Cleanroom AMC Monitoring with the Vocus CI-TOF

Carla Frege
TOFWERK, Switzerland

Cleanrooms are facilities where the cleanest possible conditions are required for industrial production or research. Cleanrooms are essential in micro and nano technology production as they are designed to maximize production rates and yields for environmental sensitive materials (microelectronics) and processes (wafer fabrication) [1]. Therefore, monitoring of airborne molecular contaminants (AMCs) is of high importance.

Over the years, the need for a high degree of cleanliness in the semiconductor industry has generated the classification of cleanrooms by the ISO 14644-1 standards in classes that range from ISO 1 to ISO 9 according to the number and size of particles permitted per volume of air. Hence, measuring airborne particle precursors becomes critical to ensure high production rates and yields.

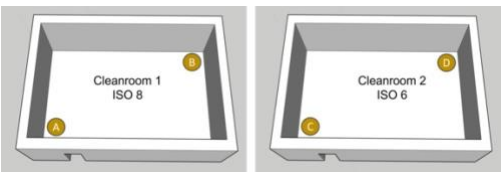

Figure 1. Schematic of sampling points in two cleanrooms. Points A and B were located in cleanroom 1 (ISO 8) while points C and D in cleanroom 2 (ISO 6).

Experimental Set Up

A Vocus CI-TOF was used for monitoring two cleanrooms ISO 6 and ISO 8 in a microtechnology facility. In each cleanroom, air samples were taken from two different points, making a total of four sampling points as exemplified in Figure 1.

Results

The rapid response time of the Vocus CI-TOF allows immediate assessment of the air quality in each sampling point. Therefore, detection of process failures and potential sources of contamination can be detected in seconds and with spatial accuracy. Figure 2 shows the concentration of acetone, acetic acid and cyclopentanone in four sampling points in two clean rooms as depicted in Figure 1. The acetone concentration was found to be constant in all sampling points, while cyclopentane shows a difference in concentration between cleanrooms, with higher concentrations in cleanroom 1, consistent with its ISO 8 class. The acetic acid concentration shows a difference not only between rooms but between sampling points, suggesting differences in processes

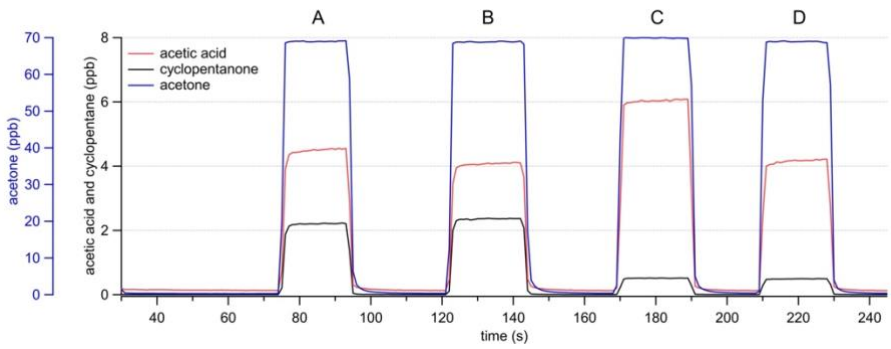

Figure 2. Sampling in each point from the cleanrooms. The trends in concentration of cyclopentanone (black) show a clear difference between the two cleanrooms while acetic acid (red) shows slight concentration differences in the location inside each clean room; finally, acetone (blue) had a constant concentration independently of the sampling point.

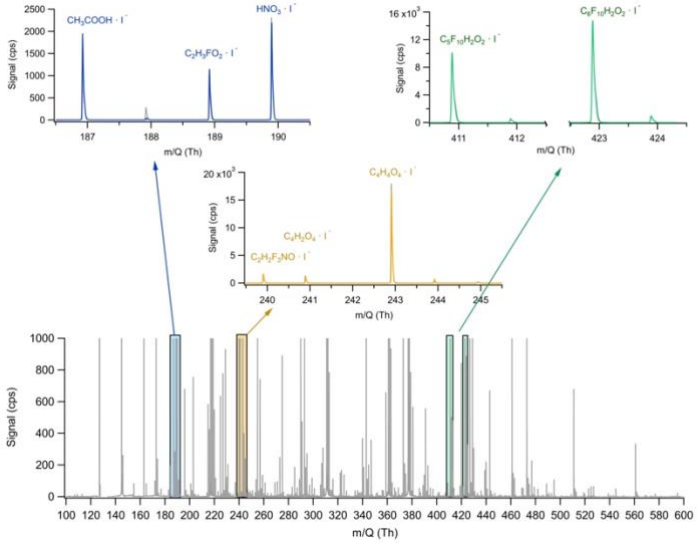

Figure 3. Spectrum from sampling point B. Examples of molecules found in the low (blue), middle (orange) and high (green) mass range. Tentatively assigned molecules: acetic acid (CH_3COOH), fluoroacetaldehyde ($C_2H_3FO_2$), nitric acid (HNO_3), trifluoroacetamide ($C_2H_2F_3NO$), acetylanedicarboxylic acid ($C_4H_2O_4$), maleic acid ($C_4H_4O_4$), Per- and polyfluoroalkyl substances, PFAS ($C_5F_{10}H_2O_2$ and $C_6H_{10}H_2O_2$).

or ventilation within the cleanroom area.

The high versatility and sensitivity of the Vocus CI-TOF allows monitoring different categories of AMCs simultaneously. Figure 3 shows the spectrum captured in sampling point B with some molecules that exemplified the detection.

Contact
ptr.info@tofwerk.com