NETZSCH

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Instruments for Testing Refractories

Testing Refractories

Introduction

The lifetime and efficiency of any technical furnace plant depend largely on the suitable selection, the quality and the correct installation of the refractory furnace lining.
The furnace designer, furnace builder, refractory manufacturer, and the engineer responsible for the operation are well aware of the relationships between these factors.

A suitable selection of the refractory furnace lining can only be made with an accurate knowledge of the properties of the refractory materials, and of the stresses on the materials during service.

The relationship between different thermal operational stresses in industrial furnaces and the important properties of refractory bricks during service (see table) forms the basis for the classification of the properties of refractory materials and the test methods. These methods are also of importance for quality control and development of new products.

type of stress	important operational properties
thermal and thermomechanical	refractoriness (PCE) refractoriness under load (RUL) creep in compression (CIC) hot modulus of rupture (HMOR) thermal expansion volume stability thermal shock resistance
thermotechnical	thermal conductivity specific heat bulk density thermal diffusivity

Thermomechanical properties are determined using high-temperature test methods with external forces causing stresses on the tested material. The stress-strain behaviour of refractories at high temperatures is very complicated because not only reversible elastic strain occurs, but also non-reversible non-elastic time-dependent deformations.

Therefore, the thermomechanical behaviour of refractories must be considered as the interrelation of four variables:

- stress
- strain
- temperature
- time

International Standards (ISO) for Testing Refractories

Many methods have been developed for the determination of thermomechanical and thermotechnical properties of refractory materials, but only a few of these have found worldwide application in laboratory practice and have been internationally standardized.

- ISO 1893
  (EN 993-8; DIN 51053):
  Determination of Refractoriness under Load (differential - with rising temperature)
- ISO 3187
  (EN 993-9; DIN 51053):
  Determination of Creep in Compression
- ISO 5013
  (EN 993-7; DIN 51048):
  Determination of Modulus of Rupture at Elevated Temperatures
- ISO 8894-1
  (EN 993-14; DIN 51046):
  Determination of Thermal Conductivity; Hot-wire Method (cross array; $\lambda \leq 1.5$ W/mK)
- ISO 8894-2 (EN 993-15):
  Determination of Thermal Conductivity; Hot-wire Method (parallel; $\lambda \leq 25$ W/mK)

(EN: European Standard; DIN: German Industrial Standard)

NETZSCH Instruments for Testing Refractories

The NETZSCH Refractory testing line is made up of the following instruments for tests according to ISO:

Refractoriness **U**nder **L**oad/**C**reep **I**n **C**ompression
RUL/CIC 421
25....1700°C

Hot **M**odulus **O**f **R**upture
HMOR 422
25....1500°C

Thermal **C**onductivity
(Hot-wire Method)
TCT 426
25....1500°C

Machines for test piece preparation

RUL/CIC Apparatus 421

NETZSCH RUL/CIC Apparatus 421 for the Determination of Refractoriness Under Load and Creep In Compression

Refractoriness under load (RUL) is a measure of the resistance of a refractory product to subsidence when it is subjected to the combined effects of load, rising temperature and time. The range in which the softening occurs is not identical to the melting range of pure raw materials, but it is influenced by the content and the degree of distribution of low melting point fluxing agents.

No single test method can objectively measure refractoriness under load under all the possible combinations of the many factors involved, including the duration of exposure.

Certain limitations must be accepted, in order to have a single standard test method. Such a method is described in ISO 1893, Refractoriness under load (RUL; differential - with rising temperature):

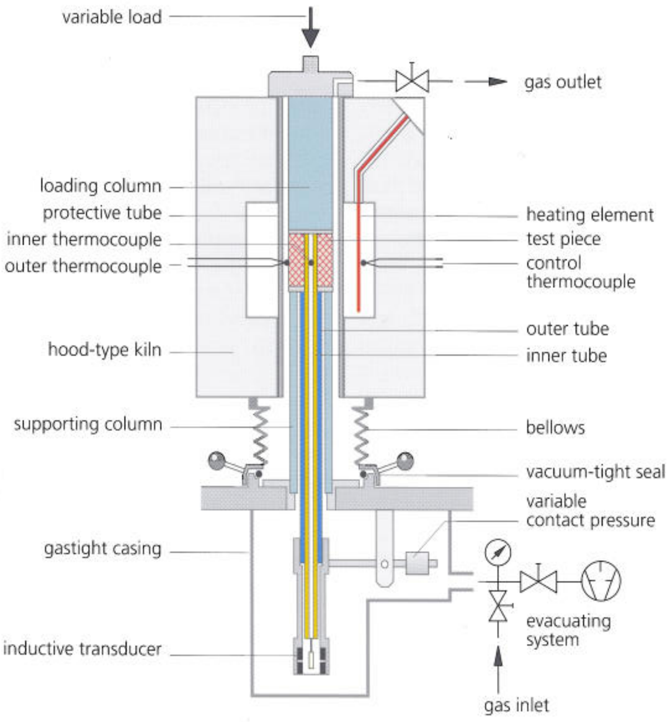
A cylindrical test piece (50 mm in diameter and height an with a co-axial bore of 12.5 mm) is subjected to a specified constant compressive load and heated at a specified rate until a prescribed deformation or subsidence occurs. The deformation of the test piece is recorded as the temperature increases, and the temperatures corresponding to specified proportional degrees of deformation are determined.

The test apparatus can also be used for the determination of creep in compression (CIC). The test procedure is described in ISO 3187:

A cylindrical test piece is heated under specified conditions (see RUL) to a given temperature. The deformation of the test piece at constant temperature is recorded and the percentage change is evaluated as a function of time.

