TGA
Thermogravimetric Analyzer

LINSEIS

General

Thermogravimetry is a technique in which the mass of the sample is monitored against time or temperature while the temperature of the sample, in a specified atmosphere, is programmed. This technique serves the determination of material compositions. It is a common used analysis method in the chemical and pharmaceutical industry. Thermogravimetric analysis (TGA) is performed on polymers, food, pharmaceuticals as well as many other materials.

Unsurpassed performance

L - DSC – Combined weight change and differential scanning calorimeter

Unsurpassed sensitivity – sub microgram balance with thermostatic controlled measurement chamber

Benchmark resolution – for detection of fast weight changes

Reliable Automation – up to 64 position autosampler

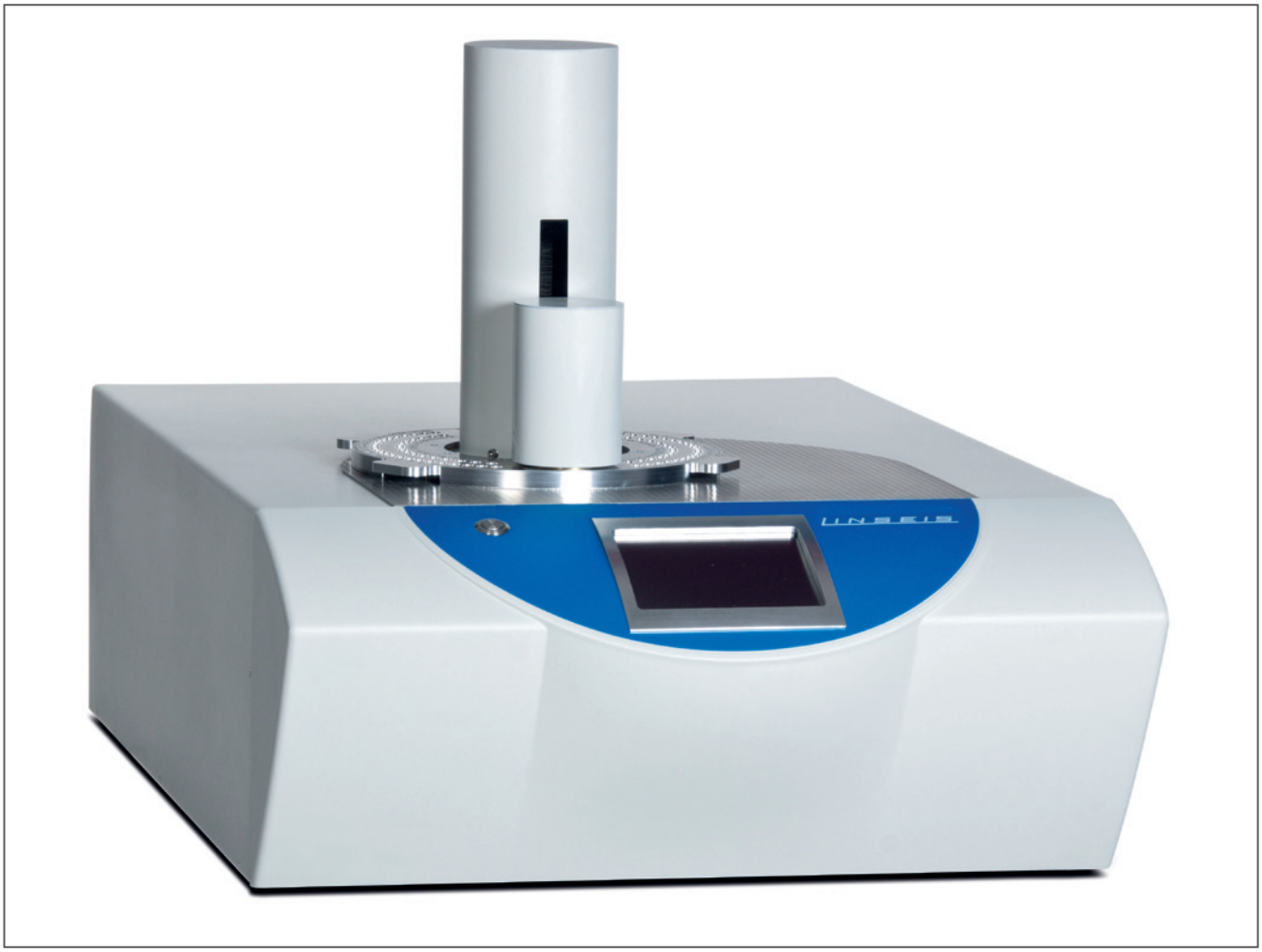
Ultra Fast Heater – Ceramic heater with up to 200°C/min

TGA 1000

The LINSEIS TGA 1000 is a robust and reliable TGA outperforming most competition high end models. The sub microgram balance offers highest sensitivity and resolution. The instrument is perfectly suited for academic teaching and day to day laboratory quality control applications.

