Technology Offer

Accurate contactless measurement of surface and micro sample temperatures

Ref.-Nr.: 0041-5601-WT

Background

The study of mechanical properties of materials at high temperatures at the microstructural length scale requires dedicated testing setups. An accurate measurement of the sample temperature is vital for reliable testing. Most of the successful current testing platforms record the temperatures of the sample and tip near the heating sources but not at the respective surface. As a consequence, due to spatial and temporal thermal gradients a reliable surface temperature cannot be measured today. Even more, the time required for temperature matching and thermal stabilization of current systems is enormous and detrimental for micro specimens and indenter tips.

Technology

We developed a novel hot stage design with independent tip and sample heating to characterize materials at high temperatures. It comprises of two independent hot stages each carrying either the sample or the indenter tip. The sample surface and the indenter tip reach temperatures of >800°C. The unique approach (see Fig. 1) is able to estimate the absolute sample surface temperature by a monitoring the thermal fields via a smart arrangement of thermocouples inside the stage. The accuracy of the estimated absolute surface temperature is better than ±2.5° at 600°C. The approach does not require a thermocouple at the sample, and is therefore avoiding any damage to the micron-sized features being mechanically tested. The device assembly with both the stages is depicted in Fig. 2.

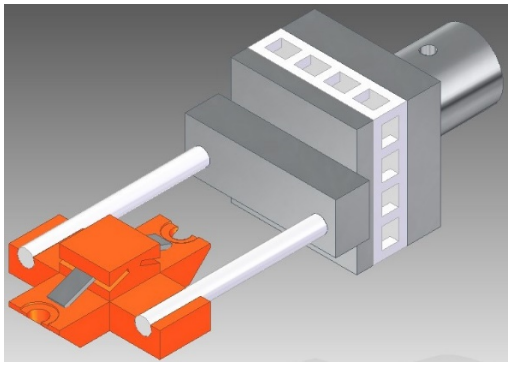

Figure 1: Design of a single hot stage

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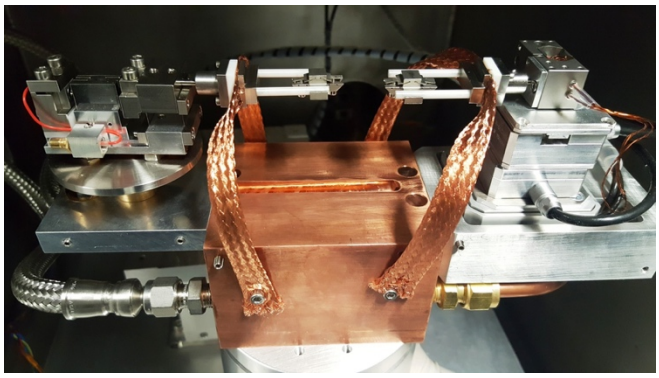

Figure 2: Heating stages, the straining rig and the cooling elements
The design allows for unprecedented fast and reliable stabilization of the temperature, which is a prerequisite for reliable high temperature micromechanical experiments without tip or sample alteration.

Advantages

- Prediction of the surface temperature by smart monitoring of spatial and temporal evolution of the temperature distribution.
- Accuracy of the predicted absolute temperature better ±2.5°C at 600°C
- Unprecedented fast and reliable stabilization

Patent Information

A European patent application has been filed in 2018.

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