Hiden HPR-20 QIC TMS

Transient MS for Fast Event Gas Analysis
Quadrupole Mass Spectrometers for Advanced Science
Introduction

The Hiden HPR-20 QIC TMS is configured for continuous analysis of gases and vapours at pressures near atmosphere.

Operating to 200°C, the QIC (quartz inert capillary) flexible 1m capillary inlet provides fast response times of less than 150 ms.

The HPR-20 QIC TMS system has a mass range of 200 AMU (300, 510, 1000 AMU options) and a detection capability from 100% to less than 5 ppb.

The TMS system is optimised for fast response studies and can respond to changes in gas composition with a 5 decade response time in <200 ms.
TMS – for Fast Event Studies

Features of the system to optimise the response for fast event studies include:

• Pulse Ion Counting detection with 7 decade continuous log scale
• 1m capillary gives <150 ms response time
• Open ion source increases pumping speed on ion source
Ultra-fast response

HPR-20 QIC TMS: > 5 decades response in < 0.2 s
The HPR-20 QIC TMS tracks the changes in concentration of fast gas pulses with incredible response and accuracy over more than 5 decades. This data shows the measurement of 5 pulses in 5 seconds.
HPR-20 QIC TMS Analyser: Hiden HAL 3F PIC Triple Filter Mass Spectrometer

- open electron impact ionisation source
- pre-filter
- mass selective primary filter
- post-filter
- digital Pulse Ion Counting (PIC) channeltron secondary electron multiplier detector
Triple Filter Mass Spectrometer

Why have a triple filter?

Two main advantages:

1. Strict control over the quadrupole entrance and exit fields provides enhanced sensitivity for high mass transmission and increased abundance sensitivity.

2. Enhanced long-term stability. The bulk of the deselected ions from the quadrupole ioniser deposit harmlessly on the RF-only pre-filter stage, minimising contamination on the mass selective primary filter.
QIC Inlet Technology

Quartz and Platinum Wetted Surfaces → No memory effects
Heated Capillary → No condensation effects
Flow Matched → Optimum response / recovery
Minimal Internal Volume → PPB detection
Interchangeable Sampling Capillaries → Analysis from 10 Torr to 2 Bar
Typical Mass Spectrum of Air

Note: Different species can have the same mass e.g. CO, N₂ m/e 28
Soft Ionisation

Unique to Hiden gas analysis systems, soft ionisation allows users to selectively ionise different gases by setting the ionisation energy for a particular mass.

This powerful technique can simplify the analysis of otherwise complex cracking patterns from multi-component gas/vapour mixtures.

The ionisation energy can be altered from 4 to 150 eV, in 0.1 eV increments. Standard operation is at 70 eV.
MASsoft 7 Professional control software

A multilevel software package allowing both simple control of mass spectrometer parameters and complex manipulation of data plus control of external devices.
HPR-20 QIC TMS - Applications

- Fast event studies
- Reaction kinetics
- Selective Catalytic Reduction (SCR)
- Steady State Isotopic Transient Kinetic Analysis (SSITKA)
- High speed switching analysis
- Operando studies
- SpaciMS
A kinetic study of the effect of H₂ on the Selective Catalytic Reduction of NOₓ with octane using isotopically labelled ¹⁵NO, using an HPR-20 QIC TMS system.

Applications: Breath Analysis

Breath by Breath Analysis of Expired Isoprene during Exercise

HPR-20 QIC TMS data showing breath by breath isoprene levels during an exercise test.
Quadrupole Mass Spectrometers for Advanced Science

Hiden HPR-20 Users

- NASA
- Dow Chemical
- Exxon-Mobil
- Imperial College
- MIT
- University of British Columbia
- University of Queensland
- BASF
- Seoul National University
- Suzuki
- University of Cambridge
- Beijing Institute of Technology
- Samsung
- ETH Zürich
- KAUST
- Durham University
- Siemens
- Shell

www.HidenAnalytical.com
Summary

• Specifically designed for fast event studies – less than 150 ms response time

• Bench-top triple filter quadrupole mass spectrometer gas analysis system

• Real-time, multi-species analysis – 5 PPB to 100%

• Soft ionisation for reduced spectral fragmentation and simplified data interpretation