µ-CTE

Micro-Chamber / Thermal Extractor

MARKES international

The Micro-Chamber / Thermal Extractor (μ-CTE™) from Markes International provides industry and researchers with a versatile and automated tool for testing materials.

Key applications include:

- Testing emissions from material surfaces at low temperatures for:
  - correlation with data from conventional emission chambers / cells
  - intercomparison of products within a range (e.g. different colours / patterns)
  - testing prototype, "low-emission" materials
  - monitoring product uniformity in between formal certification tests
- Testing VOCs and Semi-VOCs (SVOC) in bulk materials for routine quality control (content and emissions testing)
- Testing vapour permeation into and through materials at various temperatures
- Flavour and Fragrance profiling

Figure 1. The μ-CTE

Surface or bulk emissions

The new system comprises six micro-chambers (up to 28 mm deep and ~45 mm in diameter) which allow surface or bulk emissions to be tested from up to six samples simultaneously (Figure 2). When testing surface emissions 12.82 cm^2 of sample surface area is exposed to the air / gas flow and the air / gas volume above the sample surface is 3.2 cm^3. The volume of the Micro-chamber available for bulk emissions testing is ~44 cm^3.

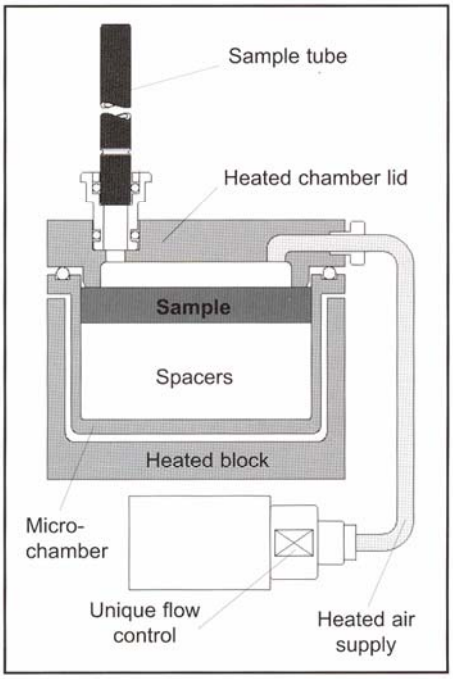


Figure 2. Schematic of single micro-chamber as used for surface emissions testing

Compatible with a range of sampling tubes and multiple standard analytical methods

Conditioned Tenax or multi-sorbent tubes are attached to each micro-chamber and a controlled flow of air (10-500 ml/min) or inert gas is passed through all chambers simultaneously. The μ-CTE is compatible with industry standard (89 mm long x 6.4 mm O.D.) sorbent tubes. Adaptors are also available for non-standard 6 mm O.D. sorbent tubes and aldehyde (DNPH) cartridges with a 4 mm 'luer' outlet.

VOC and SVOC vapours are swept from the sample material in the micro-chamber and onto the attached sorbent tube. After sample collection, trapped vapours are thermally desorbed and analysed by GC(-MS) as per standard methods e.g. ISO 16000-6, EN/ISO 16017-1, ASTM D6196-03. Formaldehyde and other carbonyls are measured using alternative sampling and analytical procedures (ISO 16000 parts 2 & 4, ASTM D5197 etc.).

The thermal desorption analytical process is carried out off-line allowing a fresh set of samples to be introduced to the μ-CTE even while analysis of vapours emitted by the previous set of samples is being performed. This also facilitates chemical analysis by third party laboratories if preferred.

Alternative analysers, combining thermal desorption with process MS or enose detectors, are also applicable in some cases - particularly during quality control of fragrance/odour of foods and consumer products.

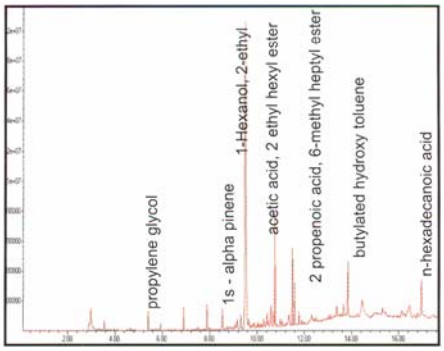


Figure 3. Characteristic VOC profile of surface emissions from adhesive, sampled using the μ-CTE at 40°C, with 50 ml/min air flow for 20 mins

Constant and uniform control of

air/gas flow

Unique technology* maintains a constant flow of air or gas through each sample chamber, independent of sorbent tube impedance and whether or not a sorbent tube is attached (Figures 4, 5 and Table 1). No pump or mass flow controller is required. This makes the system fundamentally easy-to-use and ideal for routine quality control tests.

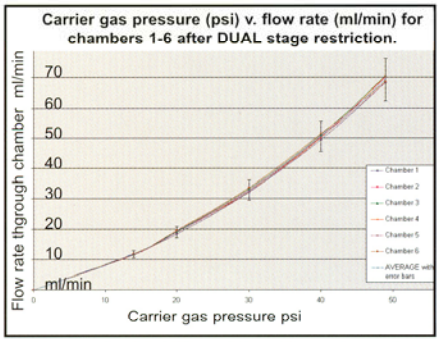


Figure 4. Stability of flow through each micro-chamber in the low flow range (10 - 70 ml/min)

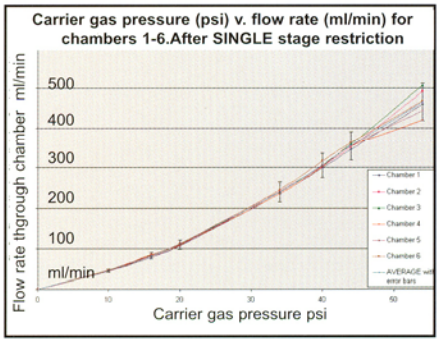


Figure 5. Stability of flow through each micro-chamber in the high flow range (50 - 500 ml/min)

