MILESTONE
HELPING CHEMISTS

THE RIGHT COMBINATION
OF PERFORMANCE AND PRODUCTIVITY
IN ELEMENTAL ANALYSIS

ultraCLAVE

Fully Automated Single Reaction Chamber
Microwave Digestion System

MARKET-LEADING
INNOVATION

FULLY
AUTOMATED

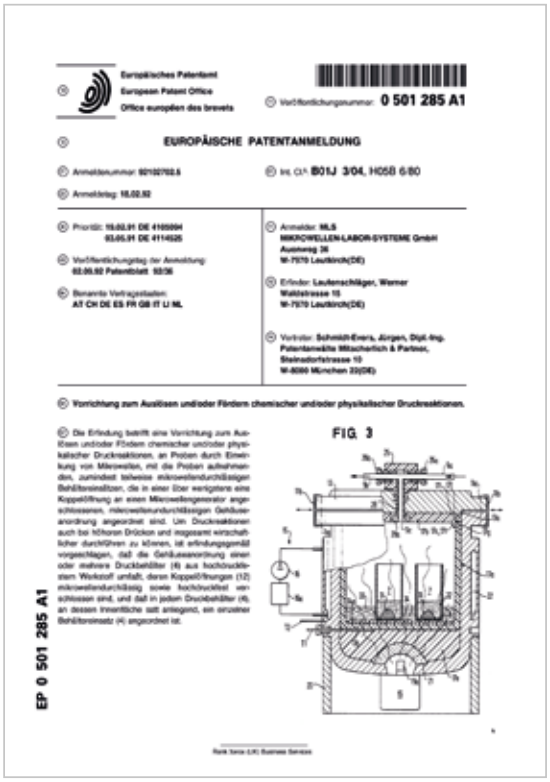
ENHANCED
PERFORMANCE

UNSURPASSED
THROUGHPUT

GREAT RETURN
ON INVESTMENT

THE TECHNOLOGY THAT REVOLUTIONIZED SAMPLE PREPARATION

Thousands of laboratories worldwide perform heavy metals analysis on a wide variety of matrices daily with sample preparation often bottlenecking productivity and efficiency. The ultraCLAVE was invented and introduced by Milestone in the mid 90's, and is based on the revolutionary concept of Single Reaction Chamber technology (SRC), more recently applied by Milestone to the ultraWAVE. SRC technology breaks the standard paradigms in microwave digestion, moving from rotor-based technology to a high-pressure stainless-steel reactor. The ultraCLAVE is capable of running as many as 77 samples simultaneously at high temperature up to 300 °C and pressure up to 200 bar, thus enhancing lab efficiency.


Europäisches Patentamt
European Patent Office
Office européen des brevets

0 501 285 A1

EUROPÄISCHE PATENTANMELDUNG

Int. Cl.: B01J 3/04, H05B 6/80

Vorrichtung zum Auslösen und/oder Fördern chemischer und/oder physikalischer Druckreaktionen.

FIG. 3

EP 0 501 285 A1

Patents:
US 5,382,414-5,725,835
Germany 4105094-4114525
Europe EP0728038-W09513133

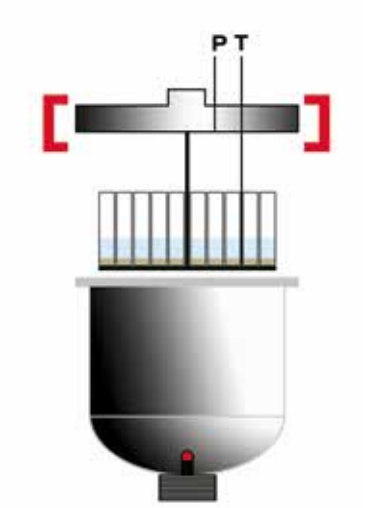
THE STATE-OF-THE-ART IN MICROWAVE SAMPLE PREPARATION

The ultraCLAVE's utilization of SRC technology allows for the processing of mixed matrices in the same run with different chemistries and to use vials/racks instead of vessels/rotors, which essentially removes the handling step in sample preparation. The ultraCLAVE completely changes the rules in microwave sample preparation and sets new standards in digestion, enhancing the overall efficiency in elemental analysis.

