MARKES international

THE QUEEN'S AWARDS FOR ENTERPRISE: INTERNATIONAL TRADE 2015

Markes XR Thermal desorbers

IngenieríaAnalítica
Chromatography & Spectrometry

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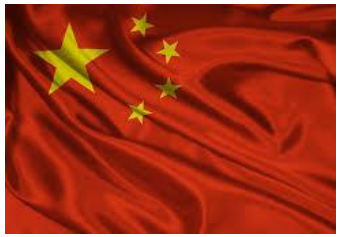
Markes International

- Manufacturer of instrumentation and sampling units for detection of trace-level volatile and semi-volatile organic compounds (VOCs and SVOCs).
- Great reputation for its application expertise and service
- Markes continued it's innovative product releases this year with the launch of Centri: Sample Automation and Pre-concentration Platform.

Wales (UK)

Germany

USA

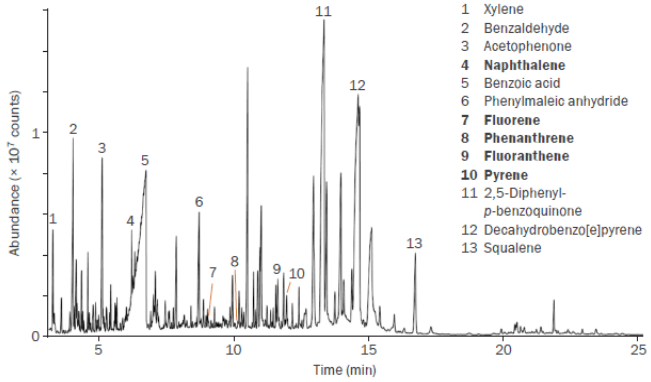


China

Pre-concentration

Thermal Desorption

A sample introduction technique for GC and GC–MS, thermal desorption enables the analysis of trace level Volatile and Semi-Volatile Organic Compounds (VOC & SVOC) from a wide range of samples covering numerous application areas.



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IngenieríaAnalítica Chromatography & Spectrometry

Markes International: 1st in TD innovation

TD technology ‘firsts’ that deliver simplicity, reliability and performance

Patented TD valve

Low volume, inert, uniformly-heated. Enables split re-collection, backflush & unique application range.

Kori-xr

Ultra-selective water removal for simultaneous online analysis of trace VVOCs & OVOCs in humid air/gas.

Easy Change Trap

World’s best TD focusing technology. Electrically-cooled and rapid heating.

TubeTAG

Electronic (RFID) labels for TD tubes.

DiffLok caps

Stringent tube seals and trouble-free TD automation.

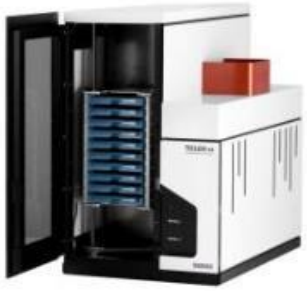
Markes also pioneered integration of TD with GC EPC for compatibility with constant flow GC methods.

Introducing the xr-series

The world's most advanced and comprehensive TD range.

- Automated, high throughput instruments for canister, tube and on-line samples

UNITY–CIA *Advantage*-xr



TD100-xr

UNITY–Air Server-xr

UNITY-xr

UNITY-ULTRA-xr

Modular upgradable systems that can evolve as your labs needs change.

xr-series: 1st for modular and expandable systems

Modular TD technology allows labs to start small and expand their TD capabilities as demand grows.

UNITY-xr

Single-tube thermal desorber

+ Air Server-xr

On-line monitoring

+ CIA *Advantage*-xr

Canister sampling

+ Kori-xr

Water management

UNITY-AS with Kori

UNITY-CIA with Kori

+ ULTRA-xr

100-tube automation

xr-series thermal desorbers offer compatibility with:

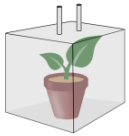
- VVOC, VOC and SVOC in air/gas and materials via a wide range of sampling approaches:

Pumped sorbent tubes

Passive samplers

Canisters

On-line air monitoring



Headspace analysis

Sorptive extraction

Direct desorption

- They use a focusing trap to concentrate analytes …
- … and release them in a narrow band of gas.

- Analytes are then transferred (injected) into the GC capillary column.

Any make of GC / GCMS can be used to enable complete flexibility for the user.

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The xr series – a closer look

TD100-xr: Automated multi-tube thermal desorber

- Cryogen free operation.
- Productivity: up to 100 standard sample tubes.
- Quantitative re-collection onto original or fresh sample tube using normal MFC.
- DiffLok caps for sample security and robust automation.
- Inert, uniformly-heated TD flow path optimises tube application range: to n-C_{44} and reactive compounds.
- Simultaneous analysis of VOCs & SVOCs.
- Versatile water management.
- Method-compliant:
  - leak-testing, purge to vent, optional IS addition, backflush, standard tubes …
- Trace & high-level samples: split ratios zero to 125,000:1. Plus Hi/Lo analysis with re-collection.
- Compatible with all major makes of GC and GC–MS.

UNITY-xr: Versatile single-tube TD platform

- Cryogen-free operation.
- Quantitative re-collection of all split flows.
- Inert, uniformly-heated flow path delivers every TD application (acetylene to n-C_{44} and reactive compounds) on one platform.
- Simultaneous analysis of VOCs & SVOCs.
- Modular system for multiple sampling modes:
  - Add ULTRA-xr for 100-tube automation,
  - Add Air Server-xr for on-line capability,
  - Add CIA *Advantage*-xr for canister automation.
- Versatile water management.
- Method-compliant:
  - leak-testing, purge to vent, optional IS addition, backflush, standard tubes …
- Trace & high-level samples: split ratios zero to 125,000:1. Plus Hi/Lo analysis with re-collection.
- Compatible with all major makes of GC and GC–MS.