The measuring unit, controlling unit and data acquisition are the main components of the RUL/CIC Apparatus 421. The measuring unit consists of: a console, furnace guide frame, **furnace** (maximum 1700 °C), balance weights of the **loading device** (maximum 1000 N) and **differential measuring system**. To prevent chimney effects and to guarantee a sufficient zone of constant temperature, the furnace is closed at the top. The test piece is placed on the supporting column; the furnace is lowered and load is applied by counterbalancing (minimum of 100 cN increments) the weight of the furnace. **Thermocouples** serve to regulate the furnace and to determine the test piece temperature. The change in length is transmitted by a measuring system consisting of an inner and outer tube which act differentially. These tubes are constructed of alumina and are connected to an inductive transducer. Its signal is amplified and stored in the computer system after A/D conversion.

RUL/CIC Apparatus 421 E/6 with controller



Schematic Diagram: RUL/CIC Apparatus 421 G/6 for measurements in protective gas atmosphere

The thermal expansion of the tubes is self-compensating. Therefore only the expansion of that part of the inner tube which corresponds to the test piece length must be considered. The differential measuring system can be used to measure the change in length of the test piece through its center bore (ISO/DIN) or along the outside.

Test Atmosphere

Measurements can be made in static air (basic version) or using an optional device for inert gas purge within the test piece area.

Special Versions

- Gastight measuring unit

For testing carbon-containing materials (e.g. magnesia-carbon [graphite] bricks) which have been under development and in use since the early 1980's, a reducing test atmosphere can be realized with a gastight test chamber (see fig.). This chamber can be evacuated and then purged with protective gas. Measurements can be made up to 1600 °C.

- Variable loading device

Optionally, the loading device can be equipped to vary the load. The preload can be up to 300 N and the varying load can be applied in a range of 0...700 N at a rate between 0.3 and 3 N/s.

Software

Windows software is available for fully automatic test run, data acquisition, storage and off-line evaluation. Graphic presentation of the results can be made on the monitor or printer.
The evaluation routines constist of:

- graphic and tabulated results, calculated according to ISO/DIN with special applications graphics for the evaluation of RUL and/or CIC tests
- correction of the measured data by calibration curves
- determination of characteristic data according to user's requirements
- option for automatic detection of the softening point and emergency reset.

Test Piece Preparation

According to ISO/DIN, cylindrical test pieces (50 mm in diameter and height and with a coaxial bore of 12.5 mm) are used, the ground faces of which should be plane, parallel, and perpendicular to the axis of the cylinder.

The following instruments are available for their preparatation:

- Drilling Machine 421/11
- Grinding Machine 421/12
- Sawing Machine 421/13

Technical Data RUL/CIC 421

Measuring Unit 421 E/6

Temperature range	: ambient ... 1700 °C
Heating elements	: 4 Super-Kanthal 1800
Protective tube	: none
Vacuum-tight system	: no
Test atmosphere	: static air, optional inert gas purge
Safety switch	: failure of test piece

Measuring Unit 421 G/6

Temperature range	: ambient ... 1600 °C
Heating elements	: 4 Super-Kanthal 1800
Protective tube	: alumina
Vacuum-tight system	: yes
Test atmosphere	: static/dynamic air or inert gas
Safety switch	: failure of test piece, cooling water failure

General Data

Test piece dimensions	: diameter 50 mm, height 50 mm
Load range	: 1 ... 1000 N, in steps of 1 N/100 N, max. stress: 0.5 N/mm²
Measuring range	: 20 mm
Measuring system	: differential
Digital resolution	: 5 nm
Thermocouples	: Type B

Variable Load Device (optional)

Preload	: 0 ... 300 N
Variable load range	: 0 ... 700 N
Loading rate	: 0.3 ... 3 N/s

Temperature Control and Data Acquisition (TASC 414/4)

Temperature control	: PI + STC
Segments	: dynamic
Resolution of measuring range	: 4.000.000 steps

Computer System and Software

IBM-compatible PC, with printer
interfaces: 1 x parallel
Windows 98 or higher

Dimensions and Weights (approx)

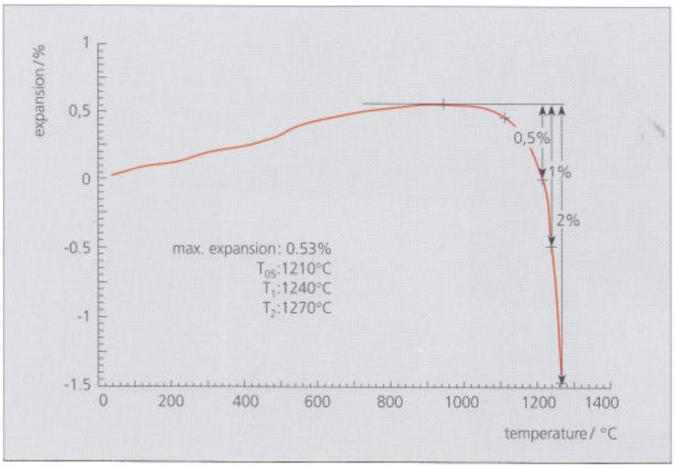
Measuring unit	1200 mm x 2400 mm x 650 mm, 480 kg
Control unit	565 mm x 1120 mm x 452 mm, approx. 220 kg

