

## The Challenge

Needing 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 off line in the usual way. The time stamps for defective products were correlated with RF data from **Octiv**. Impedans experts analysed and modelled the

## 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 data base 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.

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.

## Results at a glance



**70% REDUCTION**  
in Tool  
Maintenance time



**SEVERAL HOURS**  
Scrap Prevention  
Per Fault



**10% INCREASE**  
in Product Throughput



**>1000% RETURN**  
On Investment in 1 year



**>\$1Million**

Projected saving in maintenance and Scrap Reduction per tool per annum directly attributed to the integration of **Impedans' Octiv Sensing Platform**