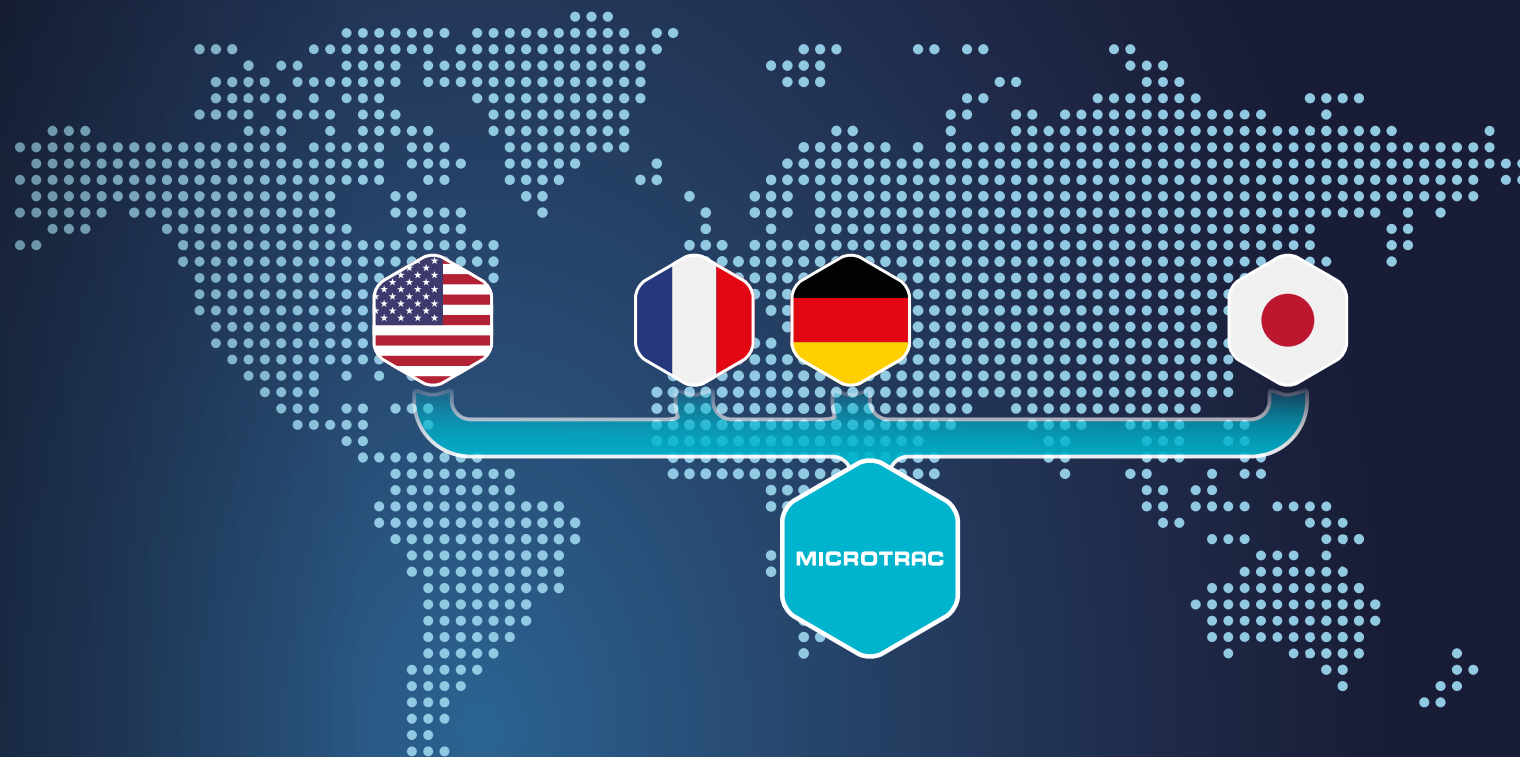




- I PARTICLE SIZE & SHAPE
- I STABILITY & SHELF-LIFE
- I SURFACE AREA , PORE SIZE & CATALYSIS

EXPERT IN PARTICLE CHARACTERIZATION



MICROTRAC

PARTICLE CHARACTERIZATION AT ITS BEST

MICROTRAC is your preferred partner for the comprehensive characterization of particulate systems. We provide our customers with advanced technologies to obtain consistently reliable results. Innovation and quality are at the core of everything we do.