Power Supply

Electronics	: 230 V/10 A/50 Hz
Furnace	: 230 V/70 A/50 Hz, max. 15 kW

- technical data subject to change -

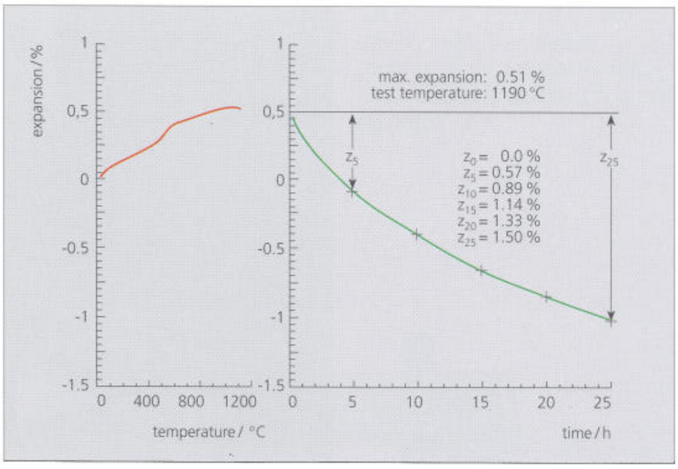
Applications



Refractoriness Under Load (RUL; differential - with rising temperature)

The graph shows the result of an RUL test on a test piece taken from a fireclay brick (approx. 35% Al_2O_3); test conditions: 0.2 N/mm²; 5 K/min; static air.

At 960°C the test piece reaches its maximum expansion. Deformations of 0.5%, 1.0% and 2.0% have been achieved at 1210°C (T_{05}), 1240°C (T_1), and 1270°C (T_2) respectively.



Creep In Compression (CIC)

A CIC test was performed on a test piece taken from a fireclay brick (approx. 35% Al_2O_3); test conditions: 0.2 N/mm²; 5 K/min; 25 h at 1190°C; static air.

The double graph shows the dynamic heating phase and the time-scaled creep at constant temperature.

HMOR Apparatus 422

NETZSCH HMOR Apparatus 422 for the Determination of Modulus of Rupture (MOR) at Elevated Temperatures

Measuring the modulus of rupture of refractories at elevated temperatures has become a widely-accepted means of evaluating materials at operating temperatures. Many companies base their specifications on this type of test. It is a very important parameter for quality control which, together with other thermophysical properties, gives information about the behaviour of refractory materials used for furnace linings.

The modulus of rupture is defined as the maximum stress that a rectangular test piece of specified dimensions can withstand when it is bent in a three-point bending device; it is expressed in N/mm^2 or MPa.

The International Standard Test Method is described in ISO 5013;
standard test piece dimensions:
150 mm x 25 mm x 25 mm.

HMOR 422/D3

For the determination of modulus of rupture of refractories at temperatures up to 1500 °C and a maximum load of 5000 N (60 N/mm^2), NETZSCH offers the model 422D/3.
This apparatus is constructed for continuous testing using a three-point bending device.

The test pieces heated to a predetermined temperature are transported to the pressure rod on sliding rails made of Al_2O_3. After precise, electrically-controlled positioning of a test piece on the bending device, a continuously increasing load is applied until failure occurs; the load at failure is indicated. Upon completion of the test, the broken test piece is transported out of the furnace and falls into a waste container. A maximum of 30 test pieces can be loaded onto the sliding rails.

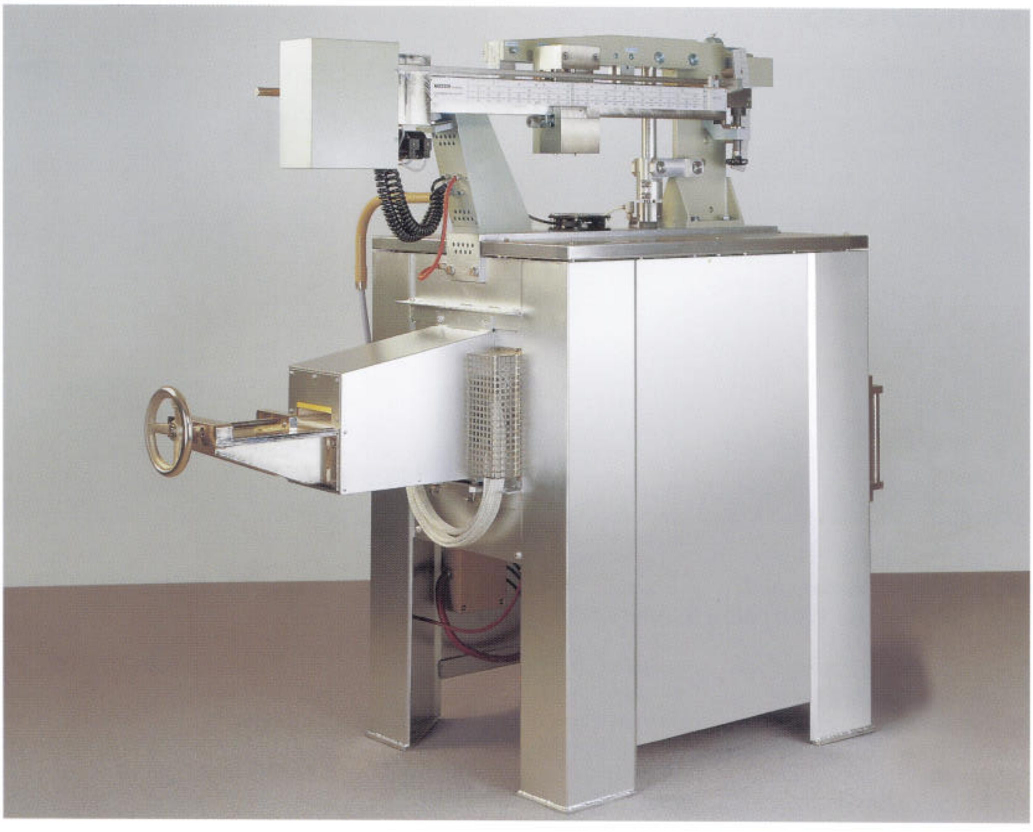
The load is applied with a motor-driven sliding weight, up to a maximum of 5000 N. According to ISO standard 5013 and DIN 51048 the bending strength increase is 0.15 $N/(mm^2 \cdot s)$ for dense products and 0.05 $N/(mm^2 \cdot s)$ for insulating products;
test piece dimensions:
150 mm x 25 mm x 25 mm.

