# 1st Workshop Hi-TRACE

Industrial Process Optimisation Through Improved Metrology of Thermophysical Properties

**online event**
**on Thursday, 21 January 2021**

The goal of this workshop is the presentation of the main results of the project to stakeholders and end-users as well as to industry and research to get feedback from them.

The project Hi-TRACE will establish new methods for characterising the thermophysical properties of any solid material up to 3000 °C, and launch a network of reference facilities and materials available to industry. By supporting reliable measurement practices, this project will improve the understanding of high-temperature materials and enable industries to develop novel and innovative materials.

The 1st Workshop Hi-TRACE will be organised as online event by ZAE Bayern and FHWS in cooperation with LNE and all other partners of the project.

## Registration (free of charge)

To participate in the workshop, please send an e-mail to

**hi-trace@zae-bayern.de**

You will get a confirmation together with a valid dial-in link for the workshop.

LNE LABORATOIRE NATIONAL DE MÉTROLOGIE ET D'ESSAIS

FH-W-S

ZAE BAYERN

## Schedule of the Online-Workshop: Forenoon on 21.01.2021

| *time* | *title* | *speaker* |
|---|---|---|
| $08^{30}$ | **Start of the video conference tool and opportunity for dialling-in and testing the functionality** | |
| **Section 1:** | **Industrial need for improved metrology (presentations with open questions)** | |
| $09^{00}$ till $09^{10}$ (10 min) | **Welcome** | H.-P. Ebert *ZAE* |
| $09^{10}$ till $09^{15}$ ( 5 min) | **Introduction** | B. Hay *LNE* |
| $09^{15}$ till $09^{40}$ (25 min) | **Need of high-precision instruments for thermophysical properties measurement** | T. Denner *Netzsch* |
| $09^{40}$ till $10^{05}$ (25 min) | **The importance for space application to manage accurate thermal material properties** | M. Cataldi, G. Pinaud *Ariane Group* |
| $10^{05}$ till $10^{30}$ (25 min) | **New SiC-based materials for nuclear fuel cladding** | C. Lorrette *CEA* |
| $10^{30}$ till $11^{00}$ (30 min) | **Coffee break** | |
| **Section 2:** | **Industrial need for improved metrology (presentations with open discussions)** | |
| $11^{00}$ till $11^{20}$ (20 min) | **Additive manufacturing metal and ceramic components: sensors for surveillance of process parameters** | J. Hartmann *FHWS* |
| $11^{20}$ till $11^{40}$ (20 min) | **Characterisation of functional materials with outstanding thermophysical properties** | S. Vidi *ZAE* |
| $11^{40}$ till $12^{30}$ (50 min) | **Virtual lab-tour with multi-media demonstrations and discussions** | J. Manara *ZAE* |
| $12^{30}$ till $14^{00}$ (90 min) | **Lunch break** | |

## Schedule of the Online-Workshop: Afternoon on 21.01.2021

| *time* | *title* | *speaker* |
|---|---|---|
| **Section 3:** | **Status and results of Hi-TRACE (presentations with questions and comments)** | |
| $14^{00}$ till $14^{15}$ (15 min) | **Presentation of the project** | B. Hay *LNE* |
| $14^{15}$ till $14^{30}$ (15 min) | ***Work package 1:*** **Establishment of traceability for thermal diffusivity measurements at temperatures up to 3000 °C** | B. Hay *LNE* |
| $14^{30}$ till $14^{45}$ (15 min) | ***Work package 2:*** **Establishment of traceability for specific heat measurements at temperatures up to 3000 °C** | S. Vidi *ZAE* |
| $14^{45}$ till $15^{00}$ (15 min) | ***Work package 3:*** **Establishment of traceability for emissivity meas. and improved metrology for temp. of fusion at temp. up to 3000 °C** | K. Anhalt *PTB* |
| $15^{00}$ till $15^{15}$ (15 min) | ***Work package 4:*** **Establishment of methods for quantifying de-bonding at high temperature (above 1000 °C)** | J. Wu *NPL* |
| $15^{15}$ till $15^{30}$ (15 min) | **Questions and comments** | all |
| $15^{30}$ | **Close of the workshop** | |