ULTRA-xr: Multi-tube autosampler for UNITY-xr

- Integrates with the cryogen-free UNITY-xr thermal desorber.
- Automated sampling from up to 100 sample tubes in a single sequence.
- Adds to UNITY-xr for quantitative sample re-collection of split flows:
  - 1 × ULTRA-xr ⇒ Automated re-collection of the outlet split.
  - 2 × ULTRA-xr ⇒ Automated re-collection of outlet *and* inlet splits (unique to Markes).
- Add to UNITY–Air Server-xr or UNITY–CIA *Advantage*-xr systems for:
  - Automated re-collection of canister and on-line samples,
  - Fully automated sequencing of tubes and canisters/bags or on-line samples.
- Optional ISDP capability

UNITY–Air Server-xr for on-line air/gas monitoring

- Cryogen-free air monitoring round the clock.
  - Saves time and cost.
- Three or eight channels for unattended sequencing of sample, standard & blank.
- Water management options include:
  - Dry purge,
  - Nafion™ dryer,
  - Kori-xr/Dry-Focus3 for VVOCs & polar species.
- Suitable for field sites and mobile labs.
- Can be combined with ULTRA-xr for method compliant 100 tube automation.
- Key applications include:
  - Ozone precursors,
  - On-line air toxics,
  - On-line odour monitoring,
  - Trace freons.
- Winner of many prestigious 3rd-party field trials (shoot-outs).

UNITY–CIA Advantage-xr for canister/bag automation

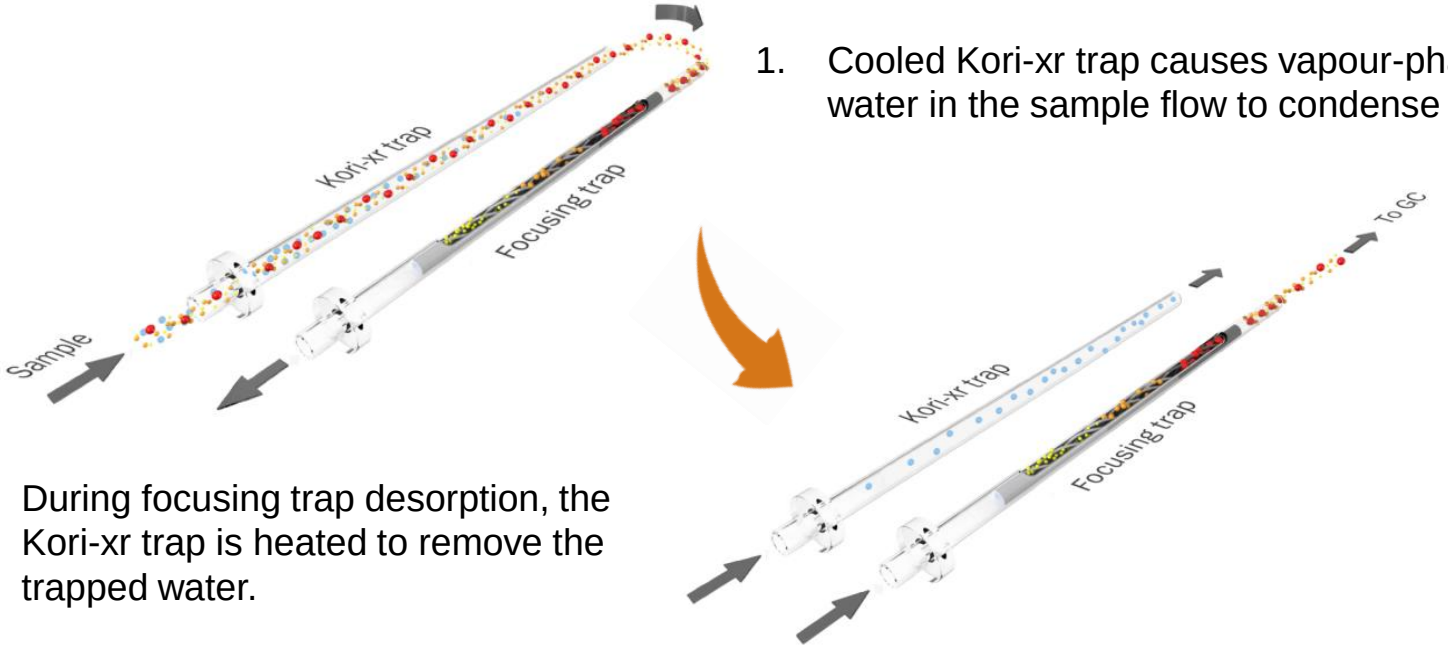
- Cryogen-free operation – saves $1000s per year
- Water management options include:
  - Dry purge,
  - Nafion™ dryer,
  - Kori-xr/Dry-Focus3 for VVOCs & polar species at ultra-trace levels.
- Compliant with US EPA Methods TO-14 and TO-15.
- Can be combined with ULTRA-xr for method compliant (TO-17) 100-tube automation.
  - Option to combine cans and tubes in one sequence.
- Two models:
  - CIA *Advantage* T-xr: 10 mL to 15 L, 4 cans/bags,
  - CIA *Advantage* HL-xr: 0.5 mL to 15 L, 14 cans/bags.

  CIA Satellite-xr adds an extra 13 channels to either.
- The HL model offers a wide concentration range:
  - 0.5 mL loop sampling for high-level samples,
  - MFC sampling (2–500 mL/min) for trace samples.
- Enhanced line purging eliminates carryover boosting productivity.

Kori-xr

Exceptional selective water removal.

- On-line or canister air samples pass through the electrically-cooled Kori-xr trap before reaching the UNITY-xr focusing trap.
- Water is selectively retained while VOCs (including polar and reactive species) remain in the vapour-phase.



