Mass spectrometers for vacuum, gas, plasma and surface science

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EQP

Mass and energy analyser for plasma diagnostic

Introduction

The EQP mass spectrometer combines an electrostatic sector energy analyser with a high performance quadrupole mass filter in an instrument designed for plasma diagnostics. The EQP can acquire the mass spectra and energy distributions of neutrals, radicals and ions (positive and negative). Trends in intensity can be plotted against time. Fast acquisition modes mean that transients and afterglows can be studied.

Configuration

The EQP mass spectrometer is a PC controlled instrument for plasma analysis and diagnostics. Spectra can be easily acquired, stored and manipulated using "Windows" based MAXSoft software. The EQP uses an electrostatic sector field energy analyzer for ion energy analysis, the transmission and resolution of this device making it the instrument of choice for plasma diagnostics.

The energy analyser is followed by a triple section quadrupole mass filter. A pulse counting electron multiplier, which can be configured for positive or negative ion operation is used for ion detection. This detector provides high sensitivity, fast response and high dynamic range (10^10) for plasma ions and neutrals. Mass range options are 300 amu, 510 amu, 1000 amu and 2500 amu. An energy range of 100 eV is standard and 1000 eV optional to provide the user with analysis of positive and negative ions and appearance potential spectra for radicals analysis. Signal gating by direct TTL input is also available with gating resolution to 1 μs for afterglow studies.

Application

The EQP operates in one of two modes:

(e) PI Mode: Ions can be directly extracted from the plasma. These plasma ions (PI) are formed in the plasma extracted from it and focussed into the energy filter.

(e) EI Mode: Neutrals and radicals are sampled from the plasma and then ionised at low pressure (10^-5 torr) inside an electron impact (EI) ion source. The energy of the ionising electrons may be controlled to enable the detection of radicals. Ions from the electron beam source are first transferred and then focussed directly into the energy filter.

Typical IEDs are shown in the figures. The spectra show the energy distributions for mass resolved ions as indicated. The energy range of the instrument is 100 eV with an option for 1000 eV operation. The energy spectrum can be used to determine the plasma potential, tailing on the energy spectra is an indication of collisions taking place in the plasma sheath.