

The Challenge



Plasma processing is used extensively in medical device manufacturing. Applications include the modification of surfaces (to improve adhesion or reduce friction), sterilization and bio-compatible coatings for implants. Impedans have assisted several multinational medical device manufacturers to implement plasma measurement solutions to improve process performance and reduce product scrap. We have developed several applications to detect RF related issues, such as arcing and equipment malfunction, which lead to poor tool performance and reduction in product yield. The main applications can be summarised as follows:

- Direct ion current measurement to detect plasma ignition failure at intervals through a 50 Hz power cycle, in processes used for **catheter** treatment
- RF matching unit tracking at millisecond report rates for sub-second RF **sterilization** processes
- Direct ion energy measurements on multiple shelves (simultaneously) in **stent** and **catheter** plasma processing chambers
- RF impedance monitoring and arc detection for process monitoring of plasma chambers used for treating various **in-vitro medical devices**.

The Process



Impedans' development team works with the customer to find the optimum plasma sensing solution for their application. A custom sensing solution is developed. The sensor is manufactured and installed. Impedans' software team work in tandem with the company's IT team to identify the optimum solution for data management if necessary. Data is captured for a range of experimental conditions. Impedans plasma team collaborate with Impedans experts to analyse the data and identify fault signatures. Corrective action procedures are developed in collaboration with Impedans experts. The customer can avail of the Impedans Protect support packages to maintain the accuracy of the custom sensing platform long into the future.

Our Solution



A custom **Langmuir** probe design and algorithm was developed for a 50 Hz ignition failure application. The **Langmuir** probe was installed in place of the *catheter* and the measurements clearly showed periods when the plasma did not strike, leading to unprocessed regions of the catheter. These measurements enabled the customer to fine tune the equipment and solve the issue. The **Octiv** RF sensing platform was ideal for millisecond tracking of the matching network in the *RF sterilization* process. The customer also made use of the industrial EtherNet/IP protocol for process monitoring. A custom **Sension** (retarding field energy analyzer) was developed for a multi-shelf plasma processing chamber application. This system highlighted that plasma was failing to ignite between some shelves leading to *stent/catheter* scrap. The customer used this data to track the source of the problem and improve tool performance. The **Octiv** RF platform and **Alfven** event detector platform were used to monitor plasma impedance and RF arcs in a process used for *in-vitro* medical device processing. This provided the customer with invaluable data for their process monitoring and control applications.

Value Add



Medical device customers utilise the enormous pool of plasma and RF expertise built up by Impedans over many years to tackle their plasma processing issues. Sensing and data management systems are tailored to the needs of the medical device customer. In all cases the return on investment far exceeded the cost of implementation. As medical device processing becomes more complex and production volumes are ramped up, smart sensing and data management capabilities are crucial requirements.

**Medical Device
Manufacturers**
Results at a glance

- Critical Process Problems Solved
- Increased Throughput
- Improved Process Performance
- Outsourced RF & Plasma Expertise
- Return on Investment Far Exceeds Installation Costs