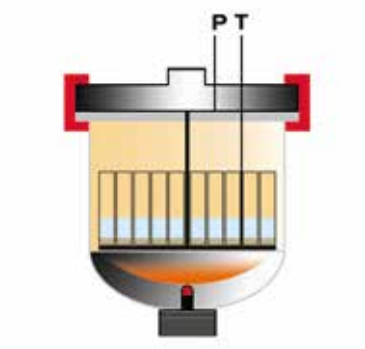
A STEP FORWARD IN SAMPLE PREPARATION AUTOMATION

THE OPERATING SEQUENCE WITH SRC TECHNOLOGY

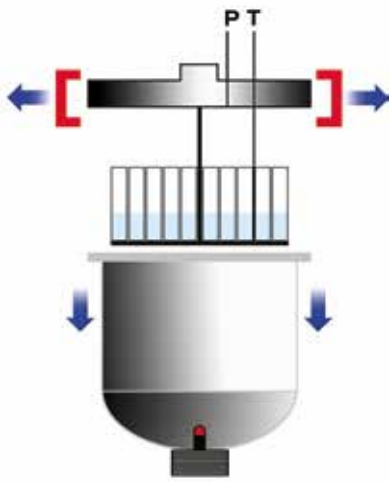
Sample preparation is the most labor-intensive step in elemental analysis, as it requires assembling, closing, opening and disassembling of the vessels. These operations involve a lot of handling, which is directly affected by the number of vessels used. The ultraCLAVE with SRC technology, uses vials and racks instead of rotors and vessels, completely removing laborious handling. SRC technology is based on a stainless-steel reactor with a volume in excess of 4 L, which act as both a microwave cavity and digestion vessel. A 3.5 L PTFE vessel with a base load is introduced into the stainless-steel reactor. The operator places the samples and acids into vials with loose-fitting caps, places the rack in the ultraCLAVE and the digestion process begins **(Step 1)**. By pressing "START" on the dedicated large screen terminal, the system automatically closes the stainless-steel vessel and clamps, loads the nitrogen pressure and runs the pre-selected microwave program **(Step 2)**. After completion the vials are cooled using a powerful external chiller, pressure is safely released, and the main reactor opens, delivering the digested solutions ready for dilution and analysis **(Step 3)**.



Step 1



Step 2



Step 3

COMPLETE DIGESTION CONTROL

The ultraCLAVE microwave program is fully controlled by our easyCONTROL software. Simply press start and the temperature program is precisely followed, simultaneously controlling all digestion parameters. The same digestion conditions are ensured in all vials through a dedicated sensor directly immersed in the base load. As the samples sit in the base load, any sample type and amount with different acid mixtures and volumes can be used simultaneously, ensuring the same temperature and pressure in all vials and enhancing the lab workflow. The wide temperature and pressure working range allows for the complete digestion of highly reactive matrices, large masses of organic samples and hard-to-digest samples, resulting in a valuable tool for elemental analysis.

DIGESTION VIALS

SRC technology completely changes the rules of sample preparation. Instead of using a traditional digestion rotor, a rack and vials with loose-fitting caps are used, which greatly simplifies daily operation and reduces running costs. The ultraCLAVE racks are available in several configurations to accommodate varying sample throughput needs as well as large sample masses. Several racks are available and the selection of vials includes high-purity PTFE, quartz and disposable glass. The use of disposable glass vials eliminates the tedious and time-consuming cleaning step, improving lab workflow. Rack handling is as simple as hanging it in the system. Moreover, SRC technology allows for the use of a single method regardless of the sample type and amount, making it possible to digest different matrices together in the same run (see picture below of the ultraCLAVE rack loaded with different matrices).

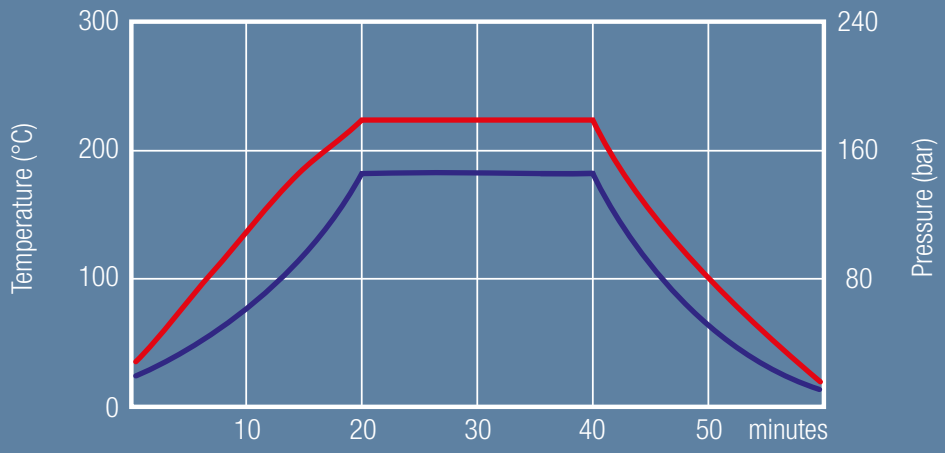
Example of racks available	Vials materials with loosing fit caps	Typical sample amount	Typical acid volume
6 positions	PTFE and Quartz	Up to 5 g	20-25 mL
15 positions	PTFE and Quartz	2 g	10-15 mL
25 positions	PTFE and Quartz	1 g	5-10 mL
40 positions	PTFE, Quartz and disposable glass	0.5 g	5 mL
62 positions	PTFE, Quartz and disposable glass	0.5 g	3-4 mL
77 positions	PTFE, Quartz and disposable glass	0.2 g	3-4 mL

ultraCLAVE rack with Ø16 mm vials available with 40 and 62 positions

GAIN EFFICIENCY WITHOUT COMPROMISING PERFORMANCE

PERFORMANCE

The combination of stainless-steel reactor with microwave technology results in a digestion system with superb performance and abilities. The temperature range up to 300 °C allows for the digestion of virtually any sample, while the maximum pressure of up to 200 bar allows for digesting very large sample amounts. Highly reactive samples such as large amounts of food, pharmaceuticals, polymers and petrochemicals can be completely digested. Furthermore, the platform's flexibility found a natural fit in other analytical testing labs such as environmental, clinical and biological. The ultraCLAVE allows for the simultaneous digestion of completely different matrices with different chemistries, as the set conditions in the stainless-steel cavity are applied to all vials, ensuring complete digestion of all samples in the reaction chamber.



