

TECHNICAL NOTE

FabGuard® Tool Data Sensor for Equipment Data Collection and Diagnostics

MANAGING TOOL DATA

To collect tool parametric information for better results and manage it at system level, INFICON FabGuard Sensor Integration and Analysis System uses the unique concept of the Tool Data Sensor (TDS). TDS is a distinctive feature of FabGuard that bundles tool SVIDs and organizes them by chamber. Once organized in this way, Tool Data Sensors allow convenient viewing and analyzing of process recipes for individual chambers. TDS also allows correlation of tool events, tool parameters, and tool recipe setpoints for optional add-on sensors.

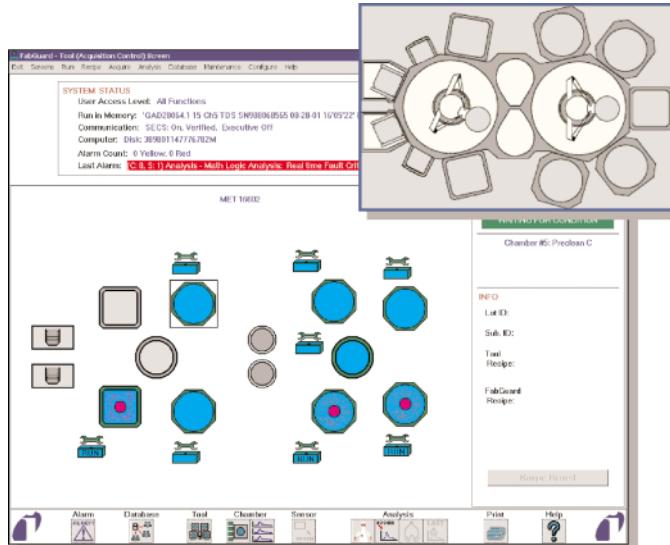


Figure 1. System-wide deployment of Tool Data Sensors

Figure 1 shows a PVD cluster tool with each chamber configured with a Tool Data Sensor. The toolbox icon indicates that SVIDs specific to a chamber are being acquired and analyzed. For each TDS, FabGuard uses a recipe table to determine what process inputs are expected for each wafer process.

There are several benefits from collecting tool information:

1. Recipe Verification – determines if the tool loaded the proper recipe;

2. Process Verification – monitors the proper execution of process recipes;
3. Process Correlation – correlates process state to measurements made with add-on sensors, such as RGAs, RF probes, and particle sensors.

Process and Recipe Verification monitor key aspects of equipment operation during wafer processing. Thus, product wafers are protected from being misprocessed, because expected process inputs do not match actual process conditions.

SVIDs provide information about the execution of a process recipe. Figure 2 shows data obtained by polling SVIDs for an oxide etch chamber. Some of these SVIDs represent machine settings. When SVIDs are plotted versus time, they can be considered representative of recipe setpoints. Other SVIDs provide the output from each of the many sensors that are built into the tool. By including other SVIDs, FabGuard can monitor many other aspects of recipe execution.

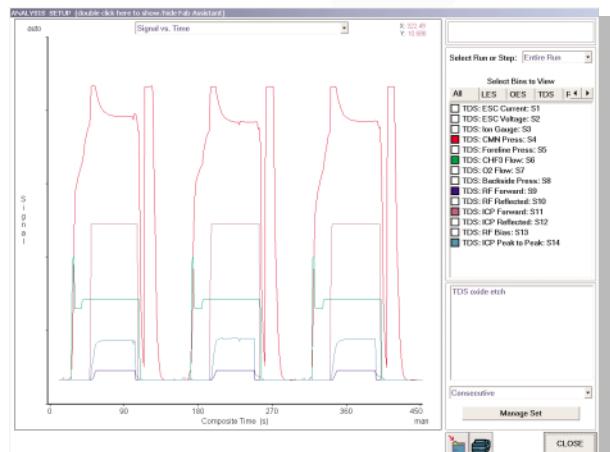


Figure 2. Etch chamber Status Variables for several wafers

CONFIRMING PROCESS RECIPES

Recipe Verification confirms that process recipe setpoints match known setpoints for individual recipes. Since the

correct process recipe is not always executed, this prevents accidental or unauthorized changes in recipe setpoints that result in wafer misprocessing.