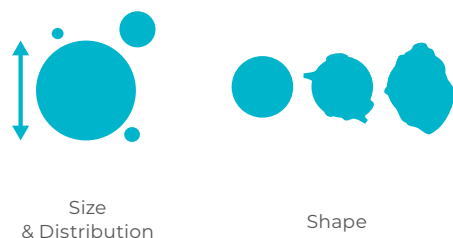
As part of Verder, we provide worldwide support through a network of subsidiaries and distributors.



Three Centers of Excellence

MICROTRAC: A SINGLE-SOURCE SOLUTION PROVIDER FOR PARTICLE CHARACTERIZATION

PARTICLE SIZE & SHAPE FOR PARTICLE ANALYSIS



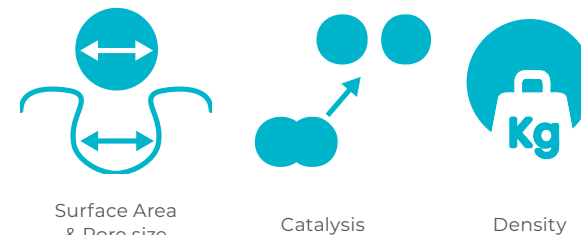
Our expertise in particle size distribution and shape analysis ensures optimal product quality control and supports advanced research efforts. At the core of our technology are **Dynamic Image Analysis (DIA) used on the Camsizer** and a combination of **Laser Diffraction (LD) and Dynamic Image Analysis used on the SYNC** systems. These two technologies cover all your needs for particle size analysis, ranging from 10 nm to 135 mm, whether for dry or wet samples. Our unique size & shape analysis technology utilizes advanced light scattering, state-of-the-art cameras, and sophisticated computational software to deliver outstanding accuracy and repeatability.

COLLOIDS AND FORMULATIONS CHARACTERIZATION



When working with colloids or formulations, the three main parameters to consider are **particle size, zeta potential and stability/shelf-life**. At MICROTRAC, we address all these needs with our comprehensive technology platforms: **NANOTRAC, STABINO, and TURBISCAN**. Our solutions analyze these critical factors to ensure rapid R&D and quality control for the highest product quality. Utilizing **Dynamic Light Scattering (DLS), Static Multiple Light Scattering (SMLS), and Zeta Potential (ZP)**, our systems offer unique features such as non-dilution, high accuracy, and fast measurement—enabling you to make fast decisions based on reliable data.

GAS ADSORPTION FOR MATERIALS CHARACTERIZATION



We offer advanced solutions for measuring surface area, porosity, and catalytic properties of materials. The MICROTRAC analyzers, celebrated for their precision in **gas and vapor adsorption measurements**, determine BET surface area and pore size distribution for both porous and non-porous materials. These analyzers employ cutting-edge gas adsorption technology and are widely used in various sectors, including Research and Development, Quality Control, and Quality Assurance. These tools are trusted worldwide, reflecting the renowned craftsmanship and quality of Japanese engineering, with comprehensive support provided by our competence centers in Japan (Osaka), Germany (Haan), USA (Newtown, PA) and France (Toulouse). The **BELSORP** and **BELPORE** analyzers are essential for achieving accurate gas and vapor adsorption analysis.

PARTICLE SIZE & SHAPE

Laser Diffraction

LASER DIFFRACTION (LD) is a leading technique for analyzing particle size in both research and industry settings. It is renowned for its precision, versatility and its broad range of applications measuring particle sizes from 10 nanometers to 4 millimeters. The particle size is measured by detecting the angular intensity of the scattered light. Small particles scatter light at large angles, while large particles scatter light at small angles relative to the laser beam.

