

SIB 52 - THERMO Stakeholder meeting

NPL May 16

Metrology for thermal
protection materials

Presentation of LNE's
high temperature guarded
hot plates



Le progrès, une passion à partager

**MESURES
& RÉFÉRENCES**

Clés de la COMPÉTITIVITÉ
et d'un MONDE PLUS SÛR

Laboratoire national de métrologie et d'essais

► Outline

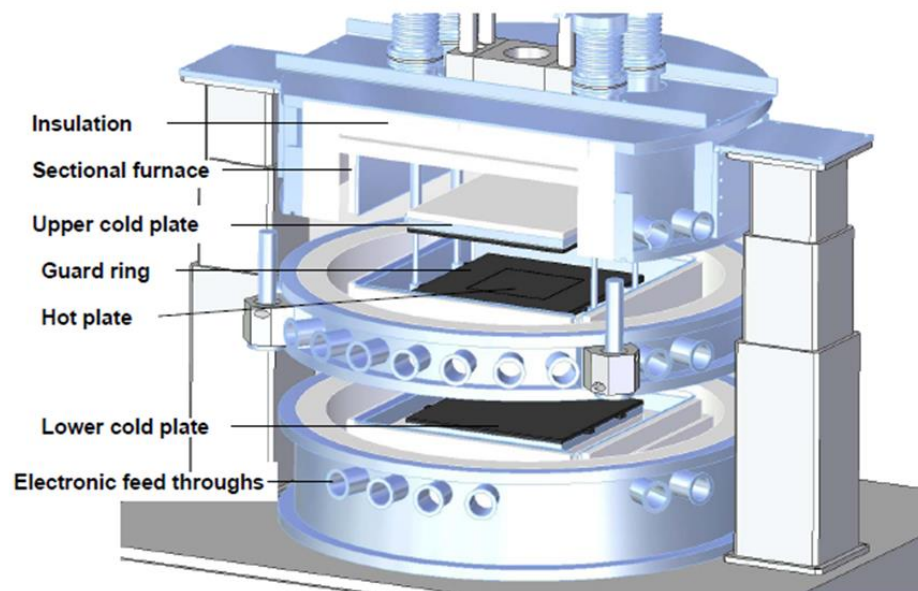
- Home made HTGHP
- NETZSCH GHP



► NETZSCH GHP

Netzsch Titan Technical features

- Heater plates material : Tungsten Alloy
- Size : 500 x 500 mm
- Metering area : 250 x 250 mm,
- Gap width : 3 mm not filled (air).
- Types of temperature sensors : N type thermocouples (PT100 originally)
- Locations of temp. sensors : Inside the plates
- No thermopile (the mean temperatures measured in the metering section and in the guard ring are used)
- Number and dimensions of temperature sensors (9 in the hot plate, 8 in the Guard, 5 in each cold plate),
- Types of heating elements : (metal sheathed electrical resistance → correction factor for junctions losses → fixed value)
- Types of edge guarding : isothermal peripheral ring. 50 mm air gap between the ring and the stack.