1. Cooled Kori-xr trap causes vapour-phase water in the sample flow to condense out.

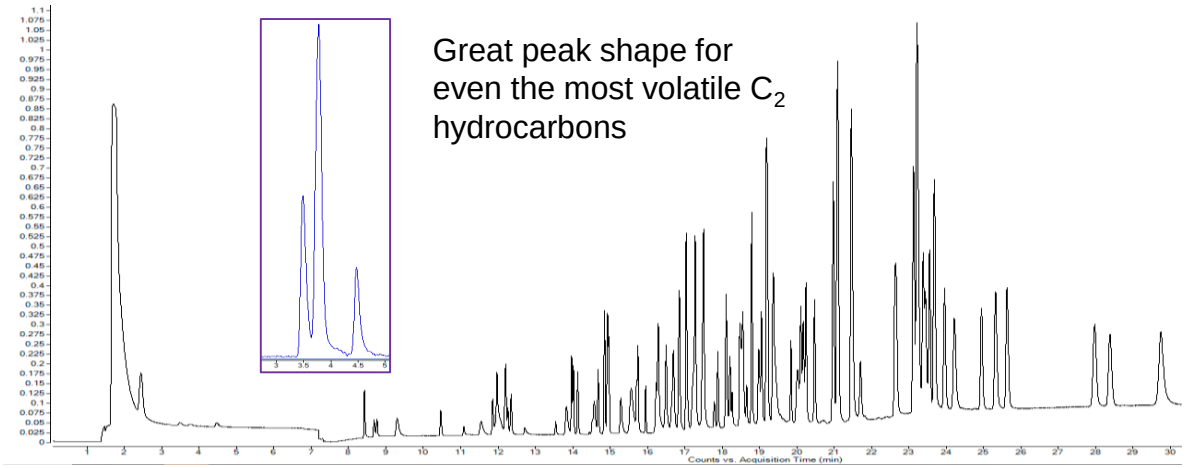
2. During focusing trap desorption, the Kori-xr trap is heated to remove the trapped water.

Dry-Focus3

The unique triple-step focusing and water management mechanism that operates cryogen-free.

- Dry-Focus3 leverages the power of Kori-xr and the splitless performance of UNITY-xr to deliver 0.01 ppb (10 ppt) detection limits or better for air toxics using regular GC-QMS.

Dry-Focus3 is compatible with polar and apolar compounds, terpenes, and C_2 hydrocarbons.



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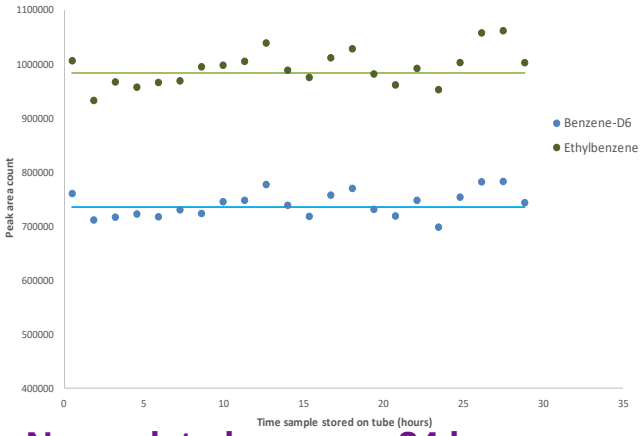
Aids for automation

Enhancing versatility and productivity whilst maintaining confidence in your results

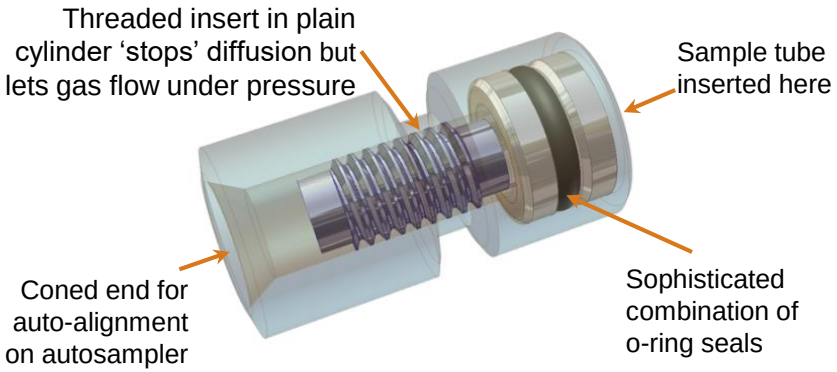
The revolutionary innovation of ‘DiffLok’

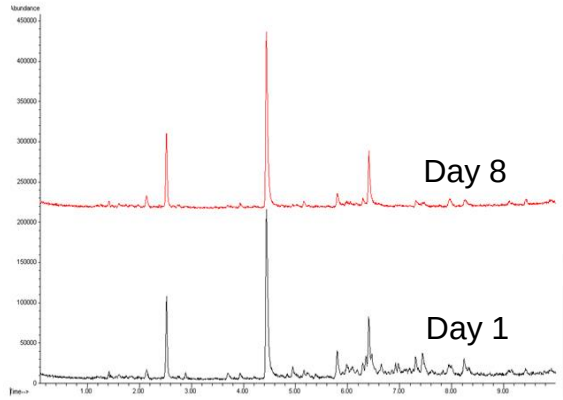
Ensuring sample integrity and simple, robust automation.

- Tubes are capped with patented DiffLok caps throughout automated desorption preventing both analyte loss and artefact ingress.
- Enables automation without uncapping and recapping. Simplifies robotics and enhances reliability.
- DiffLok caps work better than the low-friction o-ring caps used on other ATDs (e.g. ~25% loss of benzene after 14 hrs on system)[1].



No analyte loss over 24 hours





No artefact ingress over 8 days

Why did we design DiffLok caps?

Limitations of traditional TD auto-sampler capping

Background level of pollutants in the laboratory: high concentration levels of contaminants in the laboratory can produce the opposite effect causing the samples to be contaminated while waiting in the carousel for analysis.

