

Machine Learning-Based Predictive Maintenance and Process Optimization for Plasma Semiconductor System

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CONTACT

Alvin Viray
aviray@uci.edu
tel: 949-824-3104.



OTHER INFORMATION

CATEGORIZED AS

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- » Process Control
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BRIEF DESCRIPTION

An innovative machine learning system for real-time monitoring and optimization of plasma semiconductor manufacturing.

FULL DESCRIPTION

This invention introduces an advanced framework that monitors and improves plasma-based semiconductor manufacturing machines in real time. It combines data from programmable logic controllers (PLC), hyperspectral plasma imaging, and high-resolution current/power monitoring to enable dynamic optimization. The system leverages machine learning models developed alongside standard operation procedures and plasma recipes to assess machine health, predict failures, and optimize conditions. This externally integrated solution reduces downtime, improves yield, and extends equipment lifetime, addressing the limitations of traditional schedule-based maintenance and post-process inspections in plasma processing systems.

SUGGESTED USES

- » Semiconductor manufacturers using plasma processes (etching, deposition, cleaning, surface treatment).
- » Retrofit upgrades for existing plasma equipment to enable real-time monitoring and predictive maintenance.
- » Development of AI-driven, autonomous semiconductor fabrication tools.
- » Integration into industrial IoT platforms for advanced process monitoring and optimization.

ADVANTAGES

- » Non-invasive, scalable integration with existing plasma systems without disrupting operation.
- » High-resolution, real-time monitoring by combining electrical and optical sensor data.
- » Multimodal data fusion provides deeper process and equipment insight than conventional methods.
- » Machine learning enables early fault detection and predictive maintenance, even with limited historical data.
- » Real-time process validation and optimization without relying on post-process inspection.
- » Foundation for AI-driven, autonomous plasma processing systems.

PATENT STATUS

Patent Pending

UCI Beall
Applied Innovation

5270 California Avenue / Irvine, CA
92697-7700 / Tel: 949.824.2683



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