*Hi-TRACE project has received funding from the EMPIR programme co-financed by the Participating States and from the European Union's Horizon 2020 research and innovation programme.*

More information can be found on the project website:

**www.hi-trace.eu**

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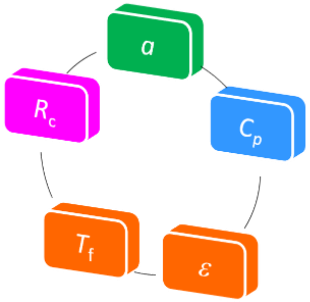
Many industries such as space, aeronautic, nuclear and glass operate installations at temperatures above 1500 °C. In order to optimise their processes and increase their competitiveness, these industries are developing new materials able to work at higher temperatures. Hence, the project outputs will enable European industries to significantly increase energy efficiency, reduce emissions, enhance safety and improve reliability of critical applications.

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### WP 1: Thermal Diffusivity *a*

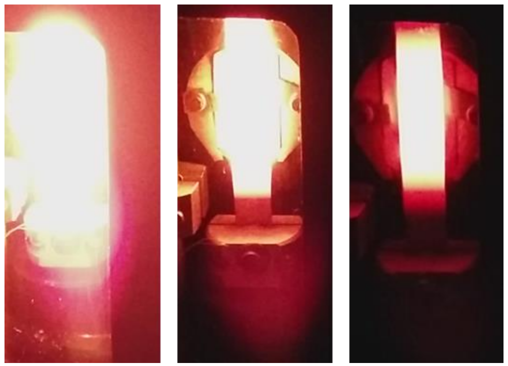
The aims of this work package are

- to establish a reference facility for the traceable measurement of the thermal diffusivity of solid materials at temperatures up to 3000 °C and
- to determine the uncertainty budget associated to the thermal diffusivity measurements at highest temperatures.

### WP 2: Specific Heat $c_p$

The aims of this work package are

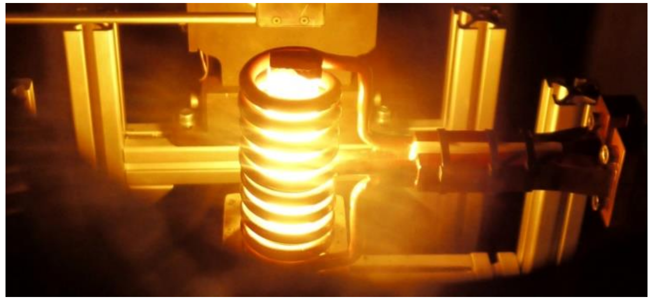
- to develop at least one reference facility based on absolute measurement methods, such as drop calorimetry or dynamic techniques (e.g. laser flash or pulse calorimetry),
- to develop validated methods for the traceable measurement of the specific heat of solid materials between 1500 °C and 3000 °C.



### WP 3: Emissivity $\varepsilon$ and Temperature of Fusion $T_f$

The aims of this work package are

- to establish a reference facility for the traceable measurement of the emissivity of solid materials above 1500 °C based on radiometric or calorimetric methods using pulse or induction heating,
- to use measurements from this new facility to compare results of total hemispherical and normal spectral emissivity measurements obtained with existing facilities and
- to develop validated methods for the measurement of the temperature of fusion of refractory materials up to 3000 °C.



### WP 4: Thermal contact resistance $R_c$

The aim of this work package is to develop and validate methods to quantify the state of interface bonding between solid materials. The idea is to use methods for measuring thermal contact resistance by dynamic heating and the results of this will be used to develop and validate a model for quantifying the state of interfacial bonding (between coating and substrate for example), with a focus on functional layers appropriate for use as thermal or corrosion protection above 1000 °C.