

# Quantum™ System

## Ion and Neutral Deposition Rate Monitor



### Retarding Field Energy Analyser with Integrated QCM

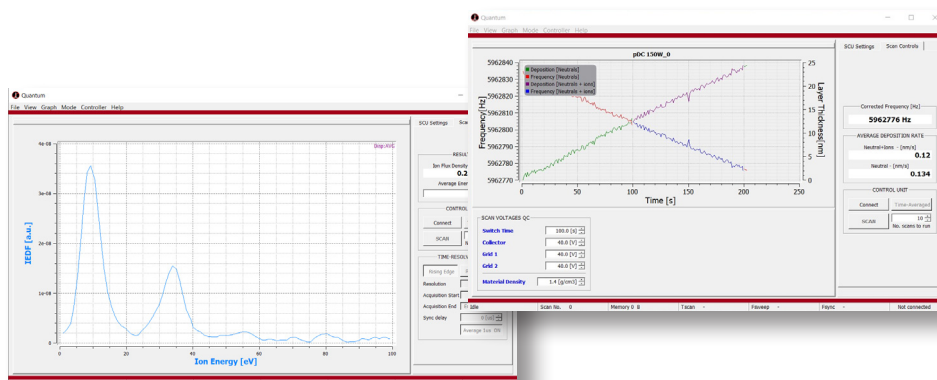
The Quantum system is comprised of a retarding field energy analyser with integrated quartz crystal microbalance (QCM), used to measure the ion energy distribution (IED) and the ion-neutral deposition ratio at a surface inside a plasma reactor. This system measures and displays deposition rates, IED, ion flux and the DC bias voltage at the surface on which the sensor is deployed. Using crystals coated with specified materials, the system can also measure etch rates of ions and neutrals. The system was designed to be mounted on electrically biased surfaces including radio-frequency (RF). A unique shielding structure allows accurate detection of the millivolt level, 6 MHz, crystal oscillation frequency in the presence of RF bias levels up to 900 V peak-to-peak. Unlike other QCM systems, no water cooling of the crystals is needed. A compensation crystal, mounted next to the measurement crystal, is not exposed to plasma particles and used to compensate for temperature effects on the oscillating frequency of the measurement

#### Key Features

- Measure the Ion Flux and Ion energy distribution energy range up to 2000eV (process dependant).
- Deposition rate resolution of 12.3ng/cm<sup>2</sup>. Suitable for grounded, floating and RF biased conditions.
- Measures deposition rates and etch rates of ion and neutral species.
- Holders with different geometries available upon request.
- Fully automated software with IED and deposition rate modes.
- Replaceable sensor elements with different sensitivities.
- Sensor elements and holder available in anodised aluminium, bare aluminium or stainless-steel options.

#### Key Benefits & Applications

- Designed for transferring deposition processes from R&D to production environments.
- Provides in-situ measurement of the IED and deposition rates under plasma processing conditions.
- Provides insight for fundamental research and for plasma model validation.
- Generate process data for customer escalations or product marketing.
- Correlate process performance with the key plasma process drivers (ion energy and ion flux).
- Measure the ion/neutral ratio, a key parameter for thin film properties.
- Use crystals coated with your specified material to investigate etch rates of ions and neutral species.



## Electronic Control Unit Specifications

# Voltage channels	3
Voltage range	-2000 V to +2000 V
Current range	10 nA to 60 $\mu$ A
Connectivity	USB 2.0
Synchronisation	TTL Input

## Crystal Monitor Specifications

Frequency range	3.5 to 6.1 MHz
Frequency resolution	1 Hz
Mass resolution (at crystal)	12.3 ng/cm <sup>2</sup>
Mass resolution (at sensor surface)	372.73 ng/cm <sup>2</sup>
Film thickness resolution (Copper)	0.4 nm
Measurement update rate	1 measurement / second

## RFEA Probe Specifications

Number of sensors (Button Probes)	1 (plus calibration button)
Probe configuration	4-grid plus Quartz Crystal
Button Probe diameter (sensing element)	33 mm
Holder diameter	100 mm (4"), 300 mm (12") as standard
Holder thickness	5 mm
Max. operating temperature	120° C
Button Probe material	Aluminium, anodised aluminium, stainless steel
Holder material	Aluminium, anodised aluminium, stainless steel
RFEA Probe cable length	650 mm (custom available)
Flange type	CF40 as standard, KF40 (custom available)

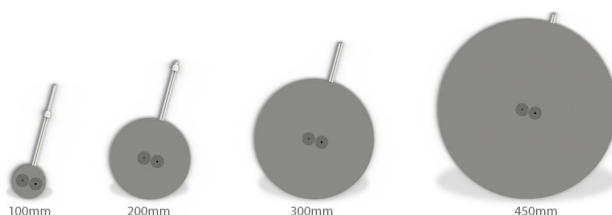
## Quantum System Specifications

Ion energy range	0 to 2000 eV
Ion flux	0.01 to 50 Am <sup>-2</sup> (custom available)
Pressure range	$\leq$ 300 mTorr (standard Button Probe)
IETF resolution	$\pm$ 1 eV nominal
Ion density range	10 <sup>12</sup> to 10 <sup>18</sup> m <sup>-3</sup>
Max. RF bias voltage (applied to probe)	900 V* (peak to peak)
Max. DC bias voltage	-1940 V
Bias Frequency Range	100 kHz to 80 MHz

\*at 13.56 MHz. Reduces to 0.3 kV at 60 MHz

## RFEA Holder Plate Assembly

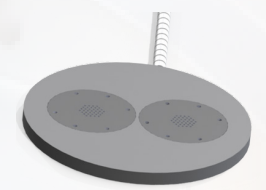
The Holder Plate Assembly can be mounted on a grounded or biased electrode or floating and is used to hold the replaceable Button Probe sensor(s). The holder is available in a number of materials including aluminium, anodised aluminium and stainless steel.



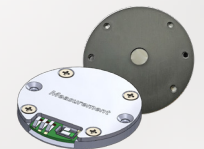
Electronic box



Feedthrough with sensor holder



Standard 100mm Button Probe holder



Button Probe front & back side



Sensor - QC plug



Sensor - 6-Pin feedthrough socket