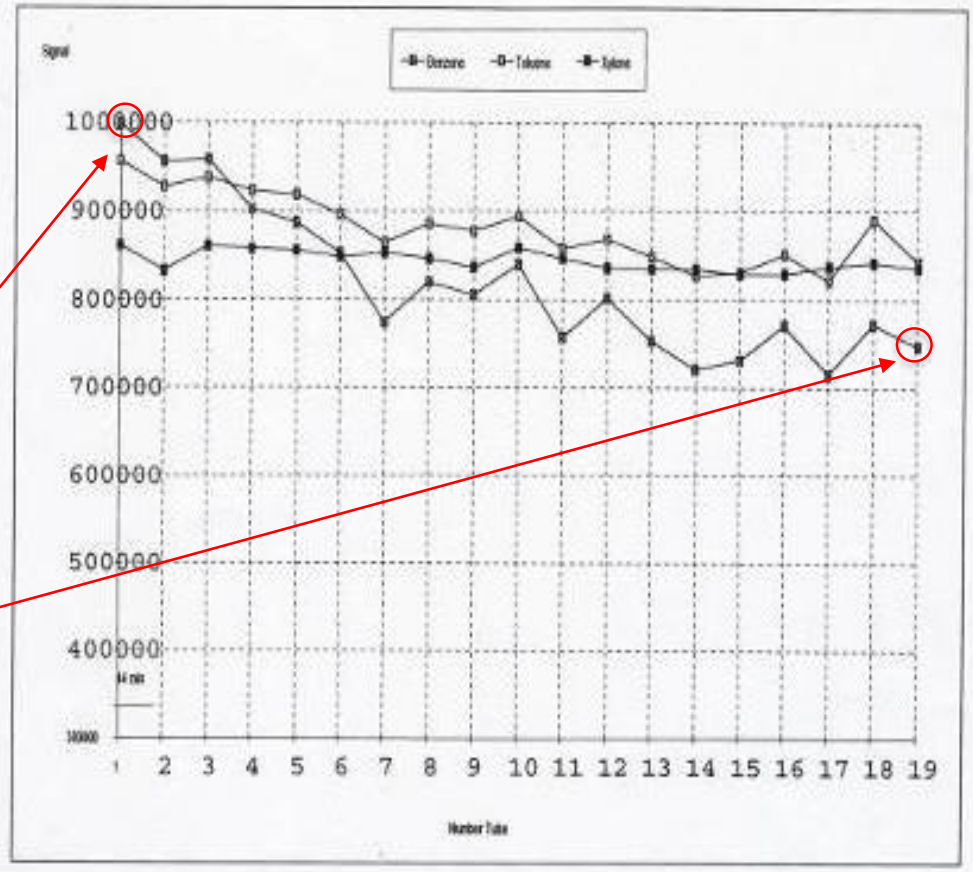


Figure 1.- Decay of concentrations in consecutive analyses in ATD-400.

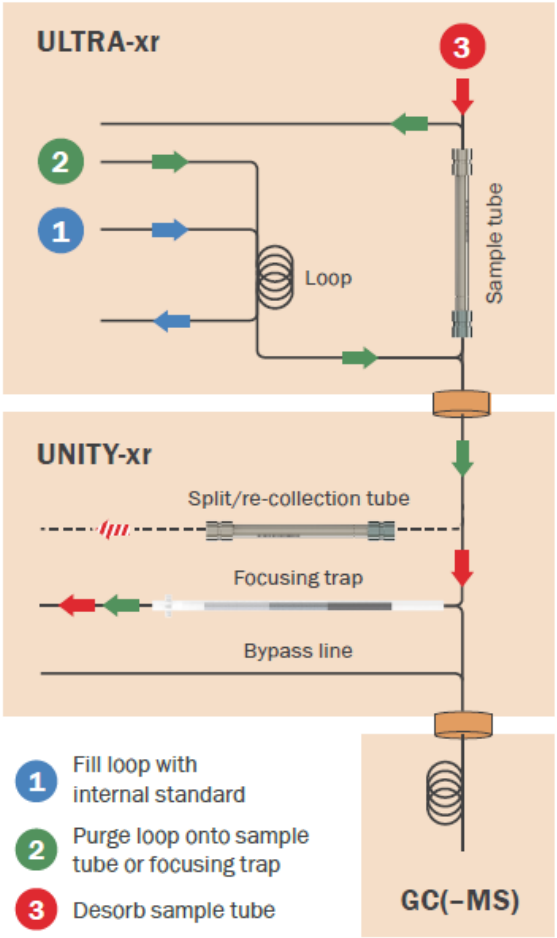
25% loss of benzene over 14 hours from a series of replicate standards

Comprehensive internal standard (IS) addition options

Versatile options for automated introduction of gas phase IS enhance data confidence for tube desorption and canister/on-line air analysis.

Available options:

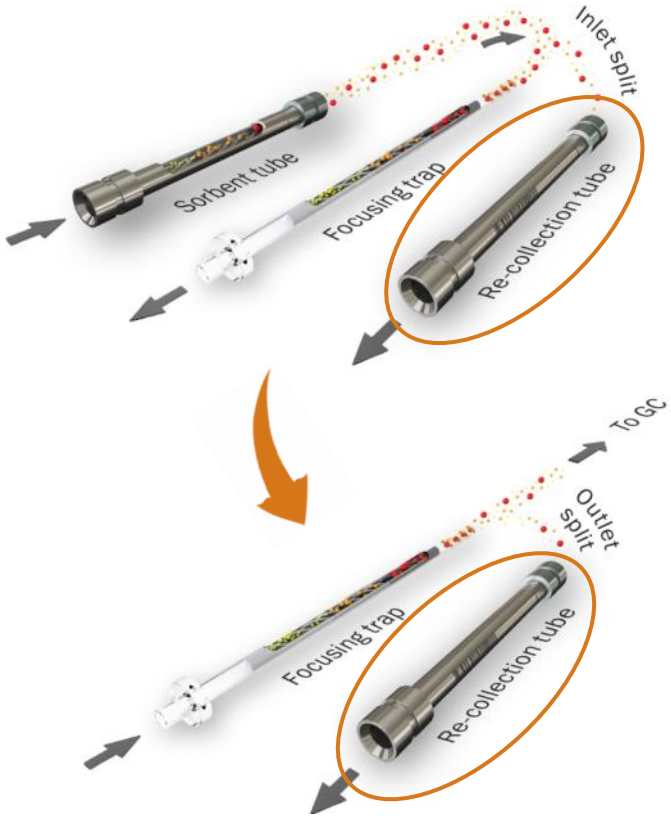
- IS addition to **sampled** tubes prior to analysis:
  - TD100-xr
  - ULTRA-xr
- Automated IS addition to **blank tubes** prior to sampling:
  - TD100-xr
  - ULTRA-xr
- Automated IS addition to **focusing trap:**
  - TD100-xr
  - ULTRA-xr
  - UNITY–CIA *Advantage*-xr (pre-fitted with system)



Best available implementation of re-collection

Quantitative re-collection overcomes the traditional ‘one-shot’ limitation of TD.

