Quantum System RFEA Applications

Ion and Neutral Deposition Rate Monitor

Retarding field Energy Analyser with Integrated QCM

https://www.impedans.com/products/quantum-rfea-system/
How to transfer HIPIMS processes using different cathodes and machines?

**Process transfer from R&D to small industrial cathode**


This paper addresses issues concerning the transfer between different cathodes and coating systems. Instead of focusing on the electrical parameters applied at the cathode the situation at the substrate position is observed. Plasma properties like electron and ion density or electron temperature, as well as the ion to neutral ratio of the film forming species are used to characterise the process conditions for the film formation.

Some example data is shown to the right.
How to transfer HIPIMS processes using different cathodes and machines?

Results of film growth and morphology shown below as first indication of proper choice for a successful approach for process scaling and transfer.

Process transfer
Coatings with similar I/N-ratio

I/N film forming species $\sim 0.25$
R&D Cathode (45 cm²)

Industrial cathode (315 cm²)

Configuration C:
Melec: 600 V
Starfire: 650 V
I/N-ratio $\sim 0.25$

Configuration D:
Melec: 675 V
Starfire: 700 V
I/N-ratio $\sim 0.55$
New design of compact retarding field analyser with integrated quartz crystal microbalance: Impedans Ltd.

Measurement of deposition rate and ion energy distribution in a pulsed dc magnetron sputtering system using a retarding field analyzer with embedded quartz crystal microbalance

DOI: https://doi.org/10.1063/1.4946788

In this research work, the IEDF and Cu deposition rates are studied in an asymmetric bipolar p-dc sputtering system using the Quantum RFEA-QCM design. The effect of ion energy, substrate rf biasing, discharge power, and pressure on the deposition rate are also examined.

Some example data is shown to the right
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Deposition rate vs time at different substrate rf biasing

Deposition rate and average ion energy vs different substrate biasing.

IEDF on a grounded substrate at a fixed (a) pressure and (b) power.

IEDF on a floating substrate at a fixed (a) pressure and (b) power.
New design of compact retarding field analyser with integrated quartz crystal microbalance

(a) IEDF on a substrate biased at three different rf powers (20 W, 40 W, and 60 W). (b) Average ion flux and average ion energy vs RF bias.

(a) Deposition vs time graph to determine percentage decrease. (b) Percentage decrease in the deposition rate after ions are turned on.

Deposition rate vs p-dc power at different pressures on a (a) grounded substrate and (b) floating substrate.
Measurement of the deposition rates in an ALD Plasma

Evidence for low-energy ions influencing plasma-assisted atomic layer deposition of SiO$_2$: Impact on the growth per cycle and wet etch rate

DOI: [https://doi.org/10.1063/5.0015379](https://doi.org/10.1063/5.0015379)

The Quantum sensor was used in this paper to measure the Deposition rate with and without Ions in an Atomic Layer Deposition (ALD) SiO$_2$ plasma. Results demonstrated that ions have a stronger impact on the plasma ALD of SiO$_2$ than usually considered.

Some example data is shown to the right.
Measurement of the deposition rates and Ion:Neutral fraction in a HiPIMS discharge

Effects of HiPIMS discharges and annealing on Cr-Al-C thin films

DOI: https://doi.org/10.1016/j.surfcoat.2020.126141

The Quantum sensor was used in this paper to measure the Deposition rates and the Ion:Neutral ratio. The effect of HiPIMS duty cycle and substrate bias potential ($U_B$) on the thin film composition were investigated in detail.

Some example data is shown to the right