SIB 52 - THERMO Stakeholder meeting

Nov 14

Metrology for thermal protection materials

Presentation of LNE's high temperature guarded hot

MESURES & RÉFÉRENCES
Clés de la COMPÉTITIVITÉ et d'un MONDE PLUS SÛR

Laboratoire national de métrologie et d'essais

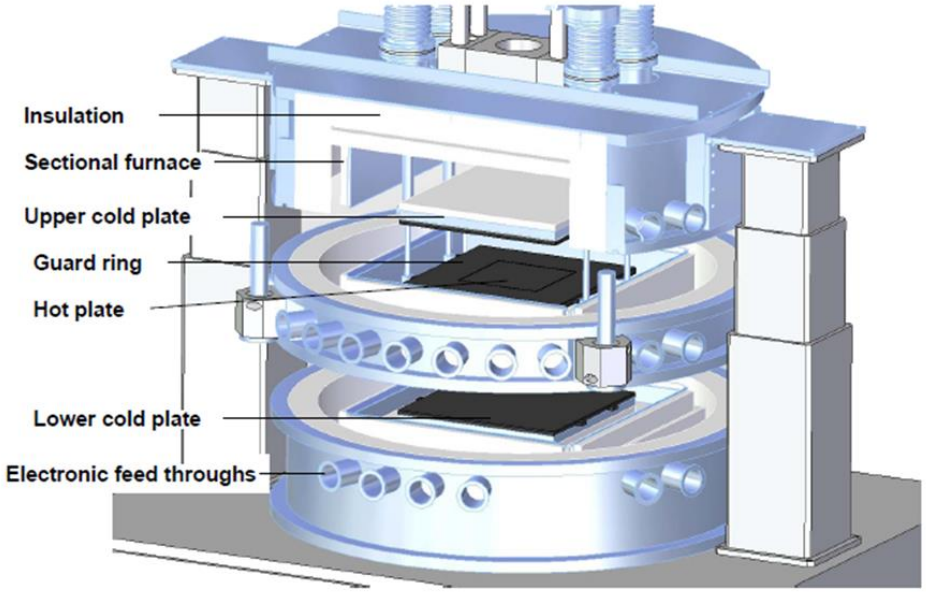
Outline

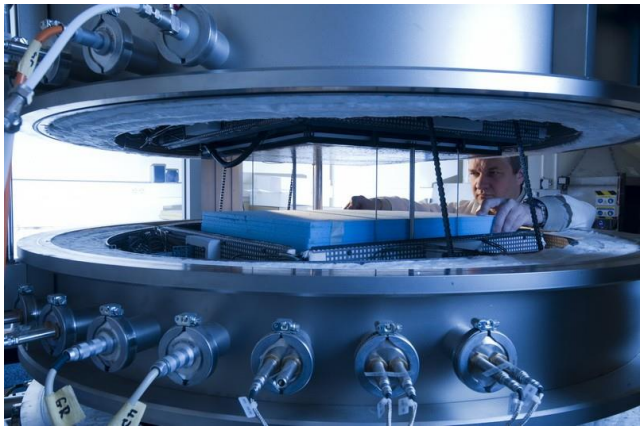
- NETZSCH GHP
- Home made GHP

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
- Types of temperature sensors : Pt100 (metal sheathed)
- Locations of temperature sensors Inside the plates
- 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)
- Types of edge guarding : isothermal peripheral ring. 50 mm air gap between the ring and the stack.





