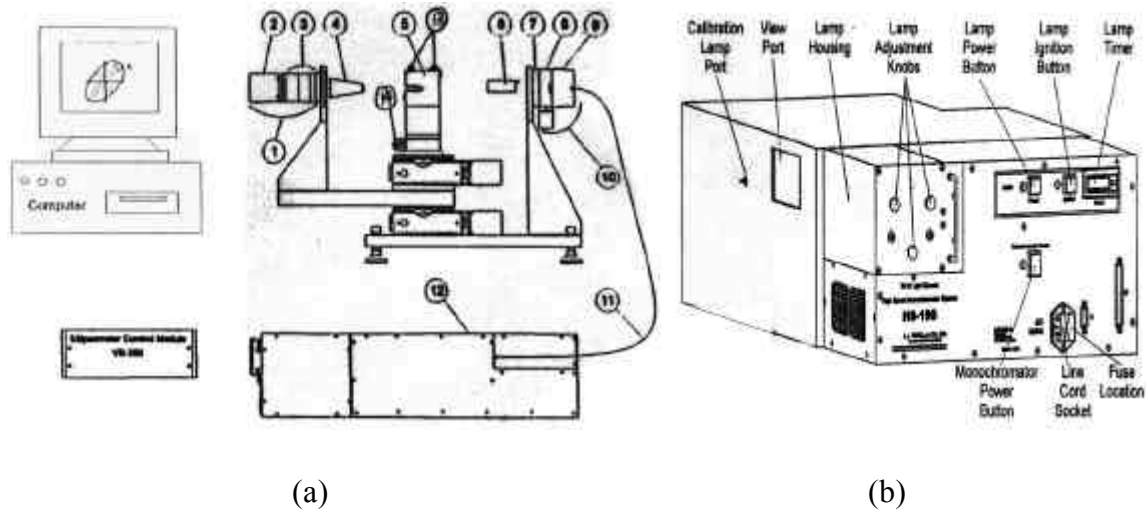


Figure 1 (a) Typical VASE System, (b) HS-190 Monochromator.

1. Output Unit	2. Detector Endcap	3. Analyzer
4. Iris and Nosecone	5. Sample Stage	6. Alignment Detector
7. Alignment Detector Mount	8. Polarizer	9. Collimator
10. Input Unit	11. Fiber Optic Cable	12. Monochromator
13. Sample Tilt Knobs	14. 'Z' Translator Knob	

## Caution:

1. **Don't use any tools to tighten the fiber optic cable. Be careful not to bend the fiber optic cable.**
2. **Don't turn the lamp adjustment knobs. Excessive stress may cause the lamp to explode.**

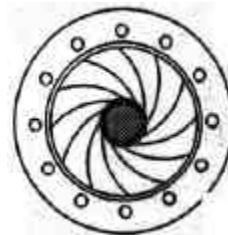
## Procedure:

1. Ensure VB-250 ellipsometer control module power supply is on.
2. Ensure HS-190 monochromator power supply is on.
3. Ensure the lamp power is on. Push lamp ignition button to ignite the arc lamp.
4. Start WVASE32 program. Select Hardware window. Select Hardware|Initialize on the menu bar at the top of WVASE32 screen. Wait until the Hardware Window updates with the message: "Hardware initialized but not calibrated."
5. Beam alignment (step 6) and system calibration (step 8) are required every time you initialize the system. System calibration is needed

every 4 hours if most accurate data is required. Otherwise you may proceed to sample alignment (step 7) and data acquisition (step 9).

#### 6. Beam Alignment

- a. Select Hardware|Move|Angle\_of\_Incidence. Enter 90 for the new angle and click “OK”.
- b. Select Hardware|Move|Monochromator|White\_Light. The Monochromator will go to the white light position.
- c. Use a business card to check the beam of white light. It should be present between the output unit and the input unit. Turn the ‘Z’ translator knob to move the sample stage back until it does not block any portion of the light beam.
- d. Examine the beam on the iris (as shown in Figure 2) which is located in the nosecone of the output unit. Adjust the iris aperture as necessary to view the beam. It should be centered. **Never perform any scan if the beam alignment is in question.** Any data acquired without proper alignment could be incorrect.



