Hesse Instruments

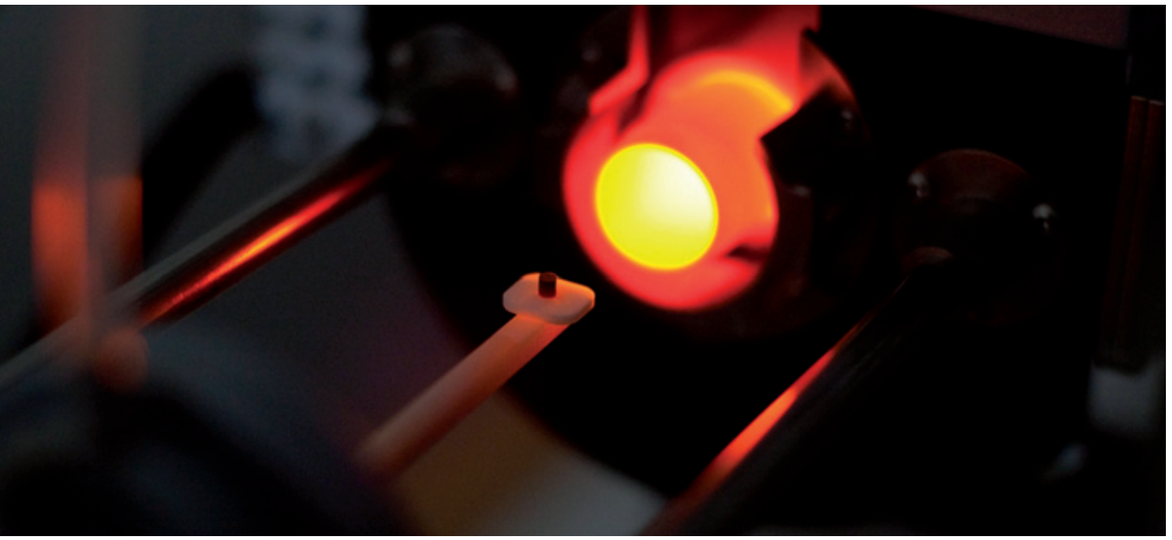
» Heating Microscope with Automatic Image Analysis

For determination of ash fusibility according to international standards

For quantitative thermo-optical analysis of high-temperature material properties

Dilatometric analysis of effects, such as sintering or blistering

» Heating Microscope with Automatic Image Analysis



The Hesse Instruments heating microscope is a complete testing system designed to enable you to easily determine the high-temperature characteristics of a wide range of materials. Its method of measurement is based on thermo-optical analysis.

The silhouettes of a test object are used to identify its **characteristic temperatures** according to DIN 51730, ISO 540 and CEN/TS 15404 and 15370-1. The Hesse Instruments heating microscope software determines **the deformation, sphere, hemisphere and flow temperatures** according to fixed algorithms. Thanks to the heating microscope's automatic software evaluation, precise and reproducible results are obtained independently of the person who performed the measurements.

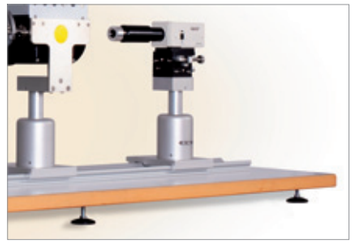
Based on quantitative measurement of the test object height and width, dilatometric curves can be viewed on screen or printed out. These curves can be used to derive information on sintering or blistering or even on direction-dependent shrinkage behavior. The wetting behavior of melts on various substrates can also be characterized by measurements of the contact angles.

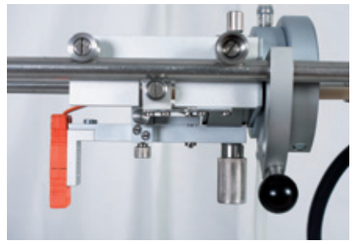
» An Optical Bench as the Basic Design

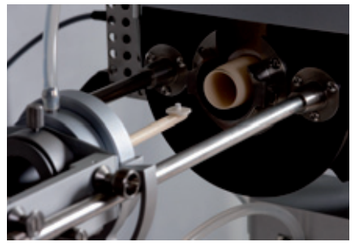
All components of the heating microscope are arranged on an **optical bench**: this reliably ensures exact alignment of the lamp, furnace and camera, which is essential for precise image analysis. Once set, an optimal specimen position will remain stable, yet can be easily changed by the user to a new position, whenever needed. As **each silhouette is analyzed in the direct beam path**, no complicated optical components have to be used. Therefore, the entire system is rugged, service-friendly and cost-optimized.