Typical ultraCLAVE digestion cycle with the 40 position rack.
0.5 g of organic samples such as infant formula, butter an API and fish oil with 5 mL of HNO_3

SIMULTANEOUS DIGESTION OF ANY SAMPLE


Agriculture


Beverage

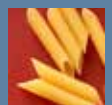

Ceramics


Chemicals


Clinical


Cosmetics


Environmental

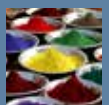

Food & Feed


Geochemistry


Petrochemical


Officials


Pharmaceutical

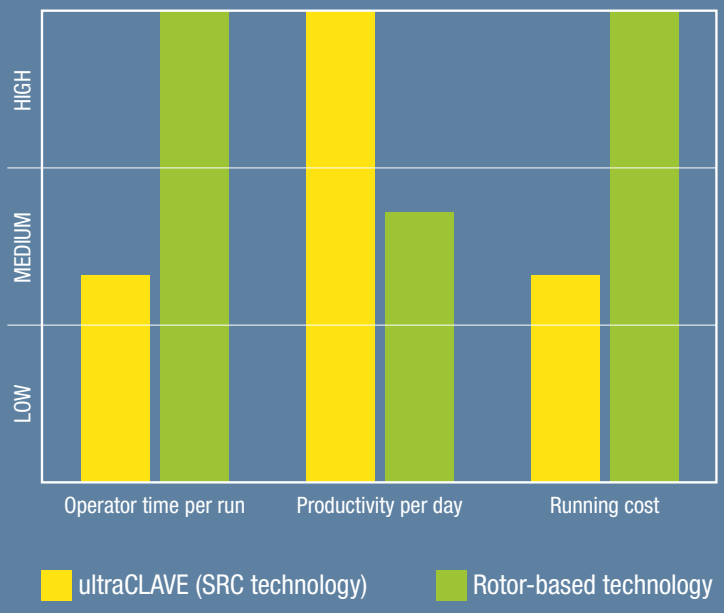

Pigments


Polymers

GREATER PRODUCTIVITY & ROI

SRC technology offers high throughput without compromising productivity. The ultraCLAVE greatly reduces handling and operator time, eliminates the need to batch the samples and to clean of vials, resulting in a more productive approach to digestion across multiple industries. Most samples will be digested using a single program, eliminating method development and simplifying the digestion procedure. The ultraCLAVE is an efficient tool for mixed or similar samples. Lab throughput is greatly enhanced, with a microwave digestion cycle taking about 60 minutes for 62 or 77 samples. Lab efficiency is improved by removing the need to batch samples, speeding up the digestion cycle and using inexpensive consumables. The ultraCLAVE offers superior productivity, ease of use and performance far surpassing any conventional digestion system.

Efficiency comparison



The above graph compares the efficiency ratio between a rotor-based system (f.e. 40 positions) and the ultraCLAVE (with 40 positions) with SRC technology, considering operator time, productivity and running costs

SMART SOFTWARE TO SAVE YOUR TIME

The ultraCLAVE is controlled via a large external terminal with an easy to read, bright, full-color touchscreen display. Multiple USB and ethernet ports are provided for interfacing the instrument to external devices and to the local laboratory network. The terminal runs Milestone's easyCONTROL software, which is user-friendly, icon-driven, and multi-language. Simply recall a previously stored method or create a new one. Press the "START" icon and the system will automatically follow the user defined temperature profile using a sophisticated PID algorithm. The easyCONTROL software controls and monitors all digestion parameters, providing the right amount of power to follow the pre-set temperature and pressure profile. Additional safety parameters are continuously monitored, such the reactor temperature and the pressure limit. Several applications, including all US EPA methods are pre-loaded, eliminating any need for method development.

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Established in 1988, Milestone is headquartered in Italy and has offices in Germany, Switzerland, the Unites States, China, Japan and Korea. We operate worldwide through a network of over 100 exclusive distributors, all providing our customers premium application and service support. Milestone's mission is to help chemists by offering them the most advanced instrumentation for sample preparation and direct mercury analysis in the world. Our industry-leading technology, in combination with fast, responsive service and applications support, allows Milestone to support our goal of providing you the highest return on investment possible.

ADDITIONAL MILESTONE SOLUTIONS FOR ELEMENTAL ANALYSIS

ETHOS UP

High Performance
Microwave Digestion System

ultraWAVE

The Game Changer in Microwave Digestion

DMA-80 *evo*

Direct Mercury Analyzer

traceCLEAN

Acid Steam Cleaning System

duoPUR/subCLEAN

Acid Purification System

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