TGA 1000 HiRes

Research grade TGA equipped with an ultra high resolution sub microgram balance. The low mass design in combination with the ceramic high speed furnace provides just the right tool for demanding researchers. In combination with the 64 position autosampler and the software controlled evacuation and gas dosing option the TGA can tackle demanding sample runs completely unattended.



Software

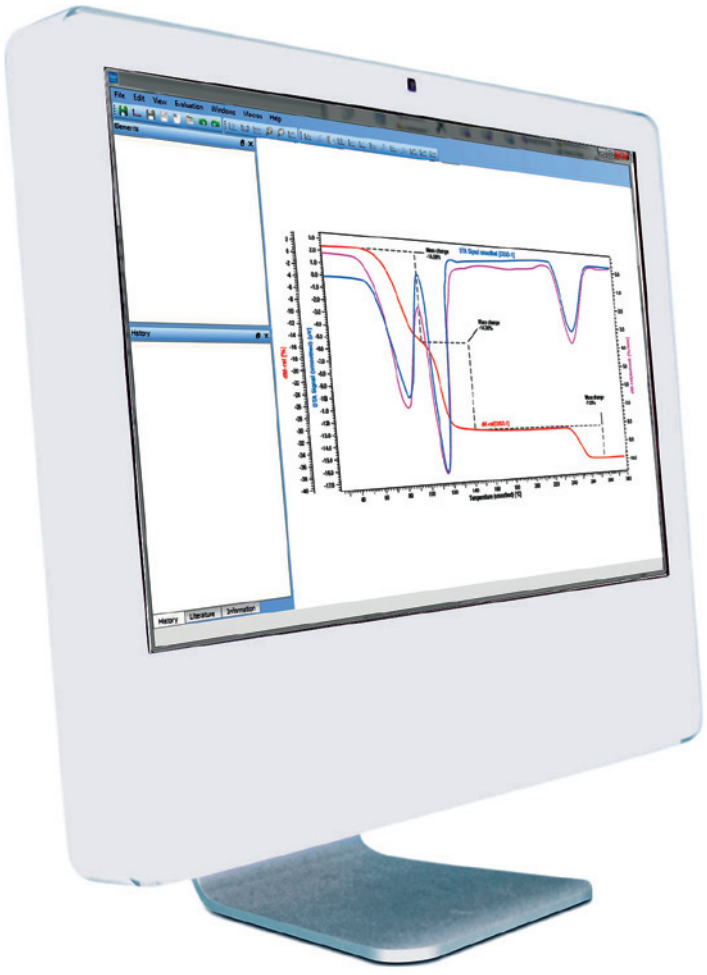
All LINSEIS thermo analytical instruments are PC controlled. The individual software modules exclusively run under Microsoft® Windows® operating systems. The complete software consists of 3 modules: temperature control, data acquisition and data evaluation. The 32 bit software incorporates all essential features for measurement preparation, execution, and evaluation of a Thermogravimetric measurement. Thanks to our specialists and application experts, LINSEIS was able to develop comprehensive easy to understand user friendly application software.

TG – Features:

- Mass change as % and mg
- Rate Controlled Mass Loss
- Evaluation of mass loss
- Residue mass evaluation

Features-Software:

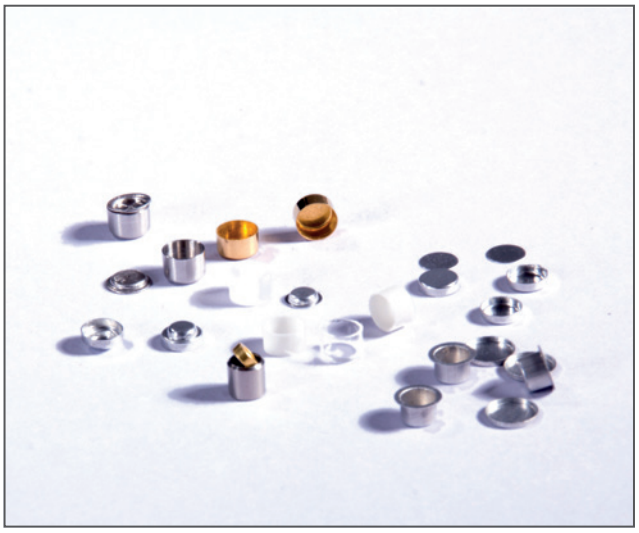
- Program capable of text editing
- Data security in case of power failure
- Thermocouple break protection
- Repetition measurements with minimum parameter input
- Evaluation of current measurement
- Curve comparison up to 32 curves
- Storage and export of evaluations
- Export and import of data ASCII
- Data export to MS Excel
- Multi-methods analysis (DSC TG, TMA, DIL, etc.)
- Zoom function
- 1 and 2 derivation
- Programmable gas control
- Statistical evaluation package
- Free scaling
- Optional Kinetic and Lifetime Prediction Software packages



Unique Features

Measurement system

The platinum measuring system enables precise TGA measurements. The unique L-Calc DSC sensor attachment permits differential scanning calorimeter signals.



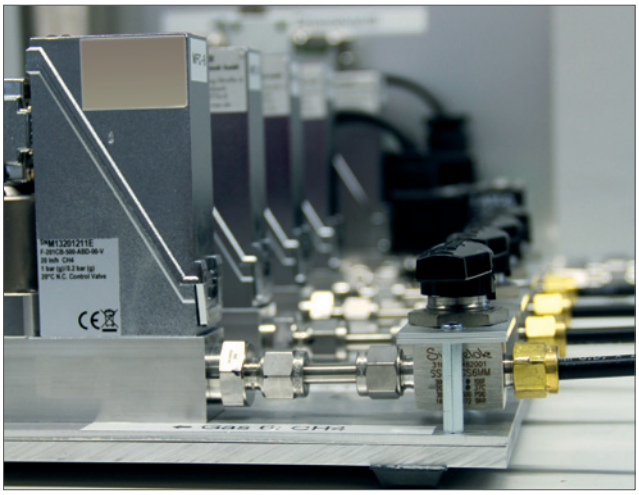
Options

The following options are available for the TGA:

GC, MS or FTIR coupling for evolved gas analysis (EGA) Turbo-molecular pump: for measurements under highest vacuum and cleanest gas-atmospheres and a vapor generator.

Gas dosing system

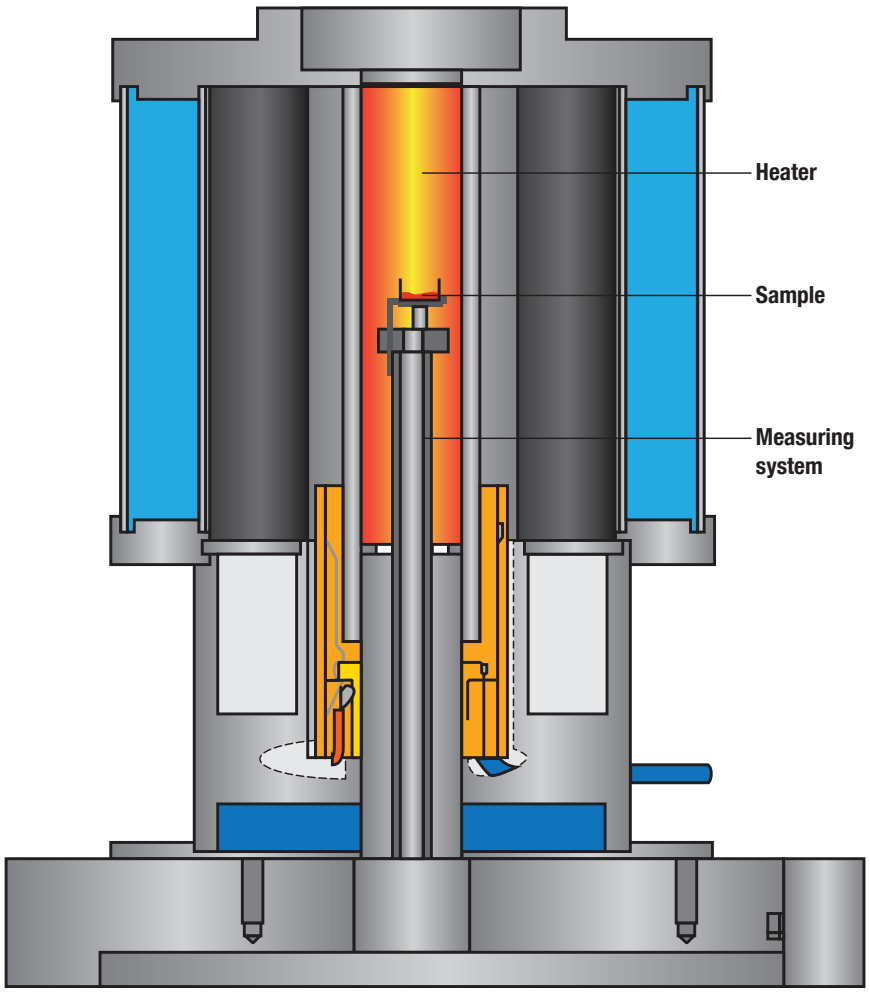
The TGA 1000 HiRes (TGA 1000 optional feature) incorporates an automatic gas dosing system (MFC Mass Flow Controller) containing two gas channels. The flow rate of the two gases is software controlled.