- Manual or automated re-collection available on all xr-series systems without extended cycle times.
- Unique features of Markes re-collection:
  - Re-collection on manual TD.
  - Re-collection of both inlet & outlet split.
  - **Leak test** of fresh re-collection tube (if used).
  - **Configured for validation** – using fresh tubes and the same MFC (w/wo re-collection).
- Applications:
  - Enables repeat analysis.
  - Simple validation of compound recovery.
  - Enables repeat analysis under different split conditions to expand the dynamic range – Hi/Lo analysis.
  - Sample archiving or 3rd party confirmation.

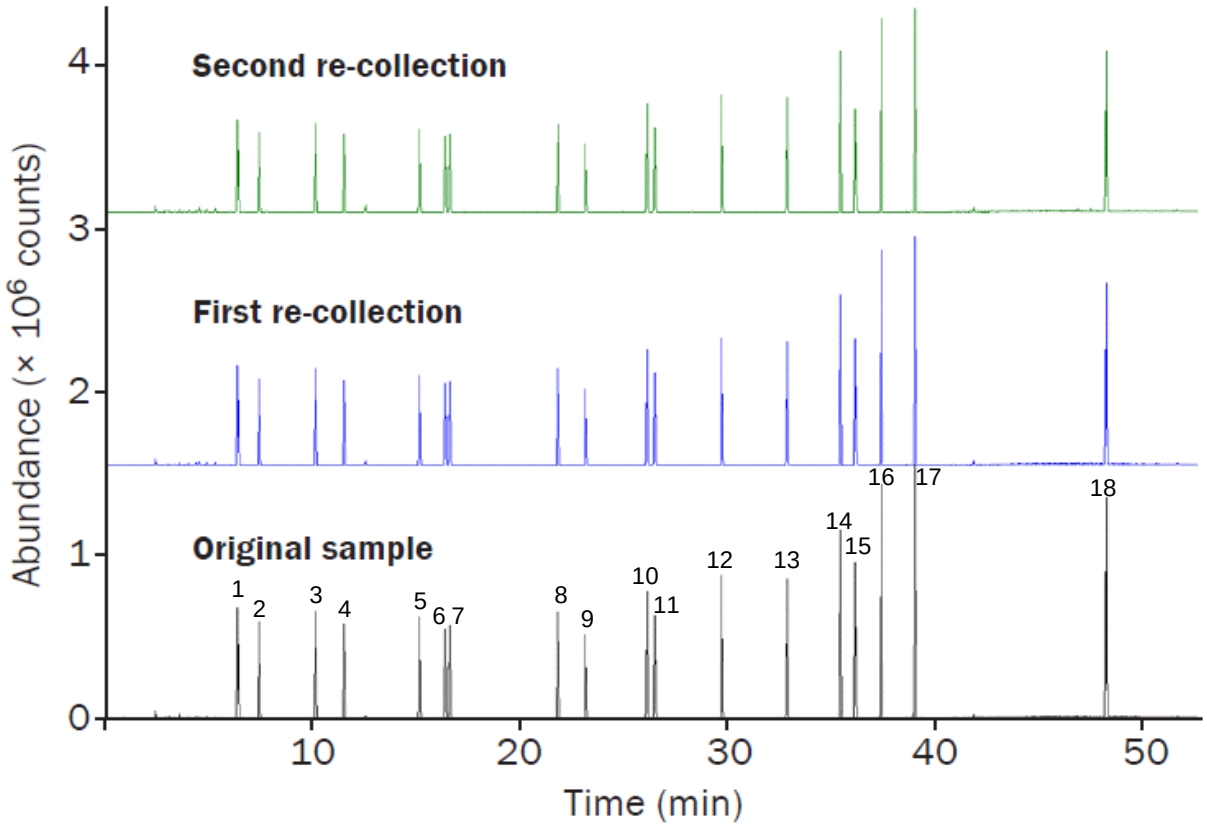


Automated TD re-collection using a single TD autosampler is patented by Markes.

Patents: GB 2395785 & US 6,446,515 B2

Validating analyte recovery using re-collection

Repeat analysis of wide boiling range sample.



1 Benzene
2 n-Heptane
3 Toluene
4 n-Octane
5 *p*-Xylene
6 *o*-Xylene
7 n-Nonane
8 n-Decane
9 2-Ethylhexan-1-ol
10 n-Undecane
11 2,6-Dimethylphenol
12 n-Dodecane
13 n-Tridecane
14 n-Tetradecane
15 Dicyclohexylamine
16 n-Pentadecane
17 n-Hexadecane
18 Bis(2-ethylhexyl) adipate

Reproducible profiles with multiple re-collections shows quantitative transfer of all compounds through the flow path – even Bis(2-ethylhexyl) adipate (cmpd 18) which is notoriously unstable

Electronic tube tracking

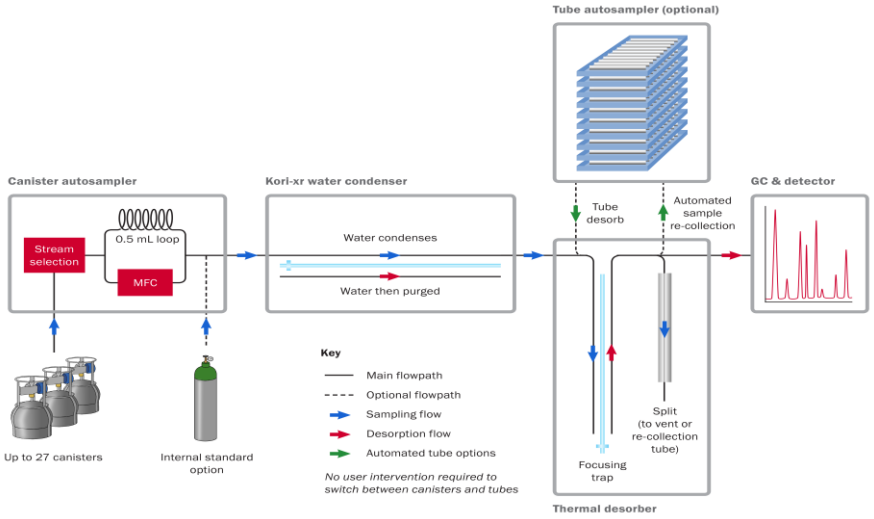
TubeTAG technology for metal or glass sorbent tubes.

