The Challenge

Needling to improve the performance, and extend the lifetime, of an aging fleet of plasma etching tools, this long-time Impedans client sought a solution with the following requirements:

- Monitor the vital-signs of each plasma etching tool
- Determine the health of the RF power delivery subsystem
- Identify if the substrate was properly positioned by the robotic arm
- Communicate data seamlessly to the factory host
- Prevent product scrappage and reduce maintenance costs

The Process

Impedans’ RF and mechanical design teams identified the optimum location for Octiv RF sensor installation. A custom sensor form factor was designed. A first unit was then manufactured and installed. Data was captured while the tool was in production over a predefined period. Product was inspected offline in the usual way. The time stamps for defective products were correlated with RF data from Octiv. Impedans experts analysed and modelled the RF data and identified fault signatures. Corrective action procedures were implemented based on Impedans recommendations. Impedans software experts worked closely with the customer’s software team to implement a simple, robust Ethernet protocol to communicate sensor data to the factory host. Once the first few product scrap events were prevented, roll out across the entire fleet was initiated.

Achievements

RF Power Subsystem Health
The first problem to be solved was product scrappage due to stress in the power delivery subsystem. Impedans experts discovered that certain plasma etch processes were operating at the edge of the matching unit’s impedance range. This caused the matching unit to become unstable, occasionally. The RF data collected by the Octiv sensor was used to identify the onset of this unstable mode. The problem was solved by restarting the process.

Substrate Misplacement
Substrate misplacement on the electrostatic chuck, due to component wear and tear, was periodically leading to wafer scrappage. This fault was undetectable from the pre-existing tool feedback i.e. forward and reflected power showed no error. Thus, several hours of scrappage could go undetected. Octiv provided a clear signature of the substrate misplacement fault enabling corrective action to be taken.

Reduced Maintenance Time
Due to the reliability of the RF data provided by Octiv, test wafer qualifications were reduced by 70%, enabling higher throughput of production wafers.

Our Solution

The Octiv RF sensor was integrated in the etching tool RF path, at the output of the matching network. The key RF parameters were measured and streamed over the network to the factory host. Data was recorded, time-stamped and stored in the customer’s database along with the tool context data. The data captured during fault events were later analysed. Correlations between RF data and fault conditions were established. Control limits were then applied to relevant parameters, excursions from which are used to indicate faults and initiate corrective action.

Results at a glance

- 70% REDUCTION in Tool Maintainence time
- SEVERAL HOURS Scrap Prevention Per Fault
- 10% INCREASE in Product Throughput
- >1000% RETURN On Investment in 1 year
- >$1 Million Projected saving in maintenance and Scrap Reduction per tool per annum directly attributed to the integration of Impedans’ Octiv Sensing Platform

www.impedans.com | +353 1 842 8826 | info@impedans.com