The **SYNC** uses a state-of-the-art laser diffraction architecture with a unique Tri-Laser arrangement. The scattered light can be measured at various angles up to 163 degrees and with up to 151 channels. All data is collected continuously throughout the measurement and analyzed using MICROTRAC's innovative modified Mie algorithms for high precision and accurate particle size distribution. While the Laser Diffraction measurement is taking place, a high-speed camera is also taking live images of the sample. This patented synchronous measurement of the same sample, in the same sample cell at the same time is unique to the **SYNC**.



0.01 μm – 4 mm

SYNC

- | laser diffraction & dynamic image analysis combined in one analyzer
- | synchronous size and shape analysis from 0.01 to 4,000 μm
- | dispersion modules enable fast switch between wet & dry measurements
- | easy-to-use operating software
- | advanced design for optimized sample dispersion



0.01 μm – 2 mm

FLOWSYNC

- | wet dispersion unit
- | resistant to organic solvents
- | integrated ultrasonic probe
- | self-cleaning mechanism
- | fully automatic operation



0.2 μm – 4 mm

TURBOSYNC

- | dry dispersion unit
- | sample volumes as small as 0.1 cc
- | consistent control of aspiration
- | measurement time of 10 seconds with **TURBOSYNC** autoscan



0.5 μm – 2 mm

AEROTRAC II

- | analyzer for droplets, spray particles, powder, mist, etc.
- | accurate particle analyses at short intervals (0.02 ~ 500 msec)
- | equipped with a semi-conductor laser
- | different measurement modes to support various applications
- | including multiple scattered light correction software as a standard



Dynamic Image Analysis



0.8 μm – 5 mm

CAMSIZER X2

(with X-DRY module & X-JET cartridge)

- | unique dual camera system
- | for agglomerated powders
- | efficient high-pressure dispersion



10 μm – 8 mm

X-FALL CARTRIDGE

(for X-DRY module)

- | contact-free dispersion of free-flowing, non-agglomerated particles
- | complete sample recovery
- | no contamination



0.8 μm – 1 mm

X-FLOW MODULE

- | X-Change module for suspensions & emulsions
- | integrated ultrasonic module
- | resistant to organic solvents
- | automatic fill and rinse
- | liquid volume 200 ml to 700 ml



20 μm – 30 mm

CAMSIZER 3D

- | dynamic image analyzer for granulates & bulk material
- | proven dual camera technology
- | patented 3D measurement



30 μm – 5 mm

CAMSIZER S1

- | 12 Mpixel camera for efficient analysis: high-resolution, excellent repeatability
- | easy operation for QC requirements with high sample throughput
- | alternative to sieve analysis



160 μm – 135 mm

CAMSIZER XL

- | non-contact measurement of large particles
- | more than 40 morphological parameters (incl. 3D)
- | customizable sample introduction

Information about particle size & shape is an important aspect of process and quality control. All **DYNAMIC IMAGE ANALYSIS (DIA)** systems by MICROTRAC determine the particle shape of the sample material in a detailed and representative manner.

Due to its superior capability, dynamic image analysis is often used as an alternative to conventional methods such as sieve analysis.

The unique dual camera measuring setup of the **CAMSIZER 3D / X2** makes it possible to measure an extremely wide dynamic size range accurately, without having to switch measuring ranges or making hardware adjustments. The sample is transported to the measurement field by a vibratory feeder. During the measurement the basic camera records large particles, while the zoom camera records the small ones.

The **CAMSIZER 3D** detects particles in free fall several times in different orientations (particle tracking) so that the shape of the particles can be determined with the highest accuracy.

PARTICLE SIZE & SHAPE Applications

The MICROTRAC solutions cover a wide range of **APPLICATIONS**. Our analysis systems for particle size & shape are used in numerous industry segments, including the agricultural industry, geology, for catalysts, coal & carbon black, building materials, glass, metal powders, plastics, as well as in the chemical, pharmaceutical and food industries.



COATINGS

Paint, inks, pigments...



CONSTRUCTION MATERIAL

Sand, gravel, cements, glass and glass beads...



PHARMACEUTICALS

Pellets, granulates, active ingredients, excipients...



ENERGY

Battery materials, coal & coke, wood chips...