Tube	Flow Rate - Low (ml/min)	Flow Rate - High (ml/min)
No tube	42.4	346
Single sorbent *Tenax*	42.3	344
3 Bed Multi Sorbent *Tenax / CG1TD / C1000*	42.1	337

Table 1. Stability of micro-chamber flow - independent of sorbent tube impedance

Temperature versatility

Tests can be carried out at ambient or elevated temperatures (up to 120°C). In the case of building materials / products, moderate temperatures (e.g. 40°C) can be used to compensate for the relatively small sample size without affecting correlation with data obtained from conventional emission chambers or cells at ambient temperature. Total test time (equilibration and vapour sampling), for all 6 samples, is usually between 15 and 30 minutes depending on the temperature used. However, elevated temperatures can be maintained indefinitely if required - e.g. for accelerated shelf-life testing of consumer products or for extended permeation experiments.

Blank profile and sink effects

Blank profiles from the µ-CTE show low/sub-ng quantities of individual VOCs and low levels of Total VOC (TVOC) even at elevated temperatures. This satisfies the most stringent requirements of relevant standard methods (Figure 6).

Efficient heating of all µ-CTE chamber components - sample pans, chamber lids, air / gas supply tubing, etc. - prevents surface adsorption / condensation and sample-to-sample carryover. Internal surfaces coming into contact with sample vapours comprise polished stainless steel to minimise sink effects. Inert silica-coated micro-chambers are available on a custom basis. Micro-chambers are readily removed from the µ-CTE for easy cleaning.

Orientation of the air / gas inlet at 90° to the emitting sample surface maximises turbulence and eliminates areas of still or low-flow air / gas. Surface air velocities are roughly uniform across the sample surface and range from ~0.5 cms^{-1} at 50 ml/min inlet gas flow to ~5 cms^{-1} at 500 ml/min.

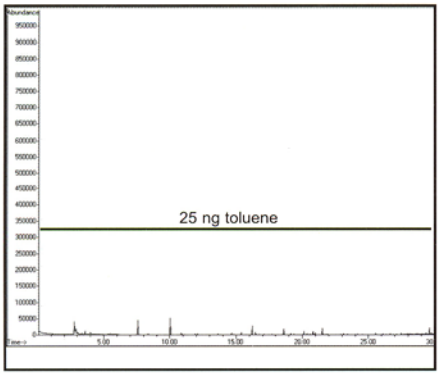


Figure 6. Blank profile at 120°C. Individual compounds <5 ng, TVOC <30 ng

Applications and accessories

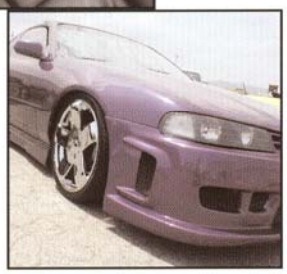
The µ-CTE includes a complete set of sample spacers. These are placed inside the micro-chamber, underneath the sample, such that the emitting surface is presented to the air flow at the correct height - whatever its original thickness. Surface emissions testing requires a 4.5 cm diameter circular sample specimen to be cut from the product / material such that it fits snugly into the micro-chamber. A collar or ring projecting down from the chamber lid helps define both the exposed sample surface area and the depth of the air space above the sample. It also prevents emissions from the sides and rear of the sample diffusing into the air space and contributing to the result.

Materials for bulk emissions testing or odour / fragrance profiling may simply be weighed directly into an empty micro-chamber or into a custom made 'sample boat' which is subsequently placed into the chamber itself.

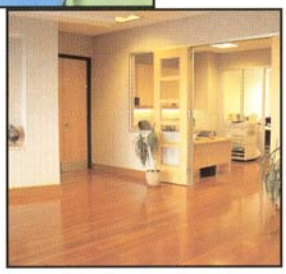
Special accessories are available for introducing liquid standards and for permeation testing - for example evaluating the permeability of textiles or rubber gloves.

Specific applications examples include:

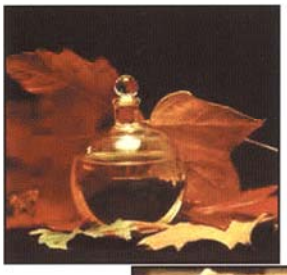
- **Volatile content of materials** - for example; residual monomer in polymer, or emissions of VOCs and 'fogging' compounds from **car interior trim components**



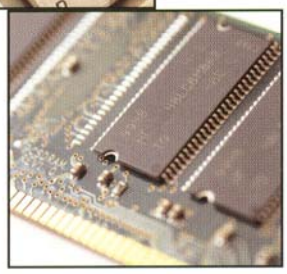
- Automating **materials emissions testing for routine quality control of construction products** - 6 samples in less than 30 minutes. Low temperature data obtained using the µ-CTE correlates with that produced by conventional emissions chambers / cells



- **Odour/fragrance fingerprinting** and troubleshooting off-odour issues

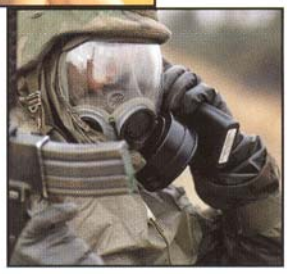


- High temperature **emissions from electronic components**



- Permeability of **food packaging**
- **Accelerated shelf life testing** of food and consumer products

- **Permeability of protective clothing** - glove materials, textiles, etc
- Adsorptivity of various materials and coated surfaces to **toxic chemicals**



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