*Figure 2. Iris*

#### 7. Sample Alignment

- a. Select Hardware|Move|Angle\_of\_Incidence. Enter 75 for the new angle.
- b. Carefully insert the Alignment Detector into its keyed socket on the input unit (**Do not break the pins of the detector**) and ensure that the detector fixture is firmly seated.
- c. Turn on the vacuum pump.
- d. Mount the sample on the sample stage. The sample should be roughly centered on the sample stage. When performing a system calibration (step 8), the sample should be the calibration wafer. Otherwise the sample you wish to characterize.
- e. Select Hardware|Acquire\_Data|Align\_Sample.
- f. A gray intensity bar will appear in each of the four quadrants of the display on the computer screen.
- g. Adjust the sample tilt knobs to align the cross hair on the screen.

- h. The alignment screen in Figure 3 shows proper alignment of the beam. The cross hair is less than  $\pm 1$  on each X and Y scale. The gain is at 1.
- i. Once the sample is aligned press <Esc>.
- j. Choose “OK” in the following dialogue box. Now adjust the ‘Z’ translator knob to maximize the signal.
- k. Once the signal is maximized press <Esc>.
- l. The alignment detector may now be removed. For samples with adequate reflectivity or to intentionally reduce the beam size, the detector can be left in place.

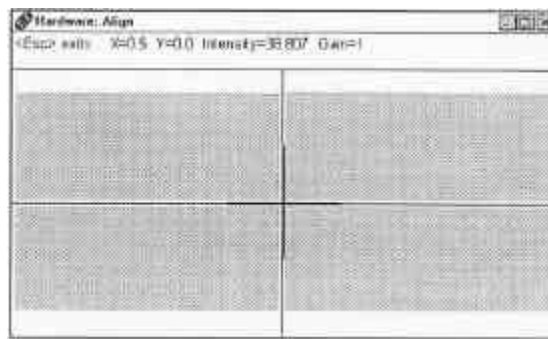


Figure 3. Proper Sample Alignment

## 8. System calibration

- a. Perform the sample alignment procedure (step 7) for the calibration wafer ( $\sim 25\text{nm SiO}_2$  on Si).
- b. Select Hardware|Acquire\_Data|Calibrate\_System. Choose fine calibration. Use the default values.
- c. When the calibration is complete the graph window will appear similar to Figure 4.
- d. Remove the calibration wafer from the sample stage.

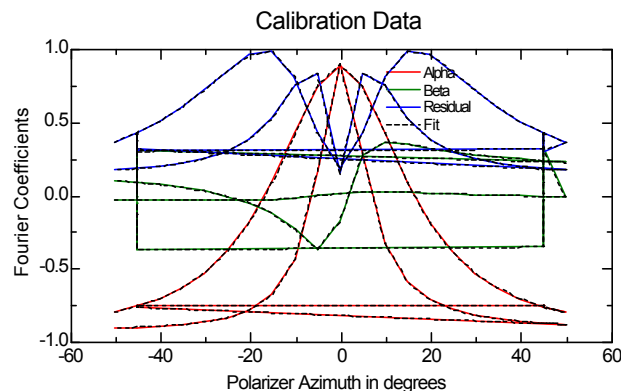


Figure 4. Calibration Graph

9. Data Acquisition

- a. Select Hardware|Acquire\_Data|Spectroscopic\_Scan.
- b. Change wavelength range or angle range or settings if default values are not appropriate. The scan will take 20 minutes or so.
- c. Save the file in 'User' directory.

10. To characterize more samples, repeat steps 7 and 9.

11. Data Analysis

Build a model for the desired sample and analyze the acquired data to get desired parameters, such as film thickness and optical constants.

12. Close the WVASE32 program.

13. Push lamp power button once to turn off the arc lamp, and then once again to turn back on the lamp power (now the ignition button and arc lamp will be off). This keeps the electronics on at all times to reduce system warm up time. **Do not leave the arc lamp on unless you are certain you will be using the system again within 4 hours. The arc lamp lifetime is only ~500 hours (~21 days) and replacement lamps cost >\$220 (~\$10 per day to operate).**