CHEMICALS

Activated carbon, catalysts, polymers, superabsorbent, refractory products, supporting agents, minerals ...



FOOD

Salt and sugar, ground, coffee, dairy products, beverages ...



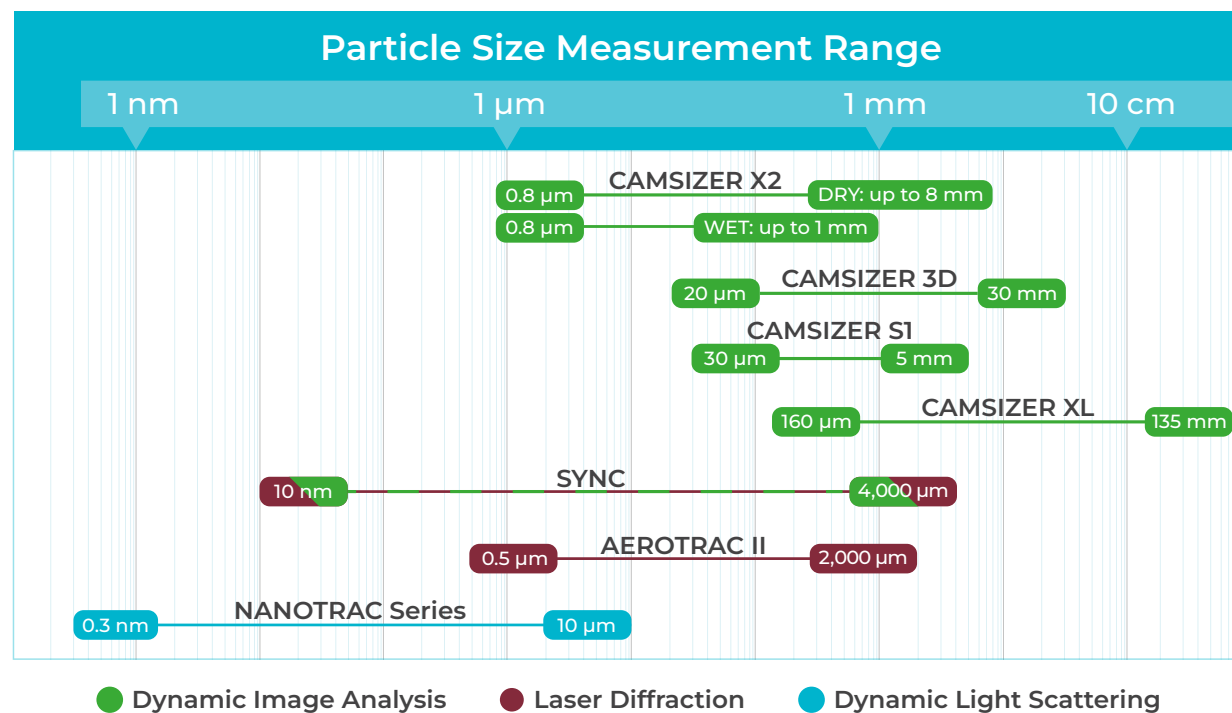
ADDITIVE MATERIALS

3D printing, metal powders, plastics, ...



OTHERS

Abrasives, ceramics, extrudates, seeds, fertilizers...



Particle Size & Zeta Potential



0.3 nm – 10 µm

NANOTRAC FLEX

- | external "dip-in" probe with 180° backscatter
- | allows for turning any vessel into a sample cell
- | small volume, as little as one drop of liquid
- | universal solvent compatibility
- | wide concentration range from ppm to 40 vol %



STABINO ZETA

- | zeta and streaming potential in one measurement
- | integrated titrator
- | suitable for particles from 0.3 nm to 300 µm
- | wide concentration range from 0.01 to 40 vol %
- | can be combined with NANOTRAC FLEX for particle size analysis



0.3 nm – 10 µm

NANOTRAC WAVE II

- | particle size with fixed optics and removable sample cell (Teflon or stainless steel).
- | zeta potential via electrophoresis
- | reference beating and 180° backscatter

MICROTRAC's innovative approach on **DYNAMIC LIGHT SCATTERING (DLS)** is based on a unique probe design. By focusing the laser probe at the material interface, the benefits of a short path length are combined with Reference Beating and 180° backscatter, delivering excellent accuracy, resolution and sensitivity. The DLS signal is evaluated by using a Fast Fourier Transformation.