Atmosphere

The balance design enables measurements under inert, oxidative, reducing and vacuum conditions. Corrosive conditions can be analyzed with proper precautions. The system is capable of adapting residual gas analysis systems using an optional heated capillary.

Specifications



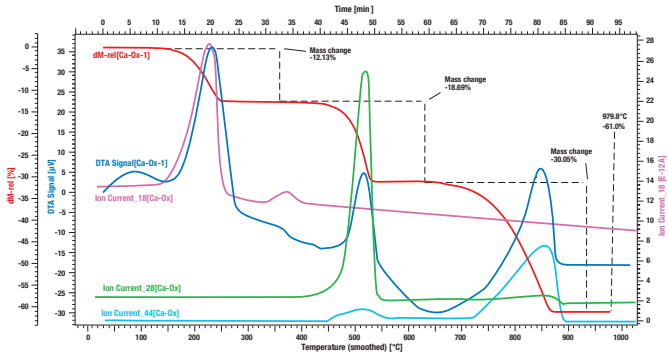
	TGA 1000	TGA 1000 HiRes
Temperature range	RT up to 1100°C	RT up to 1100°C
Heating and Cooling Rates	0.01 to 150°C/min	0.001 to 200°C/min
Sample Mass	5g	2g
Resolution	0.5µg	0.1µg
Vacuum	—	Yes (optional)
Sample Carriers	TGA	TGA-DTA/DSC*
Sample Robot	44 Positions	88 Positions
Power requirements	230/208 VAC 50/60 Hz	230/208 VAC 50/60 Hz

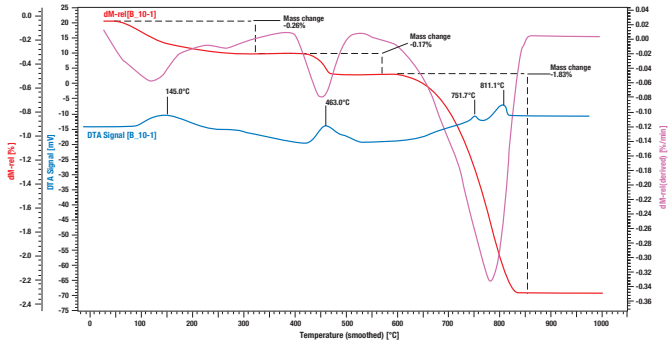
**calculated.: DTA/DSC*

Applications

Decomposition of calcium oxalate monohydrate $CaC_2O_4 \cdot H_2O$ under argon atmosphere

The evolved gases from the decomposition of Calcium Oxalate have been fed into the Mass Spectrometer with a heated capillary. The ion currents for mass numbers 18 (water), 28 (carbon monoxide) and 44 (carbon dioxide) have been imported into the graph.



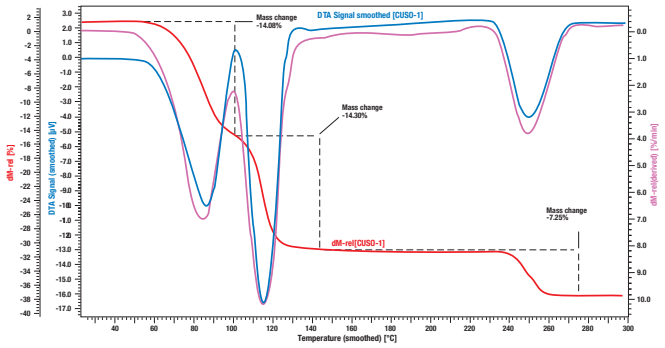


Cement

The main parts of cement are tri calcium silicate, di calcium silicate and tri calcium aluminates. After putting on the cement with water different hydrates slowly form. The absorbed water evaporates first, then hydrates of the calcium silicate decompose and at 570°C the hydroxides of calcium, magnesium and aluminum follow. Subsequently, calcium carbonate CO_2 splits off.