- Major sampling campaigns requiring large numbers of tubes.
  - Problem: Manual record-keeping.
    - Laborious and risk of error.
  - **Solution:** Associate information with tube **electronically.**
- Benefits:
  - Ensures tube traceability/chain-of-custody
  - Helps to reduce transcription errors
- TubeTAGs read/write on:
  - Any xr-series tube autosampler
  - TAG^{SCRIBE}
- Can be desorbed on:
  - Any xr-series TD system

Optimising system utilisation

Combining tube desorption and canister (or on-line) analysis in a single sequence extends system productivity over an entire weekend

- Up to 100 tubes
- Up to 27 canisters or up to 8 on-line channels
- Automated calibration – no manual intervention required
- Combining tube and canister (or on-line) analysis into a single automated sequence

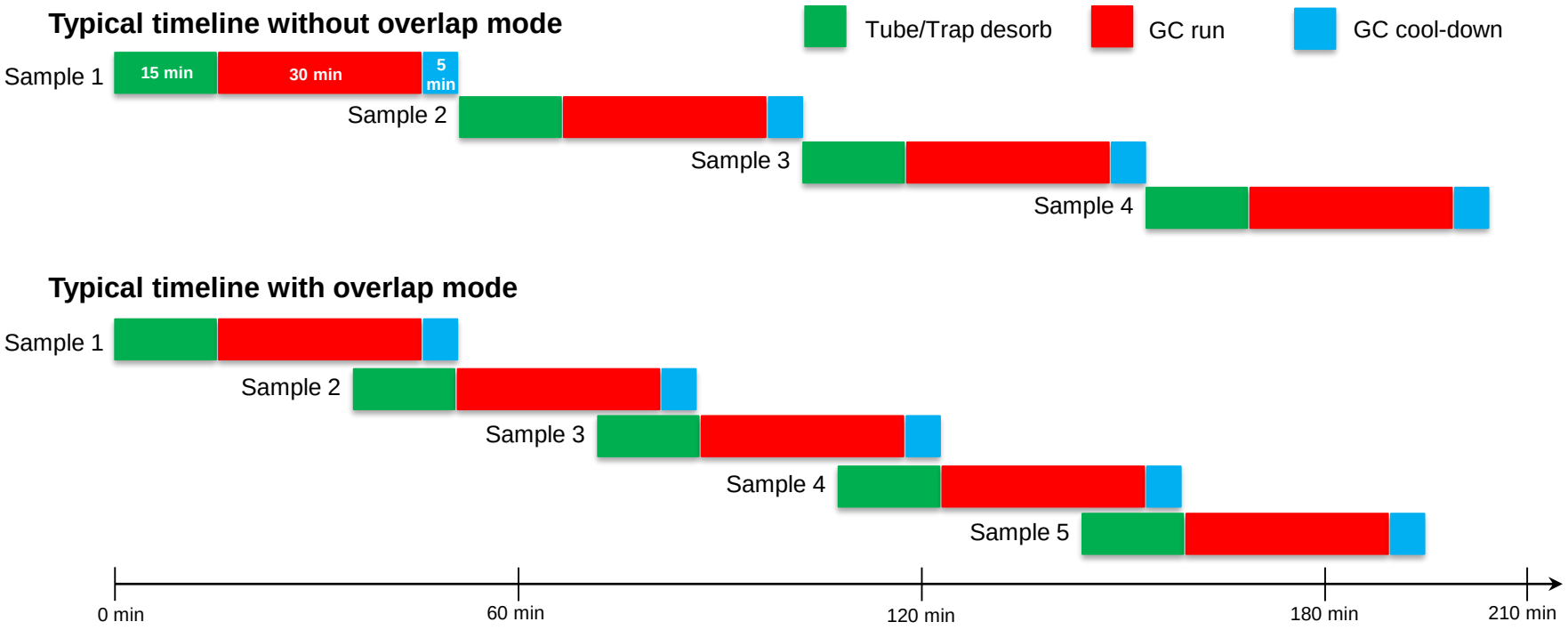


	Status	Sample Type	Comment	Method	Tube	Channel	Recollection Type	Recollection Tu...	Sample Gas
1	Complete	Sample		Tube Sample (issue 4)	1		None		
2	Complete	Sample		Tube Sample (issue 4)	2		None		
3	Complete	Sample		Tube Sample (issue 4)	3		None		
4	Complete	Sample		Canister Sample (issue 3)		12	None		N2
5	Complete	Sample		Canister Sample (issue 3)		13	Tube	99	N2
6	Active	Sample		Canister Sample (issue 3)		14	Tube	100	N2

Maximising system productivity

xr-series system feature several unique and innovative functions to minimise cycle and set-up times.

- **Overlap mode**: allows the focusing of a subsequent sample to begin during analysis of a previous sample.



- 5 samples complete in the time it would take to run <4 samples without overlap

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Thermal desorption sampling accessories

The widest range of sampling accessories and sorbent tubes to help you get the best results for your analysis

Innovative TD sampling accessories extend the application range

TC-20 & TC-20 TAG

Multi-tube conditioners and dry-purge units

Micro-Chamber/Thermal Extractor

Emissions screening and dynamic headspace

MTS-32

Sequential tube sampling

HiSorb

Sorptive extraction probes

Breath sampling options

ACTI-VOC

Low-flow sampling pump

Easy-VOC

Grab-sampler

Pumped sampling options

TC-20 and TC-20 TAG

Tube conditioning and dry-purge units

- Enhance productivity
  - Free up TD instrument for analysis
- Improve efficiency
  - Simultaneously condition or dry purge up to 20 tubes
  - TC-20 TAG also cools up to 20 tubes, whilst another batch of 20 are being conditioned
- Lower operating costs
  - Can use dry nitrogen instead of helium
- Minimise downtime
  - Eliminates risk of contamination to TD instrument of both compounds and water
- Free up bench space
  - Minimal footprint

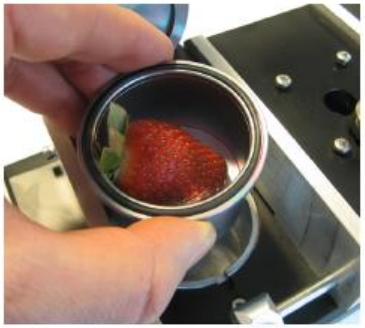
Micro-Chamber/Thermal Extractor

Fast, Simple, Cost-effective, Robust, Reliable, Sensitive, Versatile, Compliant

- Compact, stand-alone unit for rapid sampling of chemicals and odours released from a wide variety of products, foods and materials.
- Dynamic headspace approach, samples of VOCs and SVOCs onto sorbent tubes
- Simulates real-world ageing / formulation processes
- Ideal solution for
  - Industry – R&D, Formulation & QC screening
  - Test Labs – Certification, screening
  - Government labs – Certification and R&D
  - Universities – R&D
- Compatible with multiple sample types:
  - Sorbent tubes (industry standard and other)
  - DNPH,
  - online systems & continuous monitors

µ-CTE Ease of use

1 Load the material



The sample is placed inside one of the chambers. Up to four or six samples can be accommodated, depending on the model of µ-CTE chosen.