COLLOIDS AND FORMULATIONS

Stability and Shelf-Life

TURBISCAN offers the ability to investigate the dispersion state, the stability and the shelf-life of liquid dispersions (emulsions & suspensions) and formulations without any dilution, even on highly concentrated samples (up to 95% v/v).

Static Multiple Light Scattering (SMLS) is based on measuring the transmission and backscattering intensities versus the sample's height and aging time. It offers an extraordinary resolution to detect size and concentration variation. Therefore, particle diameter evolution (like aggregation, flocculation, coalescence) and concentration change (like sedimentation, creaming, phase separation) can easily be detected and monitored, up to 1,000 times faster than visual observation.

SMLS is in perfect agreement with ISO/TR 13097's recommendation regarding shelf-life and stability measurement as a direct optical method that does not require sample preparation (such as dilution) and is the leading technology to measure **stability** and **shelf-life**.



1 sample RT to 60°C

TURBISCAN LAB

- From 1nm up to 1mm, conc. up to 95%
- temperature range from RT to 60°C
- fast destabilization detection
- Turbiscan Stability Index (TSI), mean particle size kinetic and particle size distribution



3 samples +20°C to +60°C

TURBISCAN TRILAB

- From 1nm up to 1mm, conc. up to 95%
- temperature range from 20°C to 60°C
- fast destabilization detection
- Turbiscan Stability Index (TSI), mean particle size kinetic and particle size distribution



6 samples +4°C to +80°C

TURBISCAN TOWER

- From 1nm up to 1mm, conc. up to 95%
- temperature range from 4°C to 80°C
- fast destabilization detection
- Turbiscan Stability Index (TSI), mean particle size kinetic and particle size distribution



54 samples RT to 60°C

TURBISCAN AGS

- From 1nm up to 1mm, conc. up to 95%
- 3 independent storage racks from RT to 60°C
- fast destabilization detection
- Turbiscan Stability Index (TSI), mean particle size kinetic and particle size distribution



1 sample RT to 60°C – mixing

TURBISCAN DNS

- From 1nm up to 1mm, conc. up to 95%
- stability and dispersibility via mixing and circulating function
- temperature range from RT to 60°C
- Turbiscan Stability Index (TSI), online particle sizing and particle size distribution

Applications

**CHEMICALS & POLYMERS**

Surfactants, stabilizers, polymers and biopolymers, fillers, pigments, latexes, solvents, ...

**PHARMACEUTICALS**

Injectables, parenterals, vaccines, drug delivery systems, skin treatments, inhalers, cough syrups, ophthalmic suspensions, ...

**COATINGS, PAINTS & INKS**

Water-based, solvent-based, resins, varnishes, inks, primers, protective and special coatings, ...

**BATTERY & ELECTRONICS**

Anode & cathode slurries, CMP slurries, multilayer capacitors, LCD and LED display

**FOOD & BEVERAGES**

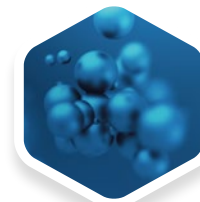
Flavor emulsions, beverages, milk and dairy products, vegetable drinks, plant protein, wine & beers, additives, gums and stabilizers, ...

**HOME & PERSONAL CARE**

Creams & lotions, moisturizers, sunscreens, detergents, fragranced formulations, cleansers, foundations, makeup, nail polishes, ...

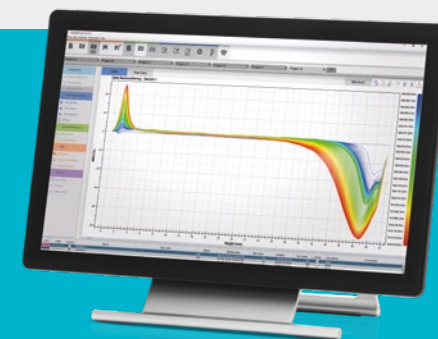
**OIL & LUBRICANTS**

Water-in-oil demulsification, enhanced oil recovery, drilling fluids, crude oils, heavy fuels, fuel & oil additives, metal-working fluids, lubricating agents, ...