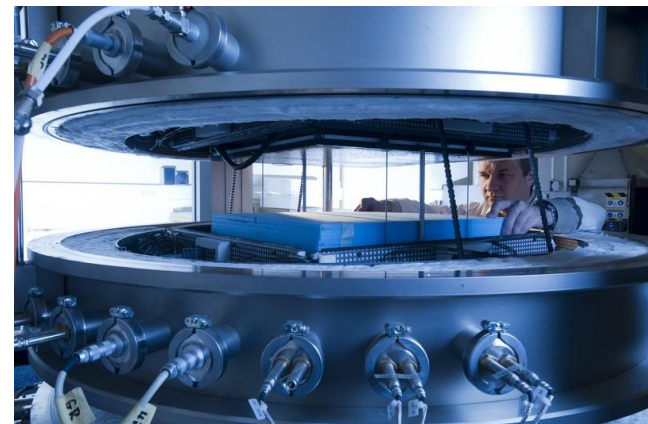
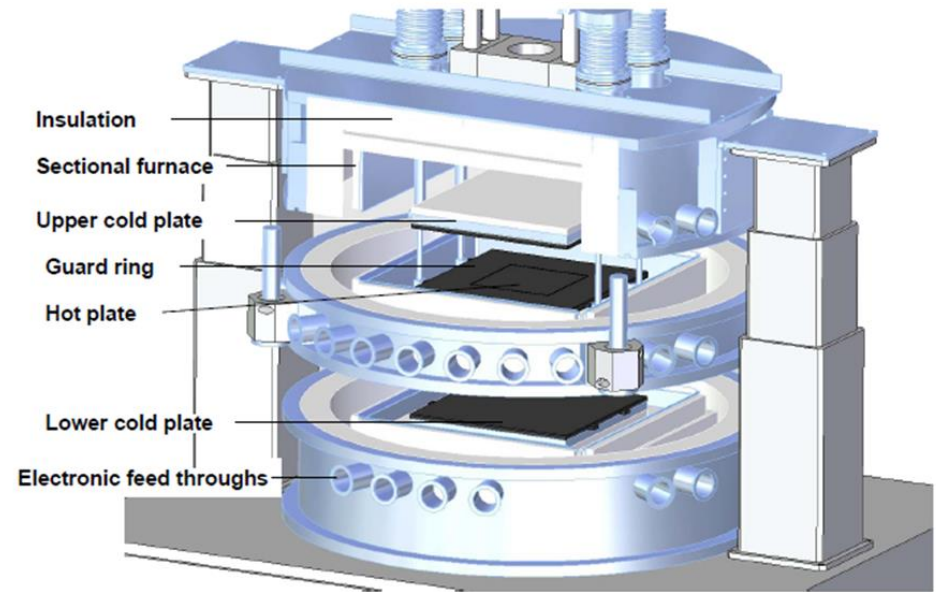
► NETZSCH GHP

Netzsch Titan

Ranges

- Temperature range : -155 to +500 °C (limited during the project)
- Thermal conductivity range : 0 to 0.5 Wm⁻¹K⁻¹
- Double specimen configuration
- Specimen thickness : max 70 mm
- Overall uncertainty : relative uncertainty from 5 to 13 % (evaluated so far).

- A hot plate was destroyed during the project when calibrating thermocouples at 700°C.