Another distinctive element of the heating microscope is its **specimen carriage**, which is moved on rails that are rigidly attached to the furnace carrier. This unique design enables you to position a specimen on the sample holder outside the (hot) furnace and then to move the sample on the specimen carriage consistently and accurately to its measurement position inside the furnace. At the same time, the furnace is sealed off. As a result, this ingenious design makes sample handling exceptionally easy.

A key feature for accurate and **representative measurement of sample temperature** is the arrangement of the thermocouple. In the Hesse Instruments heating microscope, this thermocouple is located directly below the specimen in the sample holder. The closed construction of the sample holder ensures optimal three-fold protection of the thermocouple: against mechanical damage, influences from the furnace atmosphere and, above all, against contamination by the sample itself. Over the long term, this construction **minimizes error** in measurement of the temperatures of specimens – and thus in measurement of their characteristic points.



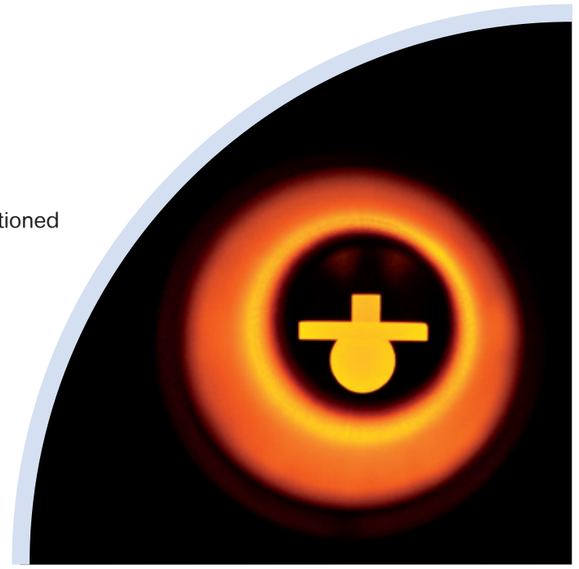


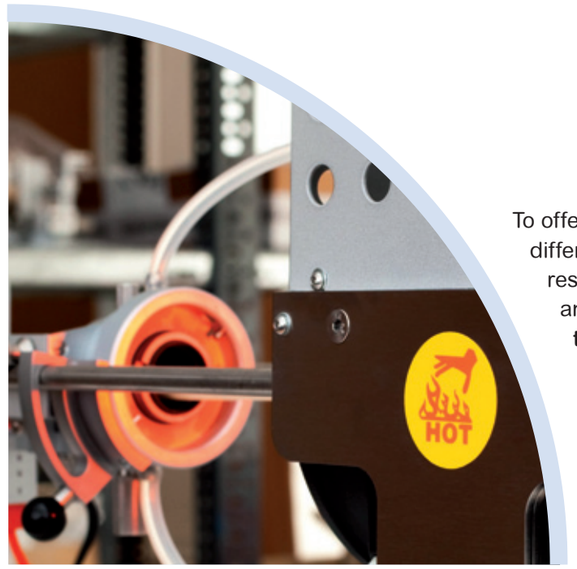


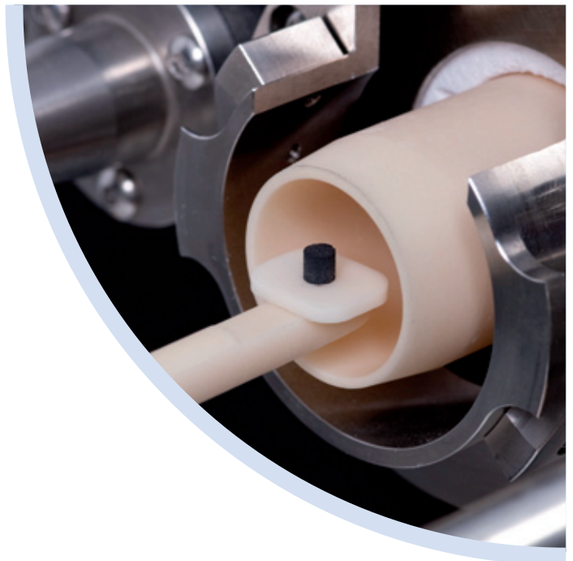
» Technically Sophisticated Furnace Systems

