



KANOMAX
The Ultimate Measurements



infiTOF Hi-Resolution & Compact TOF-MS

Process gases monitoring for semiconducting manufactures In-situ monitoring of process gases

In semiconductor manufacturing, it is important to improve quality and productivity that manages various process such as CVD, etching and epitaxial growth. RGA(Residual Gas Analyzer) has been commonly used for process gas monitoring, but it is not suitable for monitoring of remaining minor substances and by products because of low-resolution.

infiTOF can perform to monitor these reaction products in process gases with high-resolution.

Feature

- Using infiTOF, in-situ monitoring of process gases in process chamber, reactor and exhaust line can be performed.
- infiTOF is a compact, high resolution time-of-flight mass spectrometer using multi-turn technology, therefore it can be performed spot measurement on a dime.

Hi-Resolution Time-of-Flight Mass Spectrometer infiTOF-DUO



- Multi-turn TOF-MS specifically designed for gas analysis
- Compact design and superior in portability
- High resolution and accurate mass numbers
- Real-time analysis and in-situ monitoring
- Energy saving design

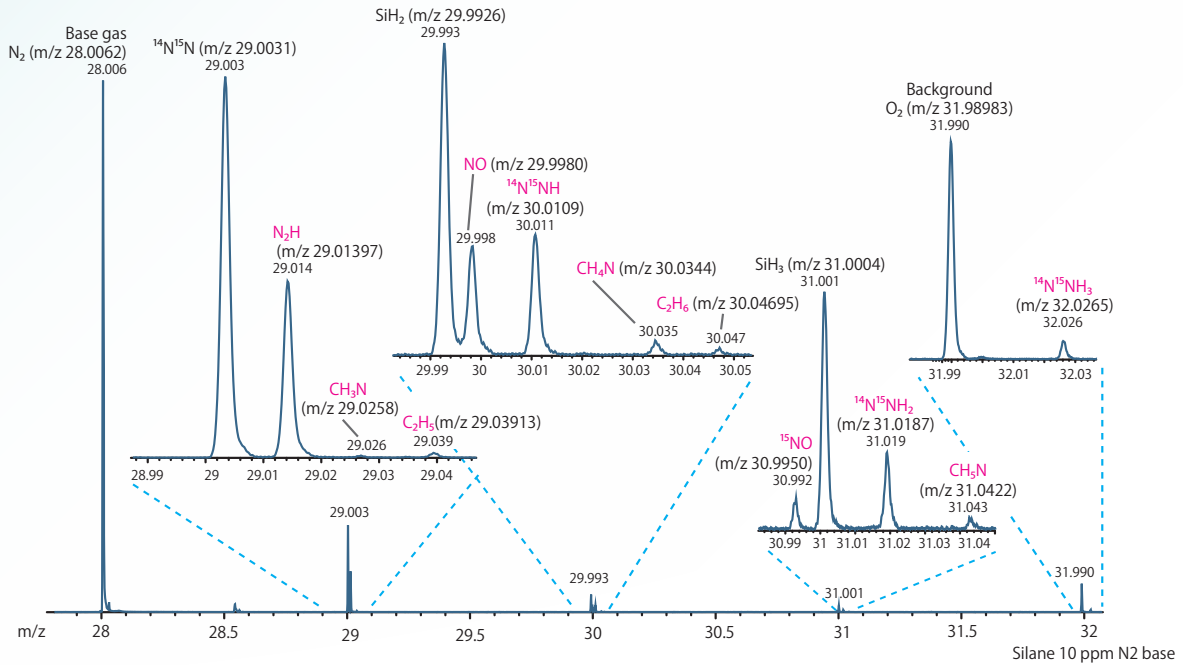
High resolution
&
Accurate mass

Compact
&
Energy saving

In-situ
&