**AND MANY MORE**

Agrochemicals, building materials, colloidal suspensions, nanoparticles...

MICROTRAC's **STABILITY AND DISPERSIBILITY** instruments can analyze a very wide variety of samples: opaque or clear, highly concentrated and very diluted, from nanoparticles to large floccs (mm), emulsions, suspensions, colloids, foams, ...



VISIT OUR APPLICATIONS DATABASE

Interested to hear more about applications in each industry, visit the MICROTRAC website

START EXPLORING!

www.microtrac.com/applications

TURBISCAN SMART ANALYSIS**TURBISCAN Stability Index (TSI)**

The TSI is a Turbiscan-specific parameter designed for formulators to compare and characterize the physical stability of various formulations with a single click and a single, comparable and reproducible number. It enables the quantification of any type of destabilization, thanks to a one-click calculation that is a robust and completely user-independent tool.



MATERIALS CHARACTERIZATION

Surface Area & Pore Size Distribution

The **SPECIFIC SURFACE AREA** is calculated via BET theory. This theoretical model can be applied to either single point or multi-point adsorption measurements. The single-point BET is often used for quality control applications. More accurate data can be obtained by multi-point BET.

The **PORE SIZE DISTRIBUTION** via gas adsorption is measured through N_2 , Ar or CO_2 isotherms as a standard, enabling analysis of the pore size from several hundred nanometers down to the molecular size range.

The following methods can be utilized for **CATALYST EVALUATION**: temperature-programmed measurements (TPD / TPR / TPO), pulse chemisorption, single-point BET and analysis of breakthrough curves.



Ø 0.7 nm – 500 nm (opt. 0.35 ~)
 ⇄ 0.01 m²/g or more

BELSORP MINI X

- | simultaneous measurement of up to 4 samples
- | short-time measurement by "Gas Dosing Optimization" function
- | high reproducibility with Advanced Free Space Measurement (AFSM™) and AFSM™2



Ø 0.35 nm – 500 nm
 ⇄ 0.0005 m²/g or more

BELSORP MAX G

- | micro- / meso- / macropore measurement (BET) with 1 sample port
- | measurement without He gas via the new Advanced Free Space Measurement 2 (AFSM2™)
- | low specific surface area evaluation by Kr adsorption at 77.4 K
- | high-performance PSD analysis



Ø 0.35 nm – 500 nm
 ⇄ 0.0005 m²/g or more

BELSORP MAX X

- | highest throughput with simultaneous measurement of up to 4 samples
- | Advanced Free Space Measurement: AFSM™ and AFSM2™ (Helium-free)
- | low specific surface area evaluation by Kr adsorption at 77.4 K
- | Chemisorption (optional)
- | special models: MAX X HT; MAX X HP



⇄ 0.01 m²/g or more

BELSORP MRI

- | fast & precise single-point BET via flow adsorption method
- | auto zero function with highly sensitive thermal conductivity detector (TCD)
- | calibration valve, Dewar elevator & cooling fan

Catalyst Evaluation & High-Pressure Gas Adsorption



BELCAT II

- | fully automated catalyst analyzer (TPD / TPR / TPO / Pulse), breakthrough curve measurement available
- | precise gas control by 3 high-performance mass flow controllers
- | automatic gas injection system for calibration
- | measurable gas/vapor: H_2 , O_2 , CO , CO_2 , NO , N_2O , NH_3 , H_2O , VOC, etc.
- | measurement temperature: -120°C – 1100°C



