Industrial Applications

Air Analysis in Clean Air Room

Context & Challenges

To ensure people's safety and a good repeatability of industrial process, the analysis of ambient air is crucial. Especially, electronic boards are produced in clean air room by complex lithographic process using very reactive chemicals. The nature and concentration of volatile compounds can be different depending on the chemical process and can also vary rapidly. There is a need to analyze precisely and continuously gas process in air with an instrument designed for industrial use.

Chromatotec® Solutions

Chromatotec® has developed a turnkey solution which allows the quantification and identification of compounds at ppt, ppb, ppm and % levels. The airmoTWA is a new industry standard for online and continuous TRAP-GC-MS-FID.

It encompasses a specific trap to concentrate the sample, a column for separation of chemicals and two detectors: a new micro flame ionization detector (FID) and a mass spectrometer for quantification and identification respectively.

airmoTWA in clean air room

Technical information and results

Mapping of the chemical composition of the room

airmoTWA can perform a mapping of the chemical composition of the clean air room. Thanks to the multiplexer, up to 12 streams can be analyzed automatically. The results obtained with the GC and the mass spectrometer will be monitored and saved. Each analysis lasts for 30 minutes. It allows the measurement of volatile compound concentrations down to 1 ppt.

In the Figure 1, the chemical compound concentrations are displayed for the different sampling points. High concentrations of compound 1 can be measured on different points. It shows that either filtration processes are not efficient or instruments involved in the production process are leaking. This method is very good for the measurement of low concentrations even after filtration. With this method, the mass spectrometer will allow you to identify every single compound.

Leak detection

Once high concentrations are measured in one location, shorter sequences of analysis can be used. For instance, here a “6 minutes method” has been developed to detect the source of the leak. The probe is moved at different locations to localize precisely the source of the leak.

In the Figure 2, a 3D plot of the chromatograms obtained using the 6 minutes method is shown. One cycle shows a high concentration. Using the mass spectrometer, the nature of this compound can be identified.

In the Figure 3, one can see that the ions responsible for the increase of intensity are the ions 43 and 45u.

Direct analysis of ambient air

It is also possible to measure directly the surrounding atmosphere using the mass spectrometer. The time between two analyses is a few seconds. The low limit detection here is 500 ppb.

An alarm system can be set to inform the user of important changes in the surrounding atmosphere. The Figure 4 is an example of where the intensity of the ion 78 is higher than the limit (displayed with the letter “B” in red).

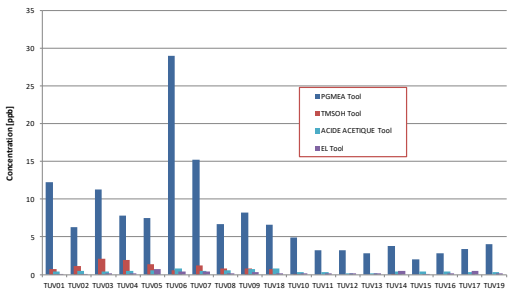

Fig. 1: Chemical composition depending on the sampling point

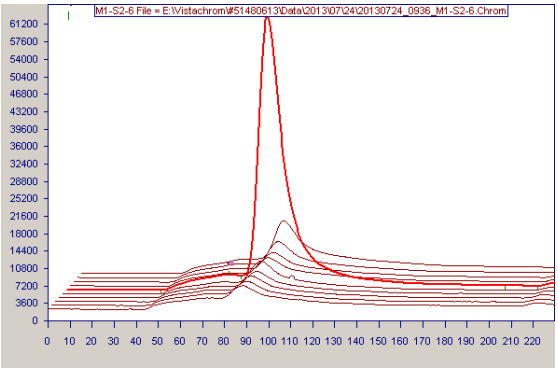

Fig. 2: Chromatogram obtained with the 6 minutes method

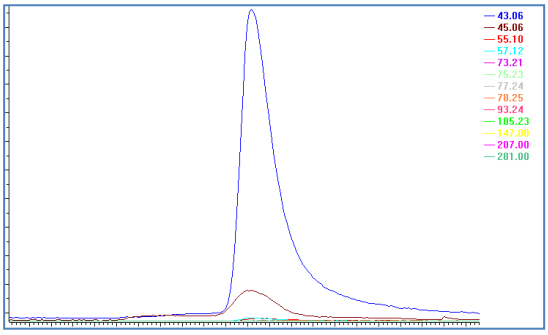

Fig. 3: Graphic obtained with the mass spectrometer. The different ions are displayed versus the time of analysis

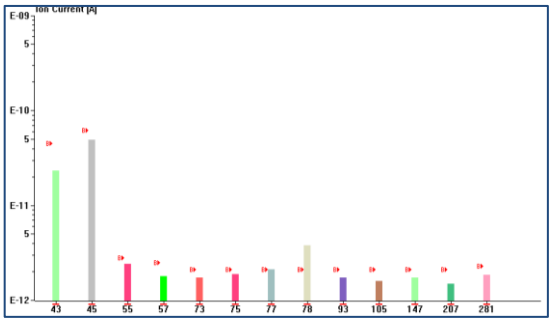

Fig.4: Intensity versus the mass of the different ions

Conclusion:

The airmoTWA is simple to use and incredibly sensitive. It is the gold-standard in chemical analysis. Particularly, the instrument can monitor high and low concentrations for a large number of molecules. The instrument is measuring and recording concentrations of chemicals and can have alarm systems which can be set to inform on important changes of the surrounding atmosphere.