Small-scale, compact and technically optimized **tube furnaces** have been designed for use in the Hesse Instruments heating microscope. Thanks to their highly effective ceramic fiber insulation and advanced heating elements made of molybdenum disilicide ($MoSi_2$), you can operate the heating microscope at **high heating rates**. For relatively large test series and high numbers of samples, this enables you to measure individual specimens in rapid succession and, therefore, to achieve **high sample throughputs**.

As the samples are positioned in the confined space of the furnace tube with exceptional accuracy, each sample is exposed to exactly the same temperature field – as a result, repeatability of the measurement results of a test series is better than that in relatively large furnaces and better than that defined in the respective standards.







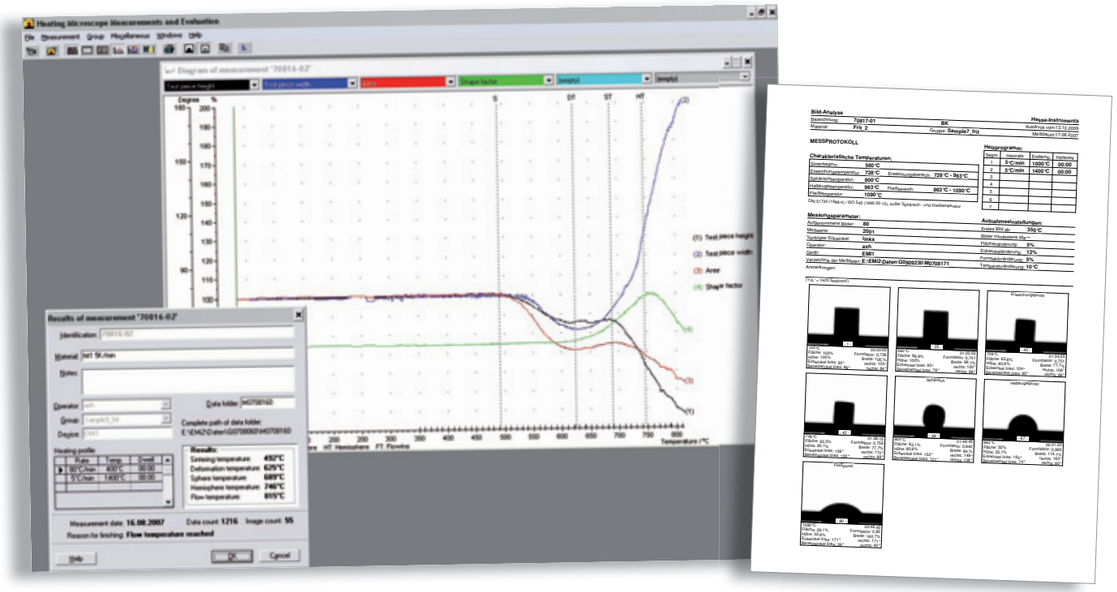
To offer suitable solutions for different applications with respect to the **heating rate** and **operating temperature**, Hesse Instruments offers you a choice of furnace models for integration into the entire system.

It goes without saying that moderate vacuum or **defined furnace atmospheres** can be set, as required in standards for measurement of ash fusibility. To meet requirements beyond these, Hesse Instruments will custom-design the equipment solution just right for you.

The technically sophisticated **furnace control units** feature an elaborate safety design: heating element temperature, heating current and water flow rate for the furnace closures are continuously monitored.

The furnace tube made of dense-sintered aluminum oxide can be exchanged in just a few easy steps. Thanks to a well-thought-out safety design, easy-to-exchange furnace tube and the $MoSi_2$ heating element, Hesse Instruments furnaces have an **exceptionally long life**.

» The Core of the Heating Microscope – Quantitative Image Analysis



Hesse Instruments software makes working with the heating microscope totally easy and convenient: A number of user-friendly features supports performance of the entire test series, such as **...**

... Data input for documentation in compliance with quality management requirements.

... Automatic determination of characteristic temperatures in compliance with the respective standards, based on automatic contour recognition and evaluation of silhouettes of a test object.