VERIFYING THE PROCESS

The incorrect execution of process recipes, often undetected, can be a costly event.

FabGuard **Process Verification** provides:

1. confirmation that actual process inputs match recipe setpoints. This generally involves detecting problems when system components (MFCs, power delivery, wafer temperature, etc.) are unable to execute properly.
2. correlation of tool events to measurements made with add-on sensors, e.g. RGA, particle sensors, OES, etc. (See Smart Vacuum Diagnostics, FabGuard Analysis Examples)

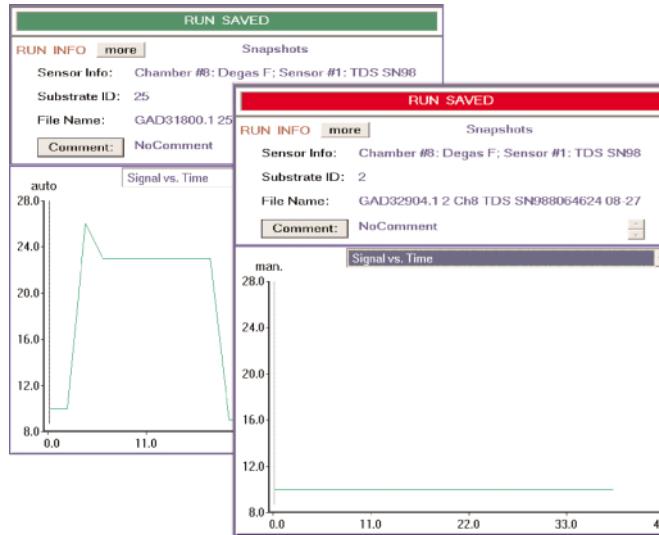


Figure 3. Process Verification: confirming expected process inputs.

Figure 3 illustrates how FabGuard Process Verification capability can be implemented to safeguard wafers by detecting simple, but costly, problems.

A single Status Variable (SV), e.g., lamp current, is obtained through SECS and plotted for two wafers undergoing degas in preparation for metals deposition. In this case, lamps are used to heat the wafers under vacuum to remove adsorbed contaminants. Degas recipes are frequently time-power based. The plot on the left shows the expected recipe profile for lamp current versus time. This particular recipe calls for 23 amps (40% power) for 15 seconds. FabGuard detected a fault and alarmed on the wafer depicted on the right. The reason for the fault is easily seen; the degas lamp power did not increase above the 10 amp idle current.

FABGUARD PROTECTS FROM COSTLY PRODUCT LOSS

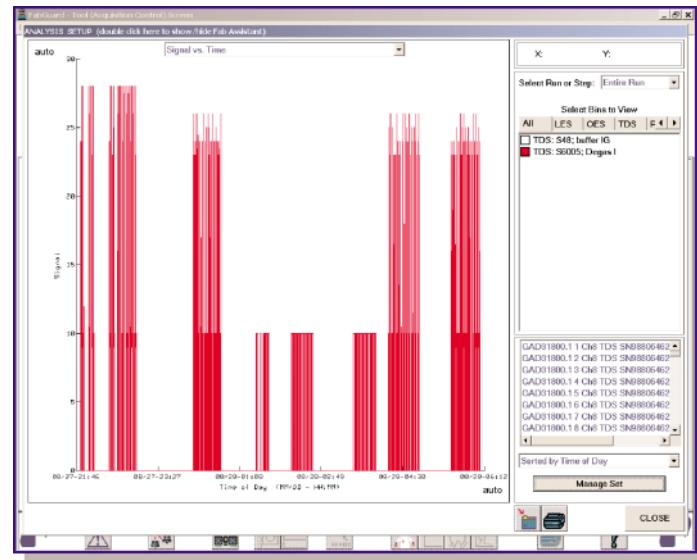


Figure 4. FabGuard Multi-Run Viewer; Wafer Degas Chamber

Since faults are rarely confined to a single wafer, a simple problem becomes costly. Figure 4 shows the same degas SVID for several lots. FabGuard detected the same fault for three entire lots - no degas and, therefore, no surface preparation. These lots proceeded to metals deposition chambers.



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