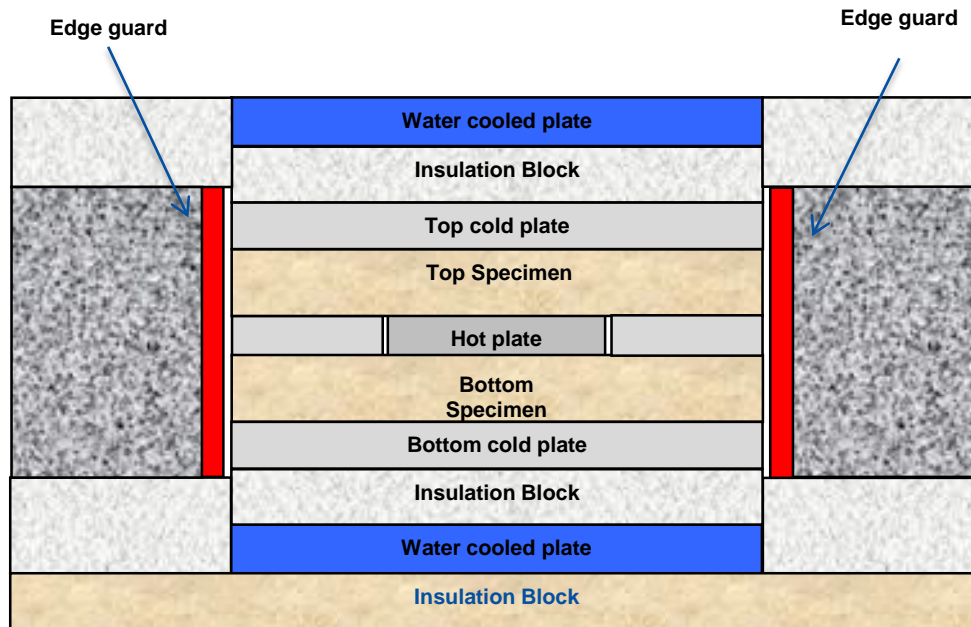
► Home made GHP



Technical features

- Heater plates material : Nickel 201
- Sample 318 x 318 mm. Square shape.
- Metering area 152 x 152 mm at mid-gap,
- Gap width : 2 mm (2 filled with insulation “paper”)
- Temperature sensors N type metal sheathed thermocouples 1.0 mm diameter.
- Thermopile for guard temperature control : 8 pairs of N type metal sheathed thermocouples.
- Locations of temperature sensors for gradients measurements :
 - In grooves at the surface of the plates,
 - In the sample
- Number and dimensions of temperature sensors (3 to 9 in the metering section for each surface of the samples),
- Types of heating elements used (metal sheathed electrical resistance)
- Types of edge guarding : active edge guard constituted of 10 blocks

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Ranges (at the end of the project)

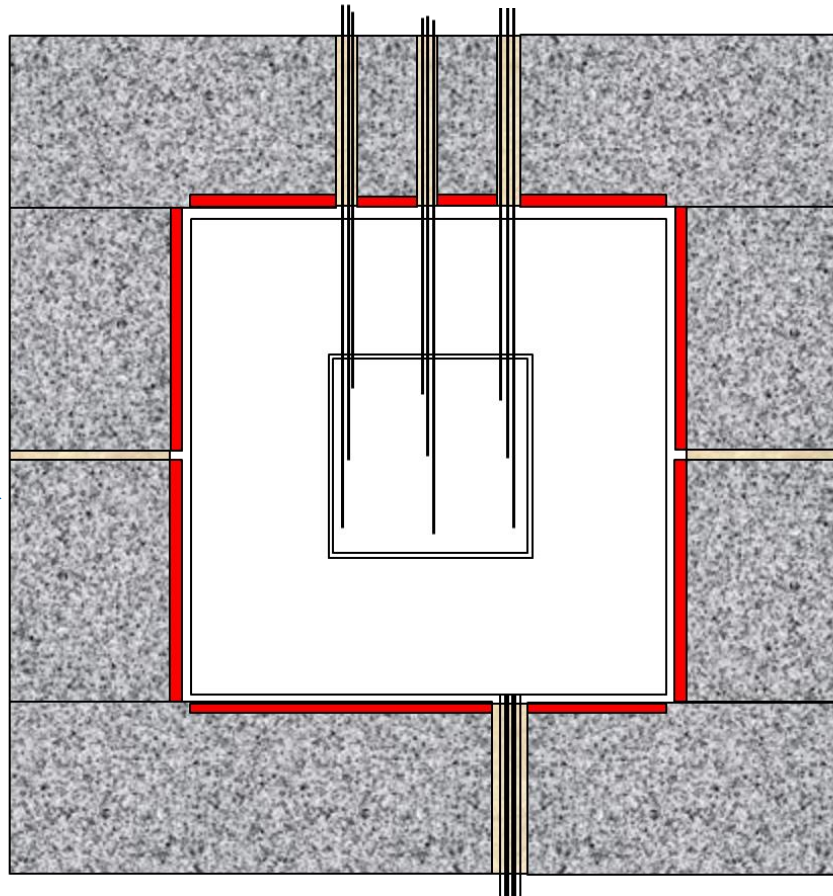
- Temperature range : 30 ($\Delta T = 10K$) to 800 °C ($\Delta T = 50K$)
- Thermal conductivity range : 0.1 to 2 $Wm^{-1}K^{-1}$
- Double or single specimen configuration
- Specimen thickness : max 60 mm
- Overall uncertainty : relative uncertainty from 4 to 10 % (evaluated so far).



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Thermocouples for the measurement of the plates temperatures

Edge guard (constituted of 10 blocks)



Electrical wires and thermocouples for control of temperatures in the plates



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