... Standard feature for displaying measured results as graphics, e.g., as dilatometric curves or as a graph comparing several test runs.

... Documentation of all test results including a short report, tables of measured results, graphics and images.

... User-definable test parameters, such as temperature-time profile of the furnace.

... Secure data management using a single user interface.

This software runs using widespread windows technology patterned after Microsoft's Windows® operating system. Its design is configured to accommodate the actual needs of your **laboratory work sequences**. For this reason, only minimal time is needed to learn how to operate the heating microscope. In daily procedures, you will find that working with the software will come like second nature right from the start. Moreover, if you happen to need support, comprehensive, easy-to-understand online help is only a mouse click away.

The software's memory for saving methods and preconfigured short reports let you **save time in** conducting **reproducible routine measurements** while conveniently generating data records and/or printouts for traceable reports. As a result, you obtain fast results that are always consistent and highly comparable.

The heating microscope's software gives you considerable **flexibility** in defining **test conditions and evaluation settings**: for instance, thanks to the "fast" $MoSi_2$ heating elements, you can have the system run temperature-time programs with extremely short cycle times. Therefore, you can optimally define the test conditions to accurately simulate the process conditions for real-world development of materials. Plus, you can do this no matter whether you are developing glass, glazes or enamels or whether you need to assess the sintering behavior of ceramic materials, the wetting behavior of refractory materials or blister behavior of a special ash or of raw materials ...

... **You name it – whatever your material and whenever temperature and time cause the shape and dimensions of your specimens to change – the Hesse Instruments heating microscope will help you obtain valuable information.**

» Key Features and Specifications at a Glance

Hesse Instruments Heating Microscope

Model	EM-201-15	EM-201-17	EM-201-17K
Furnace	HT-16	HR-18	HT-19
Maximum furnace temperature	1600 °C	1750 °C	1750 °C
Sample temperatures up to approx.	1500 °C	1650 °C	1650 °C
Readability of the sample temperature	1 K; (internal resolution 0,01 K) Standard measurement uncertainty, typically ≤ 5 K		
Maximum heating rate	80 K/min bis 1400 °C 50 K/min bis 1600 °C	30 K/min bis 1000 °C 15 K/min bis 1600 °C 10 K/min bis 1750 °C	80 K/min bis 1400 °C 50 K/min bis 1600 °C 10 K/min bis 1750 °C
Atmospheres	Oxidizing and reducing in accordance with the requirements of DIN, ISO and CEN; inert gases		
Furnace control	Program controller; temperature measuring device, limit temperature monitoring, electrical current limitation		
Optical system	Optical bench with halogen lamp that has an adjustable socket and CCD camera with a special macrolens – for consistent, high-contrast images over the entire temperature range		
Specimen carriage	Guided rail system; for placement and alignment of samples outside the furnace		
Thermocouples	Type B and type S Thermocouple probe with an alumina sheath for protection against mechanical and chemical effects; positioned directly below the sample		
Test object	Cylinders, cubes or truncated cones according to ISO, DIN and CEN Specimen heights possible: approx. 1 … 6 mm; widths possible approx. 1 … 8 mm Sample quantity dependent of the material properties and test application Substrate size: approx.14 mm x 16 mm maximum; 10 mm x 12 mm on average		

Image Analysis Software

Runs according to DIN 51730, ISO 540 and CEN/TS 15404 and 15370-1
Easy to use; online help function
User-definable test parameters and analysis conditions; memory for methods
One-page short report showing all characteristic temperatures as numeric values and images as well as all test-relevant information for documentation in compliance with quality management requirements
Continuous storage of measured values and images of a test run according to user-defined settings
Graphics of the measured results
Images, graphs and data are exported in the usual data formats; database administration and archiving functions

Accessories and Consumables

Sets for preparation of test objects; rectangular alumina substrates as specimen carriers, calibration standards, exchangeable Al_2O_3 working tube for HT 16 and HT 19 furnaces, …

Retrofits/Upgrades/Custom Adaptation to Individual Requirements

On request, you can upgrade your available Leitz equipment by installing Hesse Instruments software and/or retrofitting your equipment with Hesse Instruments' advanced furnaces and furnace controllers. We will be glad to assess your available equipment to customize these upgrades and retrofits to your particular needs.

Specifications subject to change without notice. Information version: October 2009

Hesse Instruments

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