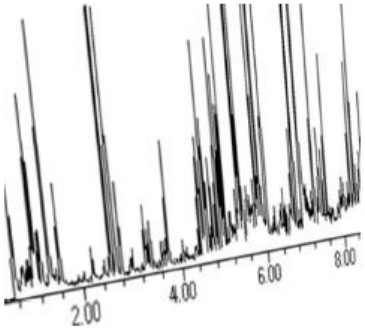
2 Set the conditions

Each chamber lid is closed, a flow of gas (air or nitrogen) is applied, and the temperature selected – from ambient up to 120°C or 250°C depending on the model of µ-CTE chosen.

3 Collect the volatiles

A sampling tube is attached to the outlet of each chamber, and vapours from the sample are swept onto it. The sorbent packing can be optimised for the analytes of interest.

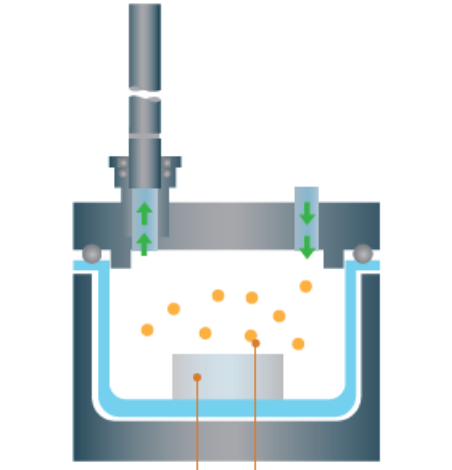
4 Analyse the sample



Analysis of sorbent tubes for VOCs and SVOCs uses thermal desorption (TD) with GC or GC–MS. Analysis of DNPH cartridges for formaldehyde is carried out by HPLC.

Sampling approaches

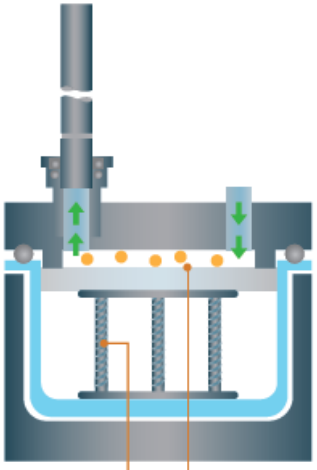
Bulk emissions testing is valuable for profiling odours and emissions, and for testing of raw materials and foods.



Samples are placed straight into the chambers.

Vapours swept from the entire sample are collected.

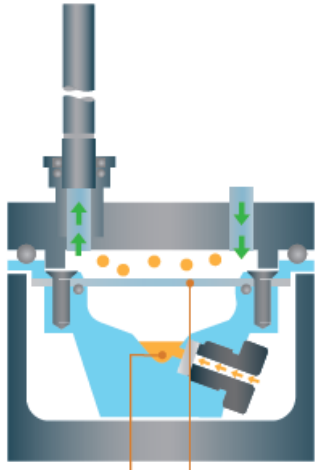
Surface emissions testing: This approach is suitable for determining area-specific emission rates from flat samples.



Sprung spacers raise planar samples to the top of the chamber.

A seal forms when the lid is closed, so only vapours released from the sample's surface are collected.

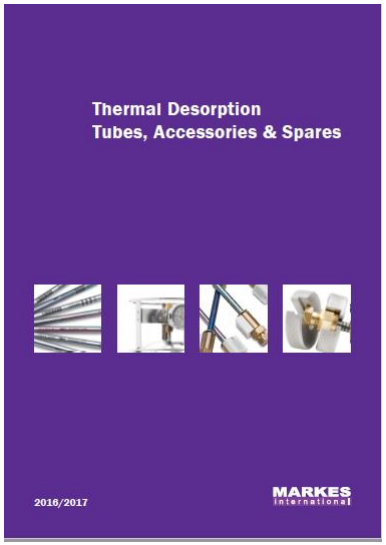
Permeation testing: A permeation accessory allows measurement of volatiles permeating through a thin layer of material.



Liquid samples are injected through a septum into the well under a sealed sample of test material.

Vapours diffuse through the test material into the chamber.

Application specific consumables



Sorbent tube labelling

Standard features

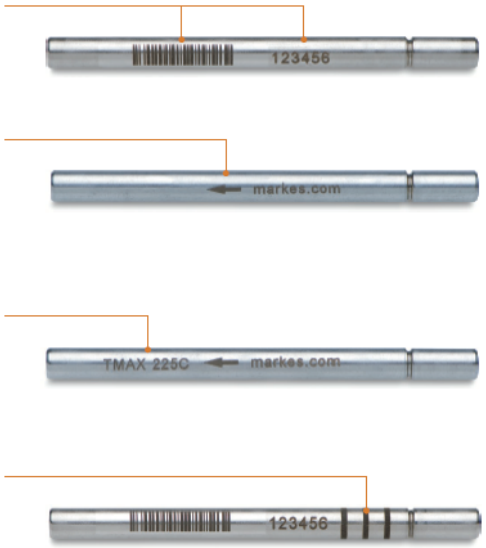
All Markes International's tubes are permanently labelled with a **unique ID number, in clear numeric and barcode formats**, to help you keep track of samples and tube stock. The barcodes reduce errors and minimise time-consuming manual data entry. See below for Markes' recommended barcode reader.