Temperature control, data acquisition and evaluation are carried out with MS-Windows™-Software.

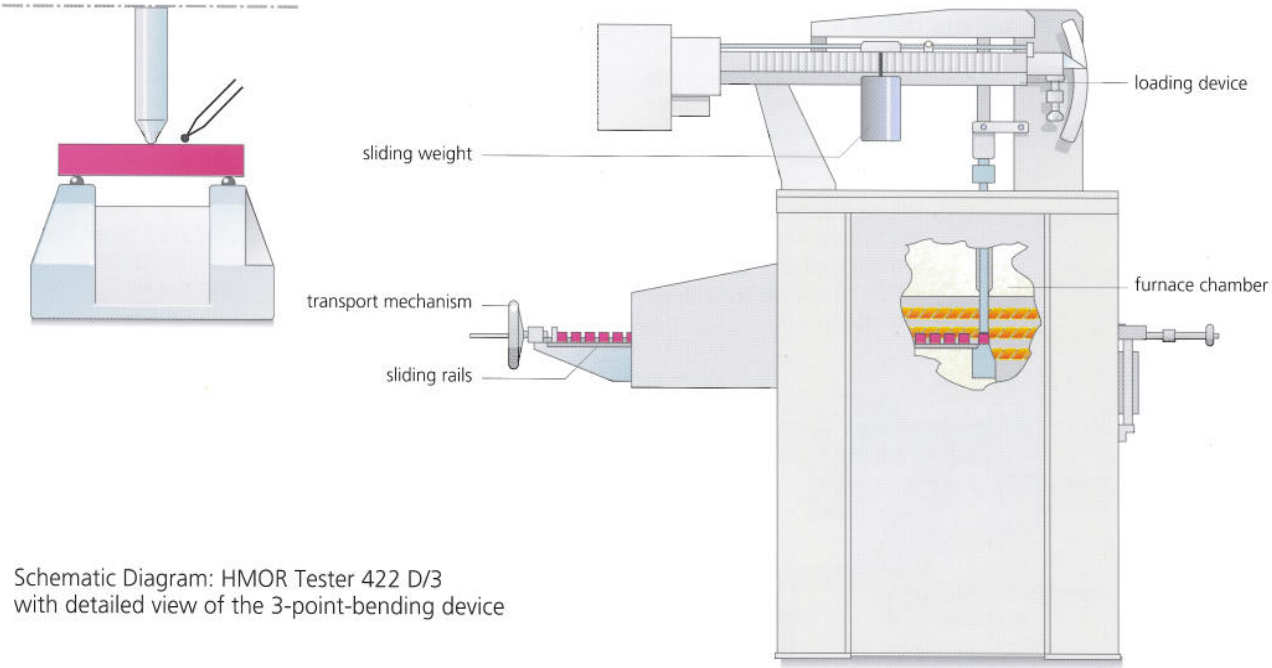
Optional Devices for

- load and deformation measurement
- constant deformation rate.

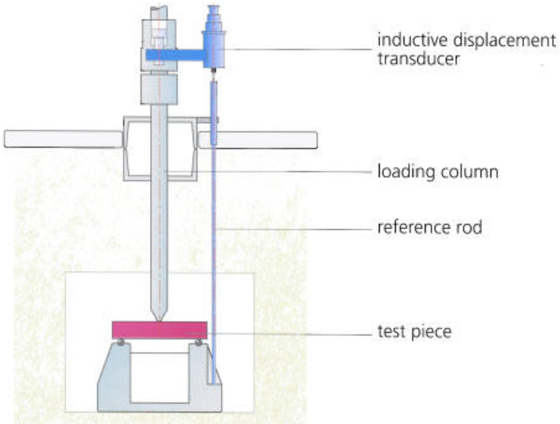
Both options give more information about the stress-strain behaviour of the material, which is important in the field of research and development.



HMOR 422 D/3; Apparatus for MOR test at elevated temperatures according to ISO 5013



Schematic Diagram: HMOR Tester 422 D/3
with detailed view of the 3-point-bending device



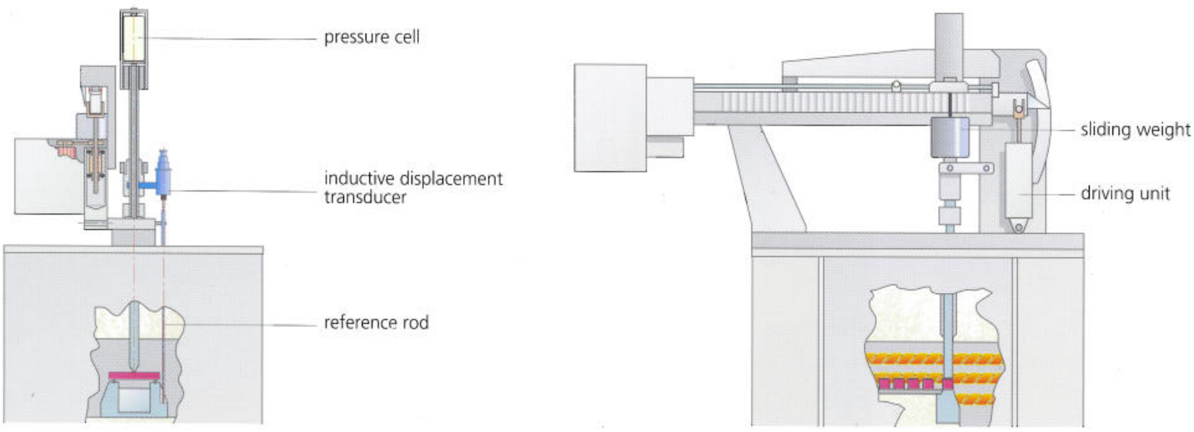
Schematic Diagram: Inductive system
for measurement of deformation