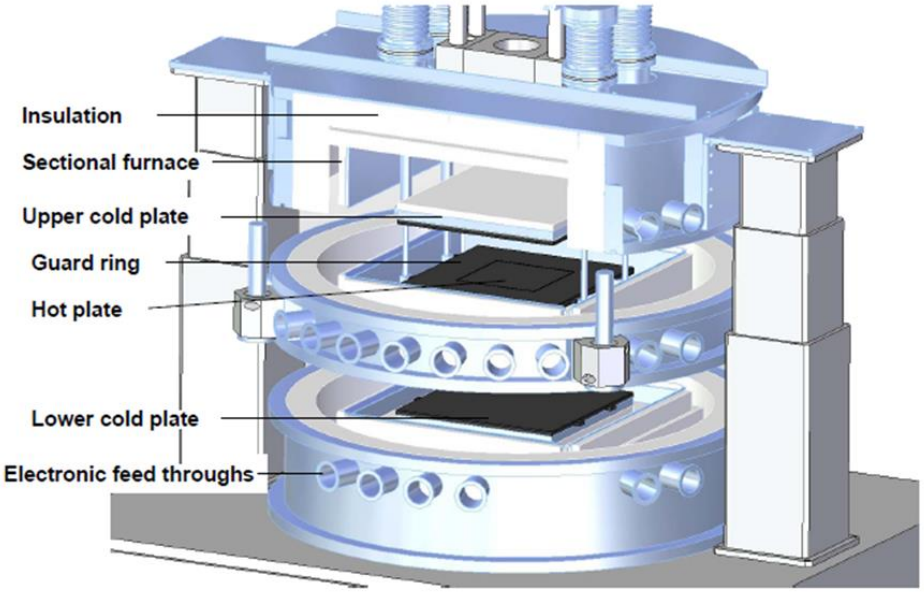
NETZSCH GHP

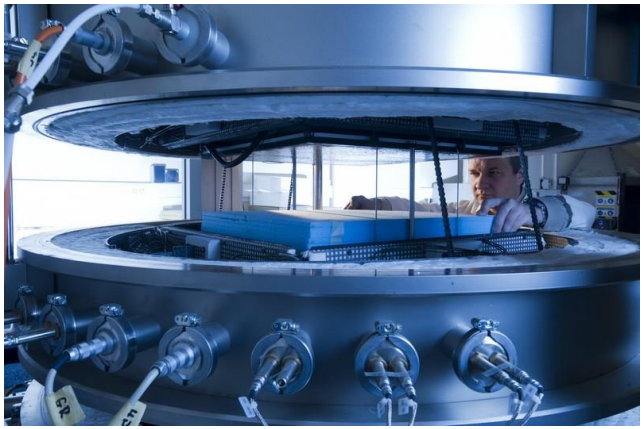
Netzsch Titan

Ranges

- Temperature range : -155 to +650 °C
- Thermal conductivity range : 0 to 0.5 $Wm^{-1}K^{-1}$
- Double specimen configuration
- Specimen thickness : max 70 mm
- Overall uncertainty : relative uncertainty from 5 to 10 % (evaluated so far). The uncertainty will be fully reevaluated in 2015.

- Problems with the hot plate in 2014 (distortion)
- The temperature range will be probably limited to 600°C in the future



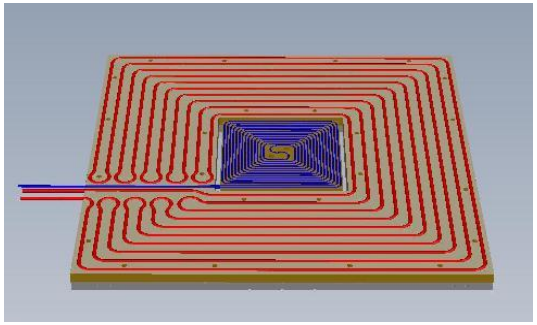


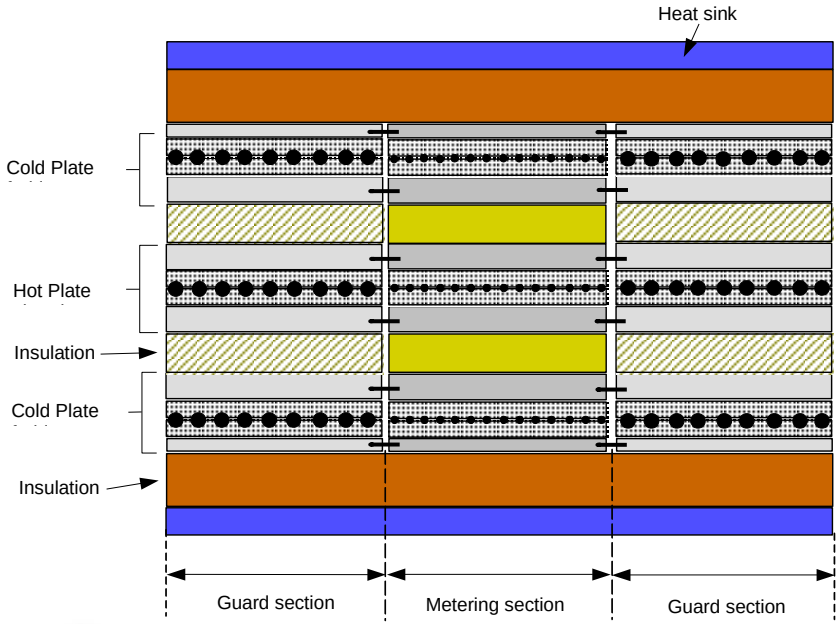
- Home made GHP

Technical features (at the start of the project)