Each tube also features a **sampling arrow** indicating the direction of the air/gas sampling flow to aid field monitoring.

Special labelling options

You can specify up to 10 additional **alphanumeric characters** to be etched on Markes International's stainless steel tubes – for example, to identify the sorbent, maximum temperature or company name. Just include clear details of your requirements with your order.

Stainless steel tubes can also be etched with up to five **permanent black bands**, for rapid visual identification of sorbent type or project ID. Just send us your banding requirements with your order, or contact us with any questions.



Recommended cold traps for UNITY 2, UNITY-xr, TD-100 and TD100-xr instruments*

Description	Part number
Cold trap, 'High-boilers', C_8 to C_{40}	U-T1HBL-2S
Cold trap, empty, for Kori-xr™	U-T1KORI
Cold trap, 'General-purpose hydrophobic', $C_{4/5}$ to $C_{30/32}$	U-T2GPH-2S
Cold trap, 'TO-14 Air toxics', C_2 to C_{14}	U-T3ATX-2S
Cold trap, 'Water management', C_2 to C_{20}	U-T4WMT-2S
Cold trap, 'Ozone precursors and freons'	U-T5O3F-2S
Cold trap, 'Sulfur/labile'	U-T6SUL-2S
Cold trap, empty	U-T7EMP-2S
Cold trap, custom-packed	U-T8CUS-2S
Cold trap, Tenax TA	U-T9TNT
Cold trap, 'Chemical warfare agents'	U-T10CW-2S
Cold trap, 'General-purpose carbon', $C_{4/5}$ to $C_{30/32}$	U-T11GPC-2S
Cold trap, 'Material emissions', C_4 to C_{32}	U-T12ME-2S
Cold trap, 'Hydrogen sulfide'	U-T14H2S-2S
Cold trap, 'TO-15/TO-17 Air toxics', $C_{2/3}$ to $C_{30/32}$	U-T15ATA-2S
Cold trap, 'Greenhouse gases', C_2 to C_{14}	U-T16GHG-2S
Cold trap, 'Ozone precursors'	U-T17O3P-2S
Cold trap, '325'	U-T18325-2S
Cold trap, 'PAH'	U-T19PAH-2S

Complete solutions…

…With full traceability

Application areas















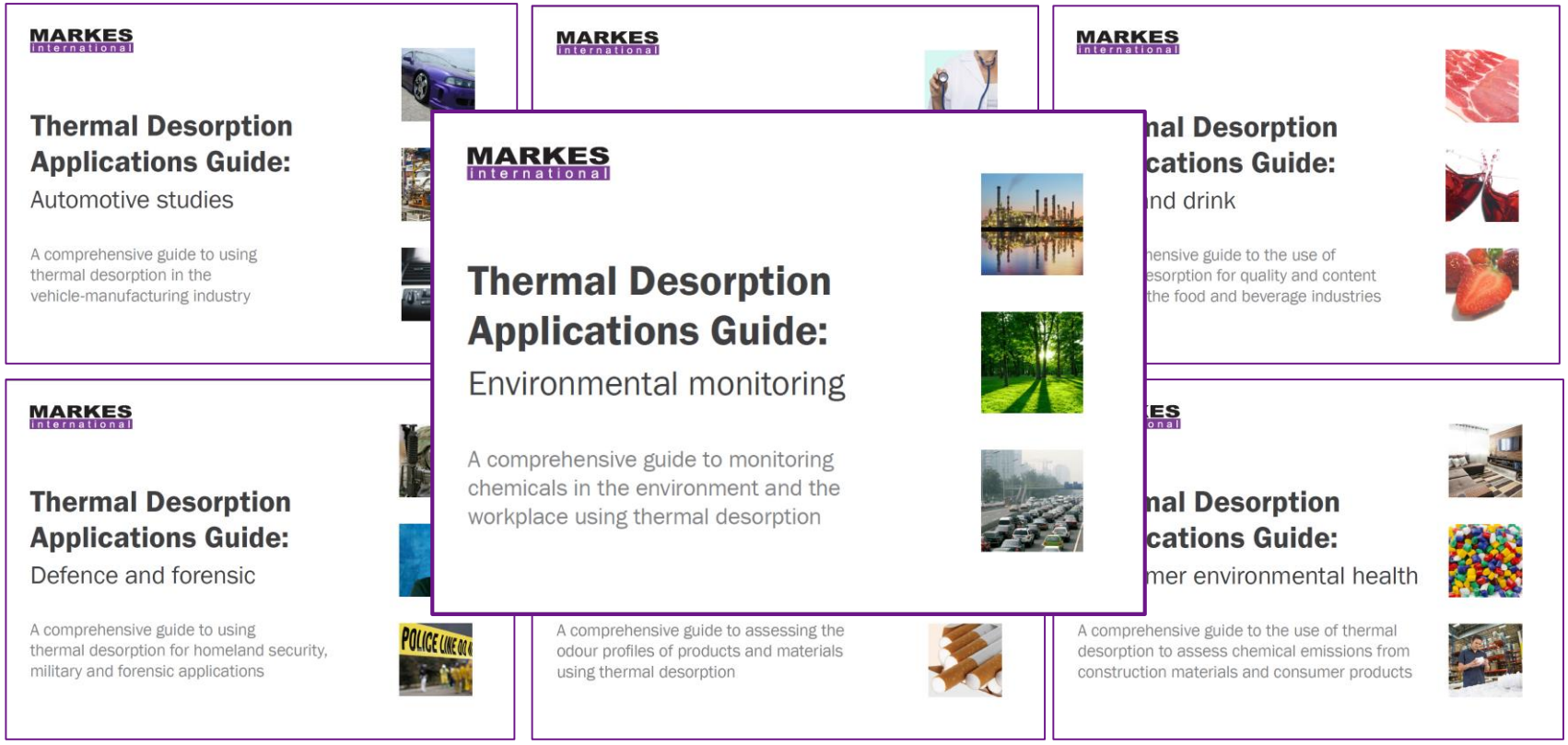





Environmental monitoring | Biological profiling | Automotive studies | Defence & Forensics | Fragrance & odour profiling | Consumer environmental health | Food & Drink

Thermal Desorption: Application Guides

Available on www.markes.com



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