Optional Device for Measurement of Load and Deformation

The deformation of the test piece with respect to the increasing load can be optionally recorded.

Optional Device for Testing at Constant Deformation Rate

Using this option it is possible to test at a constant deformation rate. The sliding weight is fixed in the 2500N position and the downward movement of the loading column is controlled by the driving unit. The load is monitored by a pressure cell. Both load and deformation are recorded.



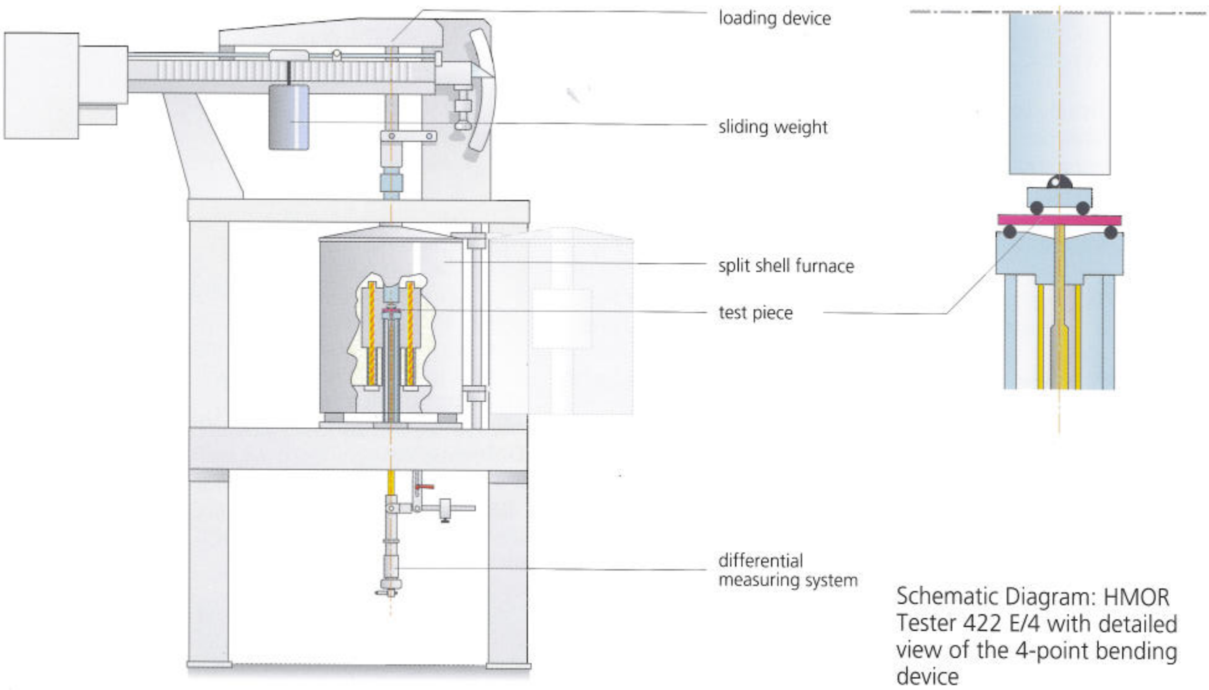
Schematic Diagram: Additional devices for
constant deformation rate and measurement of deformation

HMOR 422 E/4

The model 422E/4 performs bending strength measurements on single test pieces with the dimensions of 45 mm x 4.5 mm x 3.5 mm. Unlike the model 422D/3, the deformation of the test piece is measured at the bottom via a differential measuring device (see RUL).

The internal tube touches the bottom of the test piece and the external tube is attached to the bottom flange of the four-point bending device as a reference point.

The split shell furnace (maximum 1450 °C) is hinged and opened so that the test piece can be inserted easily. The loading device is the same as that used for the model 422D/3. Both load and deformation are stored at the PC.



Schematic Diagram: HMOR Tester 422 E/4 with detailed view of the 4-point bending device

HMOR Tester 422 E/4 with Controller

Technical Data HMOR 422

Measuring Unit	422 D/3	422 E/4
Temperature range	: ambient ... 1500 °C	ambient ... 1450 °C
Heating elements	: SiC	SiC
Furnace	: chamber furnace with preheating zone	special swing-open furnace
Thermocouples	: type S	type S
Mode of operation	: continuous	single measurement
Test piece transport	: manual	n/a
Test piece dimensions	: 150 mm x 25 mm x 25 mm	45 mm x 4.5 mm x 3.5 mm
Bending mode	: three-point	four-point
Distance between support edges	: 125 mm	40 mm
Distance between bending edges	: n/a	20 mm
Loading device	: weighing lever with movable weight	same as 422 D/3
Load range	: 0 ... 500, ... 1250,	same as 422 D/3
	2, 4.2, 8, 12 N/s	
Loading rate	4 speeds	same as 422 D/3

Measurement of Deformation	: inductive system with reference rod (optional)	differential measuring system (standard)
Measuring range	: max. 10 mm	max. 5 mm
Digital resolution	: 2.5 nm	1.25 nm

Constant Deformation Rate	: optional	n / a
Deformation rate	: 10 ... 2000 µm/min	n / a
Load	: max. 2500 N	

Dimensions and weights (approx.)

