Applications

> Microelectronics industry:

> Monitoring of volatile organic contamination in cleanroom environments

PROBLEMS WITH ORGANIC CONTAMINATION

Airborne molecular contamination (AMC) is a concern for any high technology manufacturing process, especially in the microelectronics industry. Organic contamination may cause adverse effects on production tools and consequently increase costs for high-tech companies.

VOCs can cause serious problems in production processes related to hazing of optics, masks, wafers as well as the formation of films and particles. Tool-down time can significantly be increased because of a too high VOC contamination.

AIR HANDLING SYSTEM AND FILTRATION*

Contamination-free manufacturing is a viable goal and is achieved by source control and source monitoring in combination with filtration solutions in air handling systems. Permanent monitoring of the AMC level helps identifying sources, stabilizes production and prevents unexpected shortfalls of the service life of filtration units.

THE SOLUTION

Ionicon Analytik GmbH with its ultra-sensitive online measuring solutions provide powerful tools to detect organic contamination and monitor continuously cleanroom environments.

PTR-MS

- > very low detection limit (ppt-range)
- > real time measurement
- > online monitoring
- > no sample preparation

MONITORING OF CLEANROOM AIR WITH PTR-MS

Online monitoring of indoor air with PTR-MS on a 24-hour per day basis at different sampling points in a cleanroom environment, shows the capabilities of PTR-MS when used as a surveillance tool in these sensitive production and research zones.

PTR-MS gives our customers the ability to measure online over a long period of time without taking specific point-of-time samples like when using a sampler. The detection limit nevertheless is as low as 5 pptv.

RESULTS

Results from continuous online measurement with PTR-MS in comparison with results from passive sampler air analysis of a specific cleanroom environment.

The pattern of organic AMC compounds from passive sampler analysis has been confirmed. However PTR-MS could resolve fast and short occurring phases of high VOC concentration. See table 1:

	Diffusion zone	Diffusion zone
Compound	PTR-MS [ppbv]	sampler [ppbv]
Benzene	0,6	0,42
Toluene	2 - 3	2,8
Xylene	0,5	0,9
3M-Benzene	0,1	0,12
Phenol	0,4	Not detected
Styrene	0,1	0,12
Naphtalene	0,1	0,08
M=43, EA, Ethanol	50	1,8
M=73, MEK, PGMEA	10-15	6,9
M=61; Acetic Acid, EA	100	1,8
Butyl acetate	0,4	0,6
Phosphates	< 20 – 40 pptv	Not detected

Table 1: Comparison between a passive sampler and an online PTR-MS instrument.

*For further information about the integration of Monitoring and AMC Control systems contact artemis control AG: www.artemis-control.com

The level of AMC contamination in cleanroom environments is predominately created by internal sources of solvents and acetic acid, re-entrainment of exhaust air, aromatic compounds from ambient air and return air as well as material outgassings.

Even more important, spills, leaks and mishandling have to be taken into account and can cause serious costs in terms of wafer loss and tool-down time.

The concentrations of esters, ketones and acetic acid in filtered cleanroom air are often higher than in the intake air. PTR-MS has the capability to quantify this unwanted contamination online. This is shown in table 2 and figure 1:

Compound	Intake air level	Diffusion zone
Benzene	0,1 – 0,3	0,6
Toluene	0,6 – 20	2 - 3
Xylene	0,5 – 1	0,5
3M-Benzene	1	0,1
Phenol	0,1	0,4
Styrene	0,6	0,1
Naphtalene	1	0,1
M=43, EA, Ethanol	10-20	50
M=73, MEK, PGMEA	1-100	10-15
M=61; Acetic Acid, EA	4 – 20	100
Butyl acetate	0,2	0,4
Phosphates		< 20 – 40 pptv

Table 2: Measurement with PTR-MS of the intake air and in the diffusion zone.

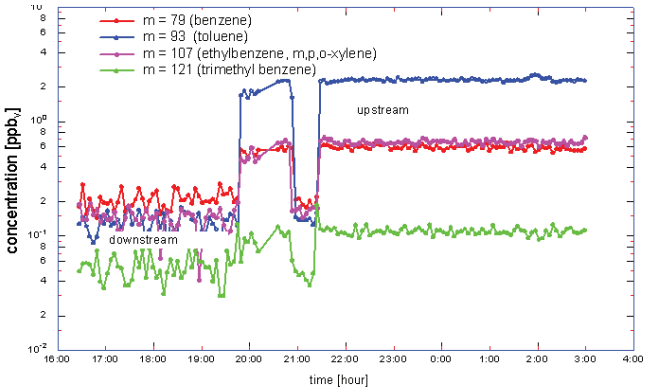

Figure 1: Monitoring of selected compounds upstream and downstream of a new air filter with PTR-MS.

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