1 amu – 200 amu

BELMASS II

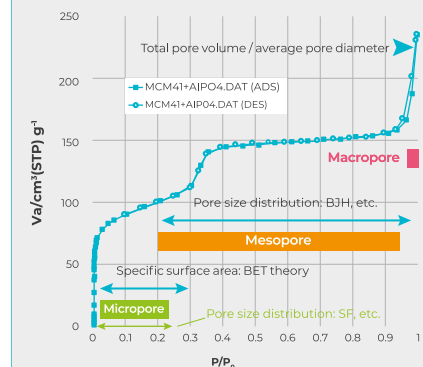
- | mass spectrometer for both qualitative and quantitative gas analyses
- | heated hose enables the analysis of vapors
- | built-in vacuum pump
- | provides information on desorbed compounds in gas / vapor mixtures and their breakthrough curves when combined with **BELCAT II**



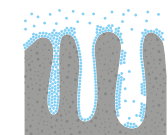
BELSORP HP

- | high-pressure gas adsorption analyzer
- | maximum pressure: 13.5 MPa
- | compact design, easy-to-use interface
- | operating temperature range: -10°C to 800°C optional -196°C
- | H_2 , CO_2 , O_2 , N_2 , non-corrosive gas

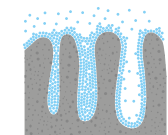
ADSORPTION / DESORPTION ISOTHERM



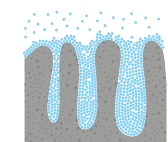
BEFORE ADSORPTION



MONOLAYER FORMATION /
MICROPORE FILLING



MULTILAYER FORMATION /
CAPILLARY CONDENSATION



FILLING ALL PORES /
ADSORPTION INTO VOIDS

MATERIALS CHARACTERIZATION

Density Measurement & Sample Preparation

The gas displacement method is used for the **DENSITY MEASUREMENT**. An inert gas, such as nitrogen or helium, is used as the displacement medium. The gas is directed to the closed sample compartment and then expands into an empty compartment with a defined volume. The pressure difference allows to determine the exact sample volume. The sample density can be calculated from the measured sample volume and the mass.

MICROTRAC provides optional systems for **SAMPLE PREPARATION**. All models guarantee a high reproducibility of the sample's condition.

The sample pretreatment can be done independently of the measurements.



BELPYCNO

- | quick & reliable true density measurements via gas displacement
- | highly precise measurement with variable cell volumes (1 cm³ - 10 cm³)
- | sample cell cap without grease
- | convenient one-hand operation via touch screen
- | measurable gas: He, N₂ or other inert gases



BELPREP VAC III

- | vacuum / heat degassing pretreatment device for specific surface area & pore distribution analysis (flow / heat optional)
- | can be operated independently to perform pre-processing parallel to the measurement
- | 6 pretreatment ports



BELPYCNO L

- | fully automated density & volume measurement of powders, granulates, porous materials, mixtures, pastes and liquids
- | multi-volume capability for easy choice of best configuration
- | built-in accurate ATC (Automatic Temperature Control)
- | variable sample volume (4 cm³ - 150 cm³)



BELPREP VAC II

- | vacuum / heat degassing pretreatment device for specific surface area & pore distribution analysis
- | can be operated independently to perform pre-processing parallel to the measurement
- | 3 pretreatment ports

Mercury Porosimetry



Hg

CE

Ø 330 µm – 15 µm, 3000 µm with ultramacropore dilatometer

Ø 180 µm – 3.8 µm, 1000 µm with ultramacropore dilatometer

BELPORE LP

- | automatic sample degassing & vertical mercury filling, maximum pressure: 400 kPa
- | 5 dilatometer models for various sample dimensions & shapes
- | particle size can be determined automatically by second intrusion
- | measurement of wet possible
- | avoids any risk of powder elutriation via special proportional valve



Hg

CE

Ø 40 µm – 0.01 µm

Ø 15 µm – 0.0036 µm

BELPORE HP

- | operates up to a maximum pressure of 414 MPa
- | particularly suited for ceramics, sintered metals, very hard materials, and solids with porosity in the macro- and mesopore range
- | highly recommended for R&D and QC labs
- | high accuracy and reproducibility via PASCAL method