Measuring unit	: 2200 mm x 1800 mm x 870 mm 540 kg	2100 mm x 1600 mm x 750 mm 430 kg
Control unit	: 1120 mm x 565 mm x 452 mm 250 kg	1120 mm x 565 mm x 452 mm 220 kg

Power Supply

Furnace	: 400 V, 3 x 60 A, 3-ph., 50 Hz	230 V, 25 A, 1-ph., 50 Hz
Electronics	: 230 V, 10 A, 1-ph., 50 Hz	230 V, 10 A, 1-ph., 50 Hz

- technical data subject to change -

Thermal Conductivity Tester TCT 426

Thermal conductivity is of special importance when refractory materials are used for the lining of industrial equipment. To a considerable extent thermal conductivity has a determining influence on the important parts of the construction. Low values are required if heat losses are to be kept to a minimum (insulation), while high values are necessary in materials in areas where heat transfer is important (control of hot face temperatures).Thermal conductivity, λ, is defined as a density of heat flow rate divided by temperature gradient; the units are W/(m · K).

Several methods have been developed for the determination of thermal conductivity of refractory and heat insulating materials at elevated temperatures. The only internationally standardized method is the hot-wire method (ISO 8894).
The hot-wire method is a dynamic, absolute method based on the measurement of the temperature increase

- of a linear heat source (hot-wire)
  – cross-wire technique –
  or
- at a certain location at a specified distance from a linear heat source
  – parallel-wire technique –

Both hot wire and thermocouple are embedded between two test pieces which form the test assembly. The increase in temperature as a function of time, measured from the moment the heating current is switched on, is a measure of the thermal conductivity of the material of which the test pieces are made.
A further variation called "Platinum Resistance Thermometer Technique", or "T(R) Technique", is described in ASTM-C 1113. Here an integral temperature measurement is carried out over the length of the hot wire between the voltage taps. This means that the hot wire itself functions as both heat source and temperature sensor. The temperature increase of the hot wire is determined from its change in resistance; the calculation of the thermal conductivity is the same as that of the cross-wire technique.

The NETZSCH TCT 426 operates according to the hot-wire method using all three techniques described above.

Thermal Conductivity Tester TCT 426 with controller
(opened measuring unit with lowered measuring inset)

Measuring Unit

The measuring unit consists of the furnace, the carrier system for the test assembly, and a motor-driven hoist to raise the carrier into position inside the furnace. Carrier system and hoist are arranged in a console. The carrier, the upper part of which is made of insulating material, is mounted between two telescopic guides. It can be pulled out of the console in its lower position and raised by the hoist for easy positioning of the test assembly.

Measuring Arrangements

The hot wire and thermocouples are fixed to a measuring frame made of Al_2O_3, which is mounted on the carrier. The frame is adjustable to variable heights.

Three different measuring arrangements are possible:

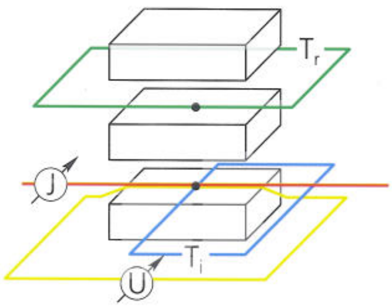
- Cross-wire technique: $\lambda \leq 2$ W/(m·K)
- Parallel-wire technique: $\lambda \leq 20$ W/(m·K)
- T(R) technique: $\lambda \leq 15$ W/(m·K)

The voltage taps to the hot wire are embedded in the test assembly. Power is held constant electronically and controlled by the computer. With the exception of the T(R) technique, the temperature change is measured relative to a reference thermocouple. The position of the measuring thermocouple is determined by the technique being used.

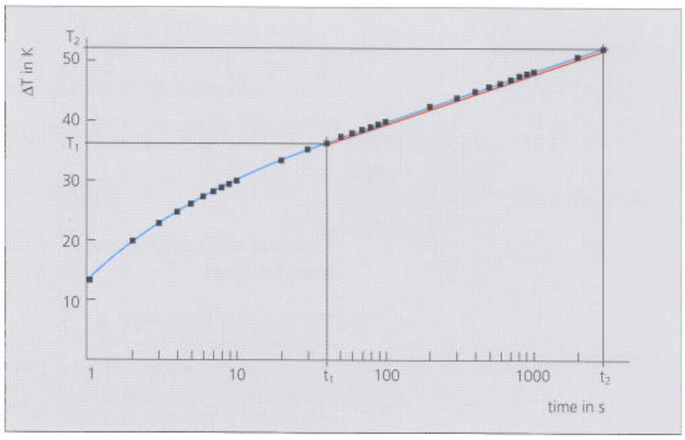
Operation

The placement of the test pieces on the carrier and the arrangement of hot wire and thermocouples in the test assembly are easily accomplished. With the aid of plug-in connections, the measuring frame can be quickly exchanged. Compared to other measuring methods, the preparation and the placement of the test assembly can be described as very easy and timesaving.

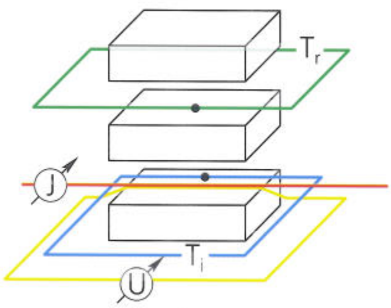
Upon completion of the preparation of the test assembly, the carrier is raised into the furnace. The experiment, including data acquisition and subsequent evaluation, is automatically controlled via the computer.



