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ODP 868 Optical Dilatometry Platform

ODP 868 makes possible the analysis of samples beyond the limits of classical dilatometry.

Result of over twenty years of R&D of optical instruments for the study of the thermo-mechanical behavior of materials, ODP 868 enables scientists to optimize the thermal cycles of industrial processes by analyzing samples above and beyond the limits of classical dilatometry techniques like heating microscopy, dilatometry and bending analysis.

The large and highly responsive furnace, motorized and PC-controlled, offers an unmatched ease of operations over a wide range of temperatures. With a maximum **temperature scan rate of 100°C/min,** it has a built-in purge gas system that enables the user to test specimens in air, oxidative, reductive and protective atmosphere.

ODP 868 precise micro-stepper motors enable fully automated, PC-controlled operations on XYZ axis, including cameras and furnace positioning. Also, to guarantee maximum performance and stability throughout the temperature range, the optical bench is equipped with four high resolution **CMOS-based video-cameras**, with a dynamic temperature thermostat control system, and with a base machined in a thermally ultra-stable material.

Scalable and field-upgradeable, the instrument can be configured to operate in any combination of **heating microscope, True Differential horizontal or vertical dilatometer, fleximeter or True Differential fleximeter** modes.

The optional **DTA** sensor and **Flash heating and cooling** broaden ODP 868 versatility and make of it the most innovative tool for R&D and production laboratories.

In Flash mode, once the temperature reaches the pre-set value, the sample is introduced in the kiln automatically so to be heated/cooled up to 200°C/sec.

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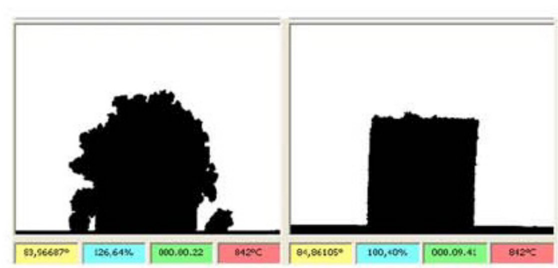
The operational mode is selected through **Misura 4**, a complete software suite with a Client/Server architecture and structured in "Apps". Each App features all instrument control functionalities and a powerful method set-up/editor. By clicking on the corresponding icon the user switches between the five different operational modes and can set up analytical methods with an unlimited number of segments of unlimited duration and complexity.

MorphometriX is the innovative image analysis engine at the core of Misura 4. Taking advantage of the unmatched **acquisition rate of up to 14 fps**, it precisely identifies and automatically visualizes in real-time specimen's characteristic shapes and temperatures, accurately follows its dimensional changes and records bending attitude. To ease the sample preparation process, and minimize its influence on results reproducibility, the user can choose the sample's area to be analyzed, and MorphometriX algorithms correct for possible asymmetries in sample geometry.

The browser-like interface makes then easy to organize, search and access test files and archived images. The MorphometriX results can be plotted and further analysed with advanced mathematical tools. Additional data can be integrated to calculate theoretical viscosity of materials according to V.F.T. equation, and the surface tension with the sessile drop method applying the Young-Laplace equation. The original data is cryptographically validated. Comprehensive reports can be interactively generated and rendered as vector PDF files; single or multiple frames can be selected and exported in web or video format (.AVI) for presentations; raw data can be imported and exported in CSV format.

The **Heating Microscope** mode uses an HD camera to frame the entire specimen and to study its behavior precisely reproducing industrial firing conditions. Capable to analyze samples in a wide range of shapes and sizes, ODP 868 can simultaneously test up to 8 samples. The recognition of shapes and the related temperatures can be done accordingly to international standard methods or by user-defined parameters and concepts.



Heating Microscope
Using the whole image of a specimen and advanced shape analysis algorithms, MorphometriX enables the study of the effects of different thermal cycles on a material though during the tests it may develop irregular shapes

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The **Optical Dilatometer** modes benefit of the patented dual beam True Differential design that allows contact-less measurements of expansion and shrinkage avoiding the need of calibration curves. It is so possible to easily determine parameters like linear thermal expansion, coefficient of thermal expansion (CTE), glass transition temperature (Tg) and the dilatometric softening temperature without the interference caused by the mechanical contact between the measuring system and the specimen .

