Recommendations for Using the ALS300 on AMAT Endura2/Centura2 Deposition Equipment

Summary: This document describes the steps and recommends criteria for successful leveling of certain elements in Applied Materials (AMAT) Endura2 and Centura2 300 mm tool platforms, including FOUP, FI robot blade (for Kensington models), buffer and transfer robot blades, transfer and deposition pedestals. These recommendations are for preventive maintenance when the tool is off the production line. It is assumed that the above stations are largely leveled, as these recommendations are most useful in pinpointing small inclination errors of less than 1° (i.e., a few thousandths of an inch over the diameter of a wafer).

Requisite Equipment

In order to perform any of the leveling steps recommended below, the following equipment will be needed:

- ALS300 (fully charged)
- Endura2 (or Centura2) tool with all stations to be characterized at temperatures <70°C
- Fully functional automation (robots) and ability to over-ride robot recipes or access a "leveling recipe"
- (Optional) OEM-recommended fixtures for teaching robots
- (Optional) ¼″ shim for robot wrist height adjustment
- Laptop running LevelView™ application
- LevelView™ software setup:
    - Go/No Go region set for ±0.05°
    - Stabilization time set for 20 s
    - Stabilization sensitivity set for 0.05°
      Note: Logging data could be continuous such as every 5 s or simply by pressing "Log A Reading Now".
- (Optional) Log file with historical inclination data for the stations of interest

Leveling the Tool

The goal of leveling the tool is to insure that all stations where a wafer would rest – either during transfer or during process – are all *coplanar*, i.e., all have inclinations that are within approximately ±0.05° from each other. We consider this the safest Go/No Go criterion for leveling your tool in order to prevent wafer damage (even in the form of added particulates) or breakage.

Use of ALS300 insures that comparable, objective records exist about the inclination of various stations. Keeping track of inclination variations over time could reveal weakening of the robot blades (e.g., twisting, drooping effects), erosion of transfer pins in process chambers, or other phenomena that adversely affect the deposition process.

Leveling the FOUP

It is preferable to use a low-wear, warp-free FOUP for this characterization. Leveling steps:

1. Place empty FOUP on the load port.
2. Place ALS300 in slots 1, 13, and 25 insuring that it is evenly supported by four points along the slot and that the slot gap appears even. Log measurements as soon as they

are stable. Comparing measurements taken at all these slots could help determine if the FOUP is relatively stable and level.
3. Place ALS300 in slot 12 or 13 insuring that it is evenly supported by four points along the slot. Log measurements as soon as they are stable.
4. If the inclination of the ALS300 is not within the Go/No Go region, adjust support pins on the load port until inclination of the ALS300 is within the Go/No Go region. Log measurements as soon as they are stable.

Leveling the Factory Interface (FI) Robot Blade

Home robot and follow the leveling steps:

1. Place ALS300 on the retracted blade (if FI is open) or pick up ALS300 from the FOUP and retract robot blade fully (if FI is closed). Insure the ALS300 notch faces the blade wrist. Note (log) inclination.
2. Rotate blade 90°, 180°, and 270°and note (log) respective inclinations.
3. Compute average pitch between the 0° and 180° positions, and between the 90° and 270° positions. If they are not within ±0.05° of each other, make the necessary adjustment using the adjustment screws of the robot.
4. If the 0°, 90°, 180°, and 270° positions cannot be leveled with each other, check for wear on the robot wrist.
5. Place ALS300 on the retracted blade (if FI is open) or pick up ALS300 from the FOUP and retract robot blade fully (if FI is closed). Note (log) inclination. Set LevelView™ to log inclination data every second.
6. Moving slowly (≤1″ per second) extend blade into the FOUP and continuously note (log) changes in inclination as the blade is extended (Note: make sure that data logged is stable: before logging a new data point wait at least 20 s after advancing each new distance). Log inclination with blade fully extended. If the inclination data thus observed (collected) are not within ±0.05° of each other, the robot blade might need servicing.

Leveling the Buffer and Transfer Robot Blades

1. Place ALS300 on the retracted blade (if chamber is open) or pick up ALS300 from the degas/transfer pedestal and retract robot blade fully (if chamber is closed). Insure the ALS300 notch faces the blade wrist. Note (log) inclination.
2. Rotate blade 90°, 180°, and 270°and note (log) respective inclinations.
3. Compute average pitch between the 0° and 180° positions, and between the 90° and 270° positions. If they are not within ±0.05° of each other, make the necessary adjustment using the adjustment screws of the robot.
4. If the 0°, 90°, 180°, and 270° positions cannot be leveled with each other, check for wear on the robot wrist.
5. Place ALS300 on the retracted blade (if chamber is open) or pick up ALS300 from the degas/transfer pedestal and retract robot blade fully (if chamber is closed). Note (log) inclination. Set LevelView™ to log inclination data every second.
6. Moving slowly (≤1″ per second) extend blade into the degas/transfer chamber and continuously note (log) changes in inclination as the blade is extended (Note: make sure that data logged is stable: before logging a new data point wait at least 20 s after advancing each new distance). Log inclination with blade fully extended. If the inclination data thus observed (collected) are not within ±0.05° of each other, the robot blade might need servicing.

Leveling the Pedestals (Pass-Throughs and Process)

1. Raise wafer transfer supports (i.e., hoops or pins).
2. Verify that clearances through the slit valve are ≥0.04″ (bottom) and ≥0.08″ (top) when ALS300 is in the middle of the slit valve. You may need to use the ¼″ shim for adjusting robot wrist height. Extend robot arm with ALS300 over the supports. Bring ALS300 in full contact with the supports. Note (log) absolute inclination. Set LevelView™ for relative measurements.
3. Lower wafer transfer supports (i.e., hoops or pins). Bring ALS300 in full contact with the pedestal. Note (log) inclination.
4. If inclination is outside the Go/No Go region, make adjustments using the leveling screws. Note that you will be making the wafer transfer plane coplanar with the pedestal.
5. Raise wafer transfer supports again if needed. Note (log) inclination.

Verifying Coplanarity of Susceptor with Gas Distribution Plate ("Shower Head"

1. With the process chamber open, place ALS300 on the outer rim so that it is completely supported and it is level. Note (log) inclination. Set LevelView™ for relative measurements.
2. Place ALS300 on the susceptor (lift pins lowered). Note (log) inclination.
3. If inclination is outside the Go/No Go region, make adjustments using the leveling screws. Note that if any adjustments are made, other stations (such as wafer transfer supports, robot blades) might need adjustments as well.
4. Verify that the adjustments made have not caused the susceptor to go out of coplanarity with the transfer pins.
5. Alternatively, with the chamber lid closed, cycle ALS300 into the process chamber and place is on the susceptor. Note (log) inclination.
6. Compare susceptor inclination measured with inclination of chamber outer rim from a historical log. If susceptor inclination differs by more than ±0.05° from that of the chamber's outer rim, adjust susceptor via the adjustment screws.

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