Real-time

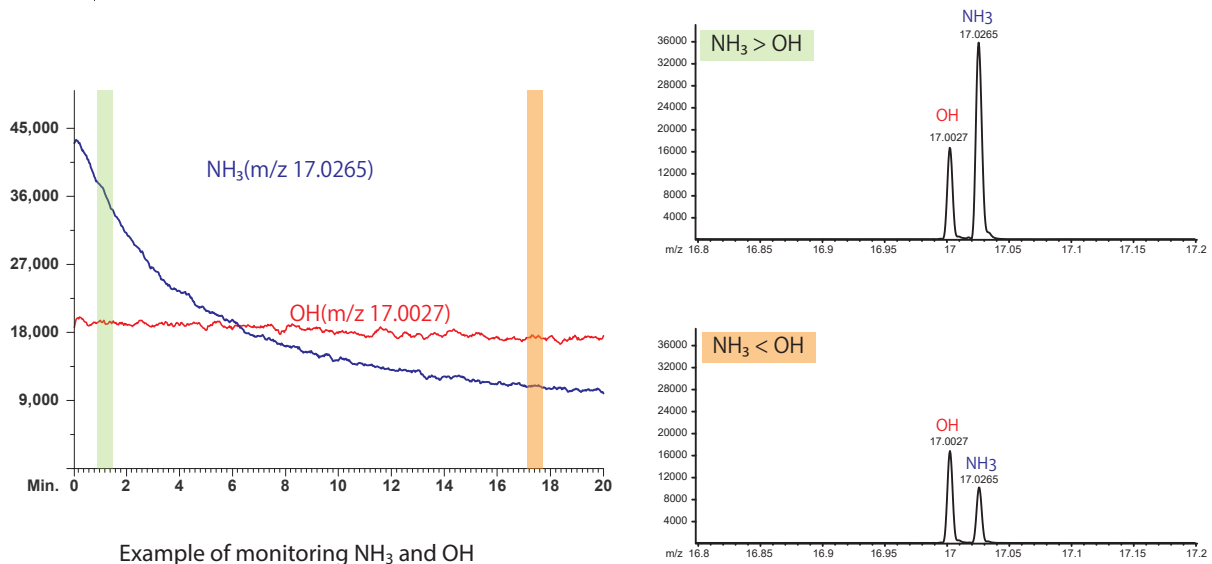
Silane (SiH₄)

In the semiconductor manufacturing process, silane is specialized material gas. Here, we demonstrate the feasibility of using the infITOF for high-resolution analysis of silane 10ppm N₂ base. ¹⁴N¹⁵NH, ¹⁴N¹⁵NH₂ and C₂H₆ were detected in the same nominal mass of SiH₂ (m/z 30). ¹⁵N¹⁴NH₂ and CH₅N were detected as the same nominal mass of SiH₃ (m/z 31). infITOF makes it possible to separate such components with high-resolution.



Ammonia (NH₃)

NH₃ is easily ionized by EI, but OH from H₂O is always interfered because their nominal mass is 17 (m/z 17). infITOF can completely separate these two peaks (NH₃ m/z 17.026 and OH m/z 17.003).



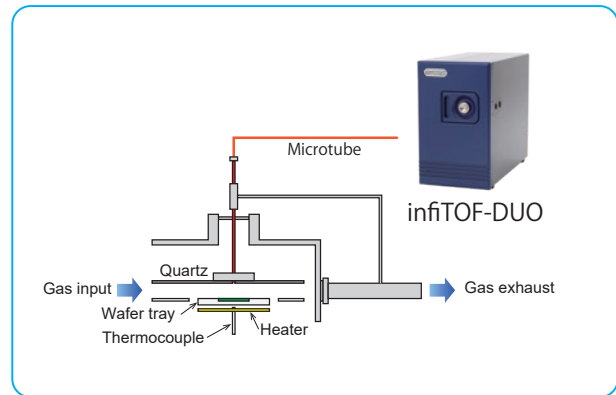
Example of monitoring NH₃ and OH

Mass spectrum of NH₃ and OH

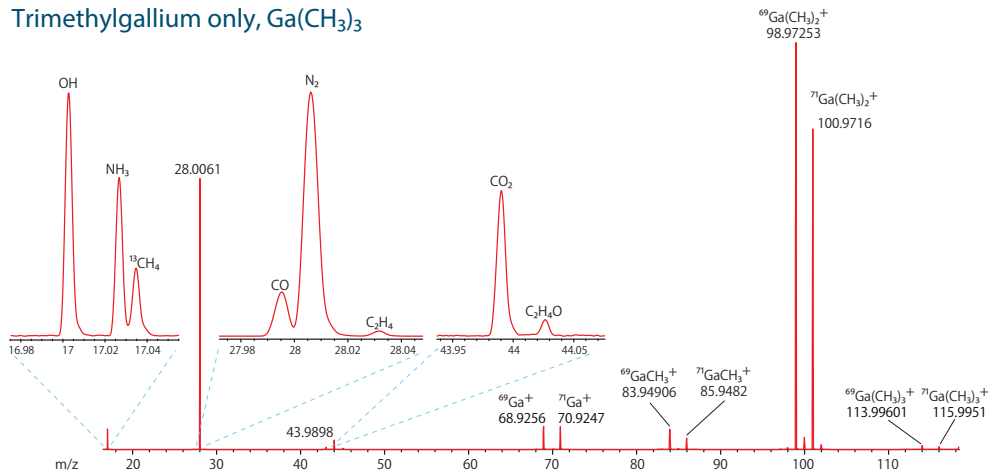
Nitride semiconductors In-situ monitoring of reaction gases in a MOVPE reactor

Nitride semiconductors are candidate materials for high-power transistors. To achieve high breakdown voltage performance, the GaN drift layer must be grown with the lowest amount of impurities(carbon, silicon, oxygen) possible. Amano Laboratory of Nagoya University studies the vapor phase reaction by in-situ monitoring in a MOVPE reactor using infiTOF.