- Heater plates material : Nickel 201
- Sample 318 x 318 mm
- Metering area 100 x 100 mm,
- Gap width : 4 mm (air filled)
- Temperature sensors K type metal sheathed
- Thermopile for guard temperature control : 8 pairs of K type metal sheathed thermocouple
- Locations of temperature sensors for gradients measurements :
  - Inside the plates,
  - In grooves at the surface of the plates,
  - In the sample
- Number and dimensions of temperature sensors (5 in the hot plate, 4 in the Guard, 5 in each cold plate), 1.0 mm diameter
- Types of heating elements used (metal sheathed electrical resistance)
- Types of edge guarding : thermal insulation

Home made GHP

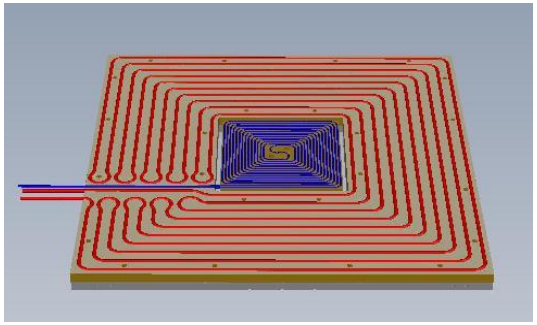


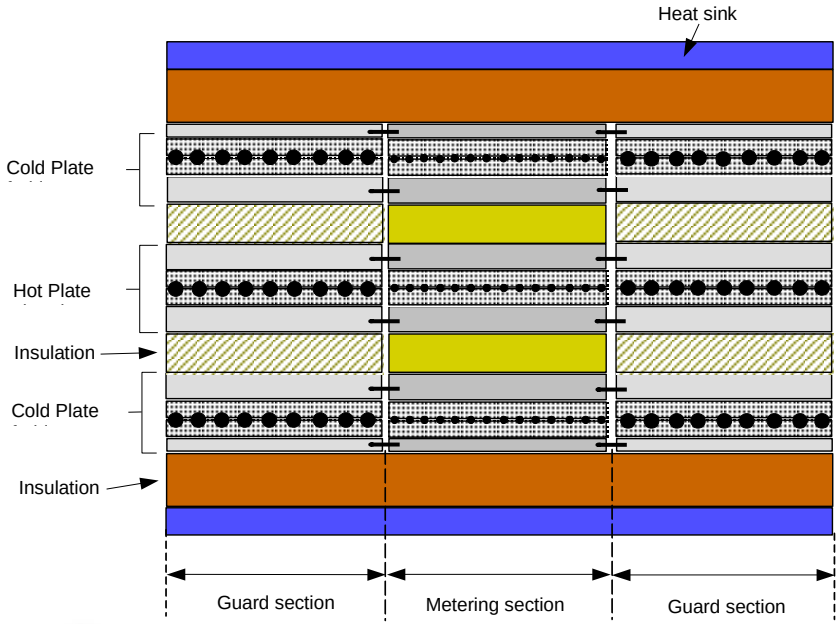


Ranges
(at the start of the project)

- Temperature range : 30 (ΔT = 10K) to 775 °C (ΔT = 50K)
- Thermal conductivity range : 0.2 to 2 $Wm^{-1}K^{-1}$
- Double or single specimen configuration
- Specimen thickness : max 50 mm
- Overall uncertainty : relative uncertainty from 5 to 10 % (evaluated so far). The uncertainty will be fully reevaluated in 2015.

Home made GHP





Modifications & improvements (during project)

- Continuous cold plates (no gap)
- Larger metering area : 150 x 150 mm
- Edge thermal guard
- Replacement of K type thermocouples by N type thermocouples
- Filling the gap with an “opaque” insulating material

⇒ The performance will be improved for low conductive materials and for high temperatures.