Hg

CE

Ø 40 µm – 0.015 µm

Ø 15 µm – 0.0065 µm

BELPORE MP

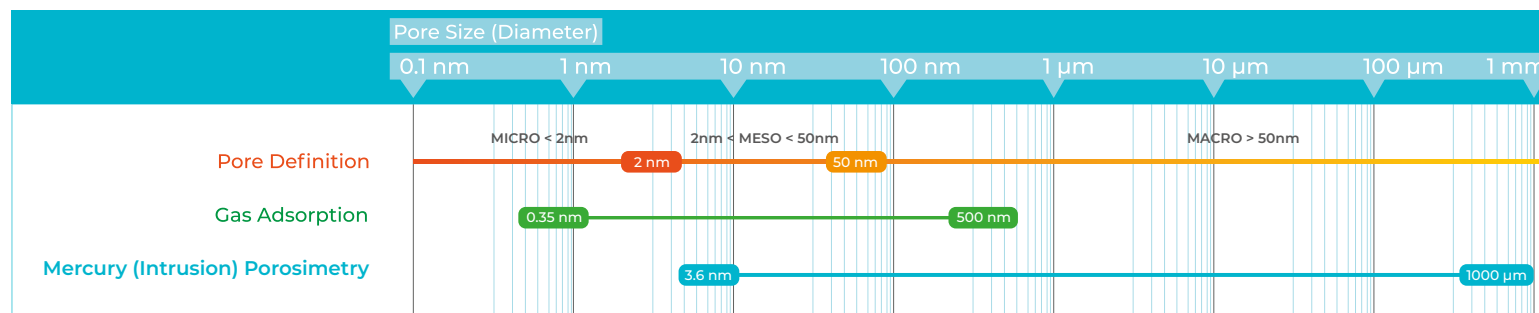
- | operates up to a maximum pressure of 228 MPa
- | automatic autoclave opening / closing simplifies operation
- | different dilatometer sizes to cover all materials & sample types
- | for hetero- & homogeneous material with low as well as high porosity

MERCURY POROSIMETRY is the most widely used method for determining the pore size distribution of solids in the range of macro- and mesopores. This technique provides reliable information about the pore size distribution, sample volume and the apparent density of most porous materials, regardless of their type and shape.

The method is based on the intrusion of mercury into a porous system under applied pressure. Using the Washburn equation, the corresponding pore size can be calculated from the pressure.

MICROTRAC's **BELPORE** series uses the PASCAL method for pressure build-up control. With this method an optimized speed of the pressure build-up is set and controlled automatically. This allows for shorter measuring times with guaranteed equilibrium conditions.

MATERIALS CHARACTERIZATION Applications



VISIT OUR APPLICATIONS DATABASE

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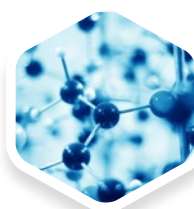
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CATALYSTS



BATTERIES



CARBON



PHARMACEUTICALS



COSMETICS



CEMENT



TONER



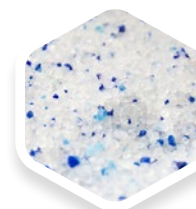
PIGMENTS



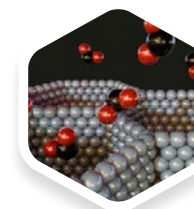
CERAMICS



SEMICONDUCTORS



ADSORBENTS



MOFS / PCPS

VERDER – ENABLING PROGRESS

MICROTRAC is part of Verder, the scientific division of the Verder Group. Five more companies are part of the scientific division; Retsch, Carbolite Gero, QATM, Eltra and Erweka. Together we set new standards in the development and manufacturing of lab and analysis equipment, as well as sample preparation tools, which are used in areas such as quality control, research and development.



For more details about the extensive MICROTRAC product portfolio please visit our website: **www.microtrac.com**

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VERDER

Verder is composed of leading laboratory equipment companies active in sample preparation and analysis for quality control as well as research & development purposes.

As trusted solution partner, Verder Scientific enables thousands of companies to ensure economic, technological and environmental progress by mastering their scientific applications. Together, we make the world a healthier, safer and more sustainable place.



ENABLING PROGRESS