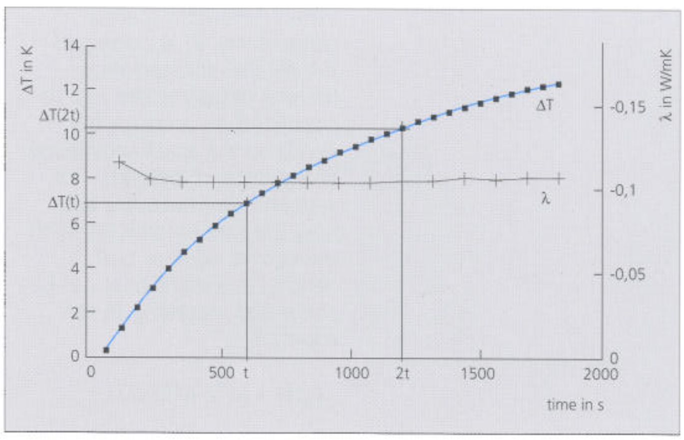
$$\lambda = \frac{U \cdot J}{4 \cdot \pi \cdot l} \cdot \frac{\ln\left(\frac{t_2}{t_1}\right)}{T_2 - T_1}$$



Schematic Diagram: cross-wire arrangement, equation and signal



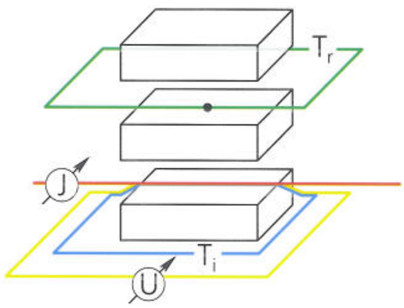
$$\lambda = \frac{U \cdot J}{4 \cdot \pi \cdot l} \cdot \frac{Ei\left(\frac{r^2}{4 \cdot a \cdot t}\right)}{T_i(t) - T_r}$$



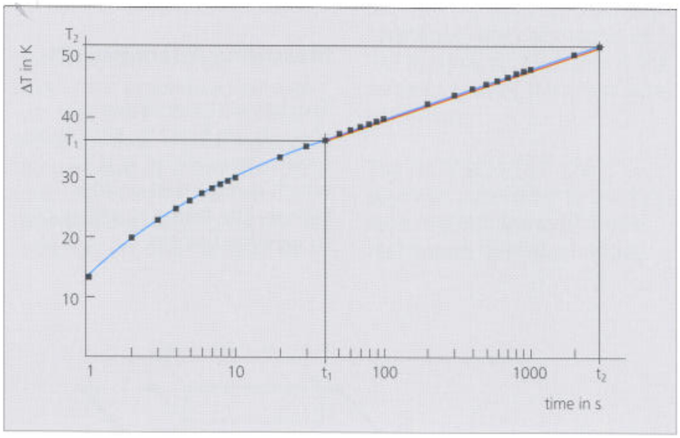
Schematic Diagram: parallel-wire arrangement, equation and signal

Advantages of the T(R) technique

- No "focal-point" temperature measurement on the hot wire as in the cross-wire technique, i.e. the influences on the signal caused by the inhomogeneities of the measuring medium (e.g. larger pores) are compensated.
- No heat transmission through the legs of the thermocouple, which are perpendicular to the hot wire (cross-wire technique), and therefore no falsification of the registered temperature increase.
- Greater evaluation range in the temperature/time diagram, because the feedback from the border of the test assembly is detected by the temperature sensor later than in the parallel-wire technique due to the axial arrangement of the hot wire.
- The field of application ranges from approx. 0.03 W/(m·K) (e.g. aerogels), up to approx. 15 W/(m·K) (e.g.magnesia bricks).
  The temperature range is the same as for the other techniques (25 ... 1400 °C).



$$\lambda = \frac{U \cdot J}{4 \cdot \pi \cdot l} \cdot \frac{\ln\left(\frac{t_2}{t_1}\right)}{T_2 - T_1}$$



Schematic Diagram: T(R) arrangement, equation and signal

Thermal diffusivity and specific heat

The thermal diffusivity, **a**, characterizes the rate of change of the temperature in a material. Its value is required for the calculation of non-stationary heat transfer as well as the value of specific heat, $\mathbf{c_p}$.

When measuring thermal conductivity, λ, according to the parallel-wire technique, thermal diffusivity can also be calculated. Its accuracy depends on the exact knowledge of the distance between hot wire and thermocouple and how they are embedded. With the known value of bulk density, ρ, specific heat can be computed according to the equation

$$c_p(T) = \lambda(T) / \rho(T) \cdot a(T)$$

More precise values for thermal diffusivity can be determined using the Laser Flash Apparatus **LFA 427.**
This transient technique has the advantage of simple test piece configuration, small test piece size, applicability for a wide range of diffusivity values, great accuracy and reproducibility.
More precise specific heat values can be determined directly using the high-temperature heat flux Differential Scanning Calorimeter, **DSC 404.**

Software

The entire experiment is programmed and controlled using an IBM-compatible computer. The operator enters the measurement parameters and initiates the experiment. Primary features of the software are:

- Input of a temperature program with a maximum of 10 temperature steps and 30 single measurements per test run; input of nominal value for hot-wire power for each temperature step.
- Tabulation of the measurement parameters.
- Calculation of the thermal conductivity as a function of temperature.
- Presentation of the thermal conductivity values in tabular and graphic form.