Below application is in-situ monitoring of the reaction of TMG with HCl in a conventional horizontal MOVPE reactor using infiTOF

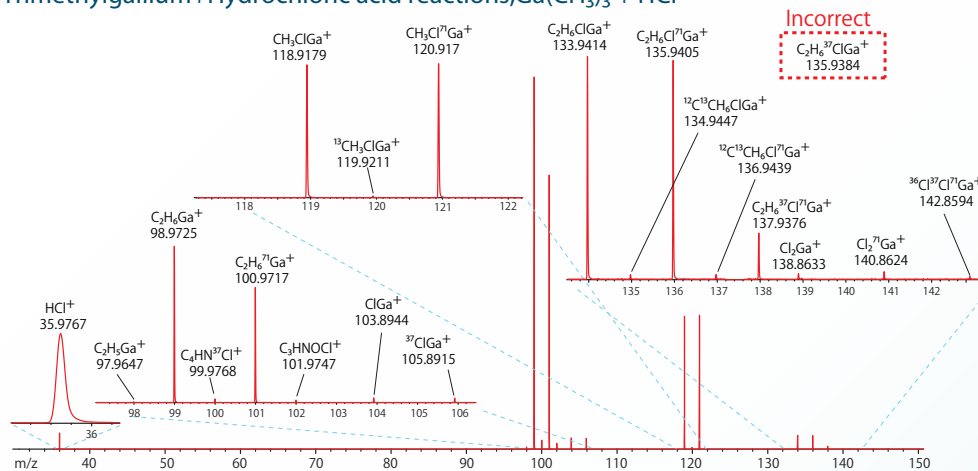


Trimethylgallium only, Ga(CH₃)₃



Upper data shows the mass spectrum when only TMG is supplied into the MOVPE. Peaks for Ga(CH₃)₃⁺, Ga(CH₃)₂⁺, GaCH₃⁺, Ga⁺ were observed. The strongest peak was Ga(CH₃)₂⁺.

Trimethylgallium+Hydrochloric acid reactions, Ga(CH₃)₃ + HCl

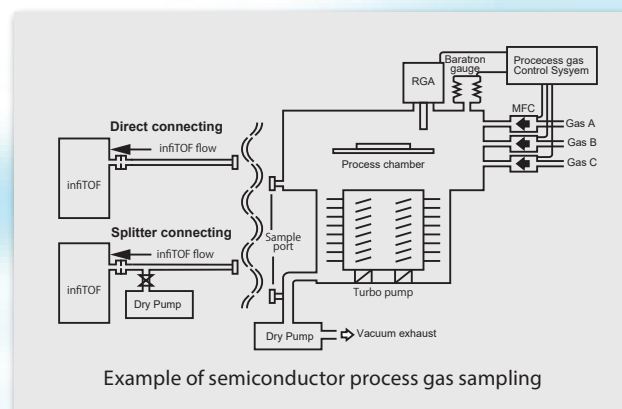


Upper data shows the mass spectrum observed from the reaction of TMG and HCl. Several reaction products were detected and identified. Since two isotopes of TMG and HCl have very similar masses, a high resolution elemental composition calculation is a very effective means to monitor the reaction process. This data shows that although C₂H₆Cl⁷¹Ga⁺(m/z135.9405) may be mistaken for C₂H₆³⁷ClGa⁺(m/z135.9384), infiTOF has no problem distinguishing this slight difference in mass(0.0021).

Splitter system for infiTOF

The infiTOF can be directly connected to vessel for analysis, but this sampling technique may not be effective regarding such as real time monitoring inside the process chamber of semiconductor manufacturing equipment.

Splitter system for infiTOF is optional sampling unit for real time monitoring of sample gas. It can perform the sampling without time-lag by built-in dry pump of Splitter system. Splitter system offers an all-in-one solution for effectively handling this scenario.



infiTOF-DUO Specification

Resolution	>30,000(FWHM)
Mass range	1 to 1,000 m/z
Ion-source	EI(Pos)
Sensitivity	^{132}Xe (approx.30ppb in air) S/N>10
Mass accuracy	<0.002u(Internal Std) <0.005u(External Std)
Data recording speed	up to 50spectra/sec
Dimensions(mm)	W270 x H460 x D550
Weight	39kg



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