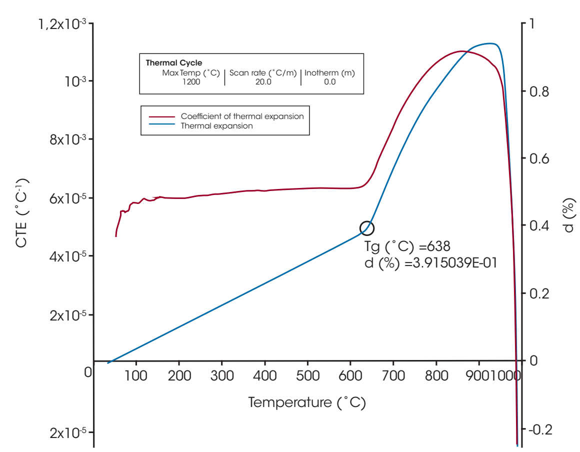
Samples that during the analysis may develop a significant volume of vitreous phases, that would cause friction between sample and sample holder can be placed vertically so to leave their top free to expand/ shrink while its lower base sits on the sample holding plate.

For samples that melt, a disposable holding plate is provided.

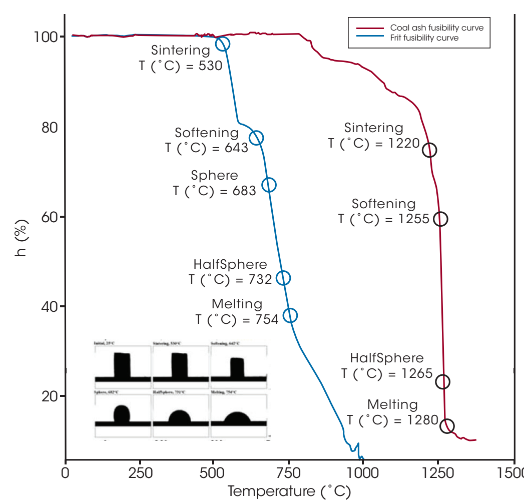
ODP 868's **Optical Fleximetry** comprises of two operational modes: standard fleximeter and the patented True Differential absolute fleximeter. They both enable non-contact bending measurements simulating real industrial thermal treatments resulting in a better and deeper understanding of the materials so to avoid altogether costly problems such as crazy, chipping, cracking and planarity.

While in standard fleximetry one camera frames the center of the specimen and requires to run a correction curve, the absolute fleximeter determines the relative displacement of the sample in three regions with three independent optical systems, avoiding the need of calibration curves to correct for the system's dimensional changes.

Specification	ODP 868
Optical measuring system	Optical bench with 4 independent measuring systems , each equipped with a HD videocamera and fully automated focus
Operating modes	Heating microscope, True Differential optical dilatometer both vertical and horizontal, fleximeter and True Differential fleximeter
International Standards	ASTM C372, ASTM D1857, CEN/TR 15404, BS 1016:Part 15, CEN/TS 15370-1, DIN 51730, IS 12891, ISO 540, NF M03-048
Sample displacement	Bidimensional
Sample number	From 1 up to 8, depending upon samples sizes and operating mode
Temperature range on specimen	RT – 1650 °C
Temperature resolution	0,2 °C
Heating rate	0,1 – 100 °C/min 200 °C/sec in Flash mode
Resolution	3ppm with standard sample
Sample dimensions:	Up to 85mm (depending upon operating mode)
MorphometriX; automatic quantitation of standard and user-selectable shapes	Sintering beginning, Softening, Deformation point, Sphere, Halfsphere, Melting, Flow point, Bloating, CTE, Linear and Volumetric thermal expansion, Shrinkage, Strain, Strain Rate, Contact angle, Height, Width, Height/Width Ratio, Perimeter, Area, Roundness, Eccentricity, Center of mass, Surface tension, Cohesion, Relative potential, Volume, Surface, Roughness, Circle fitting, Symmetry, Asymmetrical Sample Shape Filter, Sample region of analytical interest
Atmosphere	air, oxidative, reductive, quasi-inert
Light source	478nm LED source
Software	Misura 4 Thermal Analysis software



Optical Dilatometry
Typical expansion experiment on a ceramic glaze above glass transition temperature and dilatometric softening temperature. The expansion curve has a wide rising section above the glass transition temperatrue because the sample is not subject to any pressure.



Heating Microscopy
Comparison between fusibility curves of two different samples: in blue the curve of a ceramic glaze according to user-defined standard, in black the curve of a coal ash obtained acording to the ASTM standard. The strip of images shows the fundamental shapes of the ceramic glaze.