Technical Data TCT 426

Furnace

Temperature range	: 25 ... 1500 °C
Heating elements	: 12 Super-Kanthal pins
Temperature measurement	: thermocouples Pt10%Rh-Pt
Insulation	: aluminum-silicate-fiber material
Effective volume (L x W x H)	: 300 mm x 200 mm x 230 mm
Atmosphere	: air

Carrier System for Test Assembly

Construction	: multilayered, insulating structure
Operation area	: 300 mm x 200 mm
Test assembly	: max. 3 test pieces (each: 250 mm x 125 mm x 75 mm)

Measuring Frames

Material	: Al_2O_3
Measuring techniques	: cross-wire technique $\lambda \leq 2$ W/(m·K)
	: parallel-wire technique $\lambda \leq 20$ W/(m·K)
	: T(R) technique $\lambda \leq 15$ W/(m·K)

Hot-wire Power Control

Preset of nominal value	: via computer
Range	: 0.1...5 W, 1...50 W
Resolution	: 10 000 digits

Amplifier for ΔT Measurement

Measuring range	: 50, 500, 5000 µV

Temperature Control

Temperature control system 414/3, PID controller

Precision of nominal value	: 0.1 K
Resolution of nominal value	: 0.1 K

Computer System

PC (IBM-compatible), VGA, with printer. The software permits a fully-automatic test run and extensive evaluation and presentation of the results.

Accessories

- measuring frame for parallel-wire or T(R) technique
- muffle case for measurements on powdered or granular materials
- muffle case for measurements on carbon-containing materials
- test piece preparation : Sawing Machine 421/13, Grinding Machine 421/12 (grinding wheel ø: 175 mm)

Power Supply

Control unit	: 230 V, 50 Hz, 6 A
Power unit	: 230 V, 50 Hz, 25 A

Weights and Dimensions

Measuring unit	: 1745 mm x 740 mm x 640 mm approx. 300 kg
Control unit	: 1180 mm x 565 mm x 452 mm approx. 300 kg

- technical data subject to change -

Machines for Test Piece Preparation

Drilling Machine 421/11

The NETZSCH drilling machine 421/11 is used for drilling cylindrical test pieces from refractories, stone, ceramics or products similar to ceramics.

Basic Equipment

The drilling machine is supplied with chuck jaws, water protective case and water-flushed collet, and uses diamond hollow drills with Belgian connection R1/2". The water box is connected to the spindle of the drilling machine.

- variable speed drive
- sturdy design with complete enclosure of all rotating parts
- reliable and easy handling
- large spindle stroke
- powerful motor

Technical Data

Speed (variable):
240 - 2200 rpm
Electrical supply:
400 V/50 Hz/3-ph/1 kW
Table: ø 500 mm
Vertical adjustment of the table:
650 mm
Drilling depth (spindle stroke):
175 mm
Column diameter: 130 mm
Working range: 320 mm
Distance spindle to table:
790 mm
Distance spindle to base plate:
210 mm
Dimensions (packed):
2000 mm x 600 mm
x 1000 mm
Net/gross weight:
approx. 350 kg/550 kg

- technical data subject to change -

Grinding Machine 421/12

The NETZSCH grinding machine 421/12 is used for precise face and parallel-face grinding of cylindrical test pieces.

Basic Equipment

Permanent magnetic plate, ø 125 mm, for clamping support devices, made of steel, complete wet-grinding accessory consisting of cooling agent container with clarification unit and electric immersion pump, water collector plate with sheet-metal slider.

- accuracies of 10^{-3} mm with face grinding method
- pivotable grinding head with precision grinding spindle
- cross grinding guarantees plane surface
- fine adjustment of height; reading accuracy 10^{-3} mm (vernier scale)

Technical Data

Speed: 3100 rpm
Electrical supply:
400 V/50 Hz/3-ph/0.7 kW
Accuracy of
"plane parallelism": 0.002 mm
Grinding height over magnetic clamping plate: 130 mm
Coarse elevation adjustment:
140 mm
Fine elevation adjustment:
10 mm
Net/gross weight:
172kg/280 kg
Dimensions (packed):
2200 mm x 720 mm
x 1250 mm

- technical data subject to change -

Sawing Machine 421/13

The NETZSCH sawing machine 421/13 is used for cutting test pieces from refractories, stone, ore, ceramics, glass and hard metals.
The circular blade cuts from bottom to top, plunging into the cooling agent tank below the table, drawing the cooling agent into the cut over the shortest path.

Basic Equipment

Table: frame 750 mm high, table top :700 mm x 600 mm, galvanized water tank.

Feed table: specially suited for longitudinal cross-sections. Bearing surface 250 mm x 600 mm. Linear feed. Cutting length up to 250 mm at a cutting depth of 120 mm. Standard design with angled stop and clamping device.

Pivot: specially suited for precise cuts.

Accessories

The basic equipment does not include diamond wheels.

These diamond wheels can be supplied in different compounds (galvanic, bronze, synthetics, borazone etc.). Please state the intended application when placing order.

Technical Data

Speed:
1400 and 2600 rpm
Electrical supply:
400V/50Hz/3-ph/1.5kW
Cutting depth: max. 120 mm
Total height: 1200 mm
Base: 1000 mm x 1300 mm
Net/gross weight:
150kg/230 kg

- technical data subject to change -

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NETZSCH Gerätebau GmbH
D-95100 Selb/Bavaria · Wittelsbacherstraße 42
Phone.: +49 / 9287 / 881-0 · Fax: +49 / 9287 / 881-144
e-mail: at@ngb.netzsch.com

NGB · FF · E · 3500 · 0203 · MüS