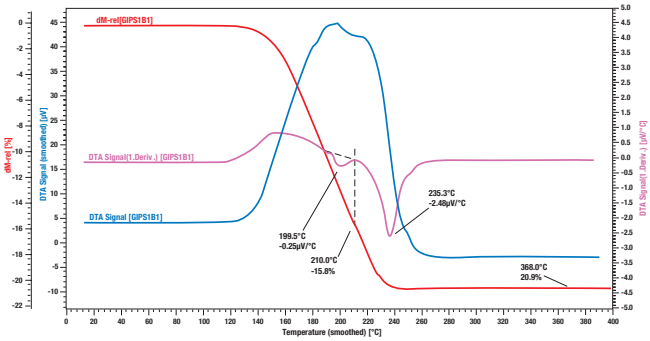
Vitriol of copper

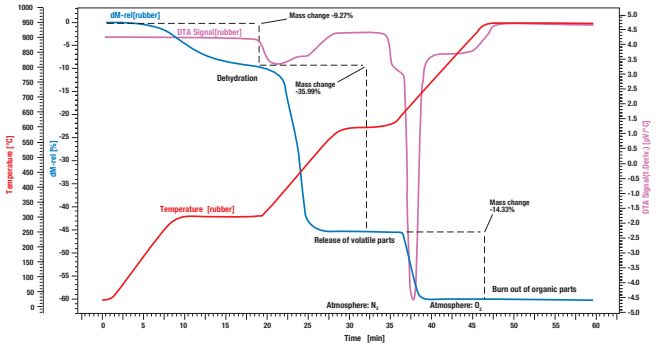
Inorganic salts first set their crystal water free. Vitriol of Copper heated with 10°C/min. results in a first TG stage, which corresponds to $4H_2O$. TG and DTA show that the curve is made up of two separate steps, one closely behind the other. At around 250°C the most strongly bound water evaporates.



Dehydration of raw gypsum $CaSO_4 \cdot 2\ H_2O$

The dehydrate is Raw gypsum. There are two molecules of water attached to a single $CaSO_4$ molecule. By heating up to app. 160°C the semi hydrate gypsum is built. 1,5 molecules of water are released; so two $CaSO_4$ molecules are sharing a single water molecule. By heating to higher temperatures (400°C) the anhydrate is built. This is the so-called „dead burned gypsum“, also known as alabaster. In this state no water at all is attached to the $CaSO_4$ molecules.



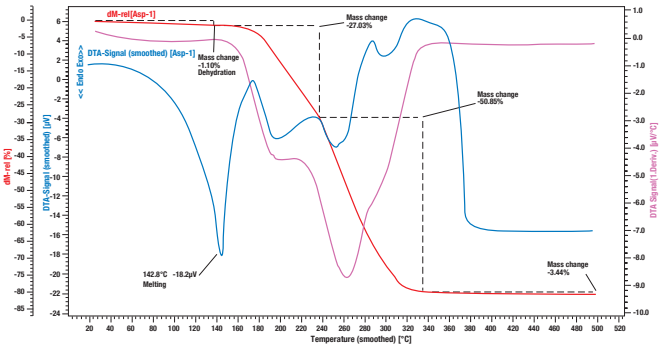


Decomposition of rubber

In the first step of weight loss, the dehydration of the sample takes place. The amount of water was 9.27%. In the second reaction step, the volatile components are released by pyrolysis under N_2 atmosphere. The amount of these components is 35.99%. For the third reaction step, the atmosphere is changed to O_2 – all organic components are burned out. The loss in weight is 14.33%. The remaining rest of 40.41% are inorganic components like ashes, slake or fillers.

Aspirin

At the beginning of the heating process some adsorbed water is released, resulting in a weight loss of around 1%. At 140°C the melting point of the Aspirin is reached, resulting in an exothermic reaction, measured on the DTA trace. At 160°C the decomposition of the melted drug takes place in several stages. Since the decomposition products are volatile a weight loss of just about 80% occurs.



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