MICROTRAC MRB

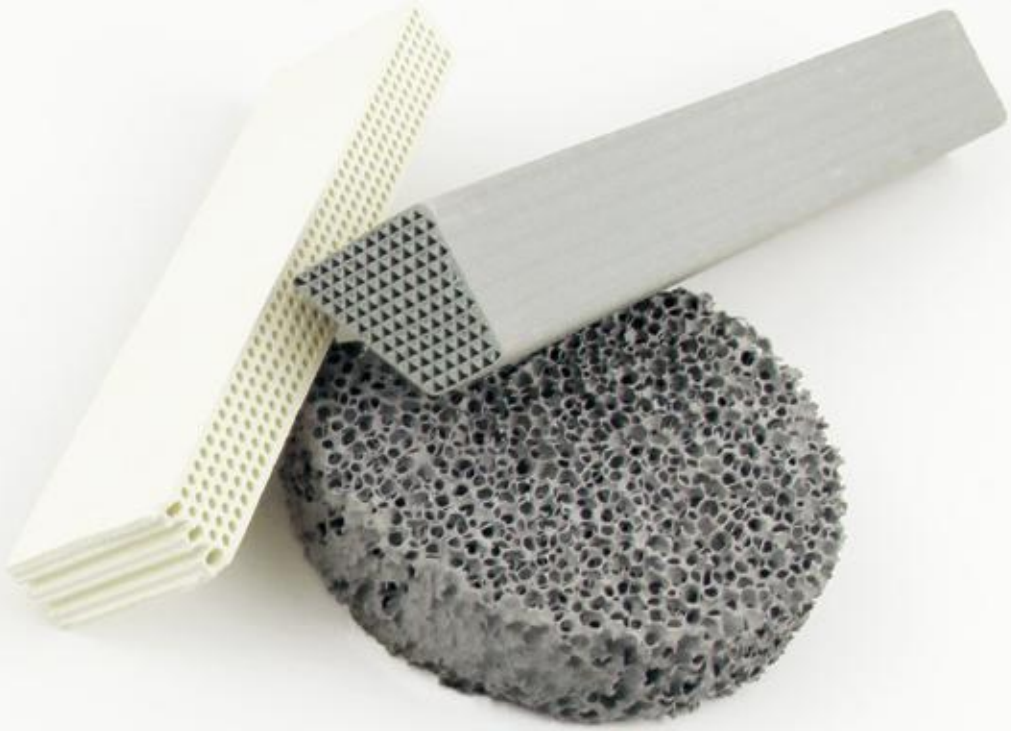
PARTICLE CHARACTERIZATION

BELPORE

MERCURY POROSIMETER

CHARACTERIZATION OF POROUS MATERIALS

part of VERDER scientific



MERCURY POROSIMETRY

THE NEXT STEP IN CHARACTERIZATION

The knowledge of porosity, pore sizes and pore volume is of fundamental importance for the characterization of porous materials. Mercury porosimetry is the most widely used method for determining the pore size distribution of accessible macro- and mesopores in solids.

The technique is based on the pressure-dependent intrusion of mercury as a non-wetting liquid into a porous material. Using the Washburn equation, the corresponding pore size is calculated from the applied pressure.

Microtrac MRB, as a provider of state-of-the-art solutions in the field of particle characterization and gas adsorption, has now expanded its extensive portfolio with a series of devices specifically for the field of mercury porosimetry. The BELPORE series consists of state-of-the-art instruments for measuring pore size distribution, pore volume, specific pore surface area, density and particle distribution of finely divided and porous materials.

The BELPORE mercury porosimeters precisely and quickly detect all accessible pores in the size range from 1 millimeter to 3.6 nanometers with stepwise equilibrium-controlled pressure increase from a vacuum up to 414 MPa.

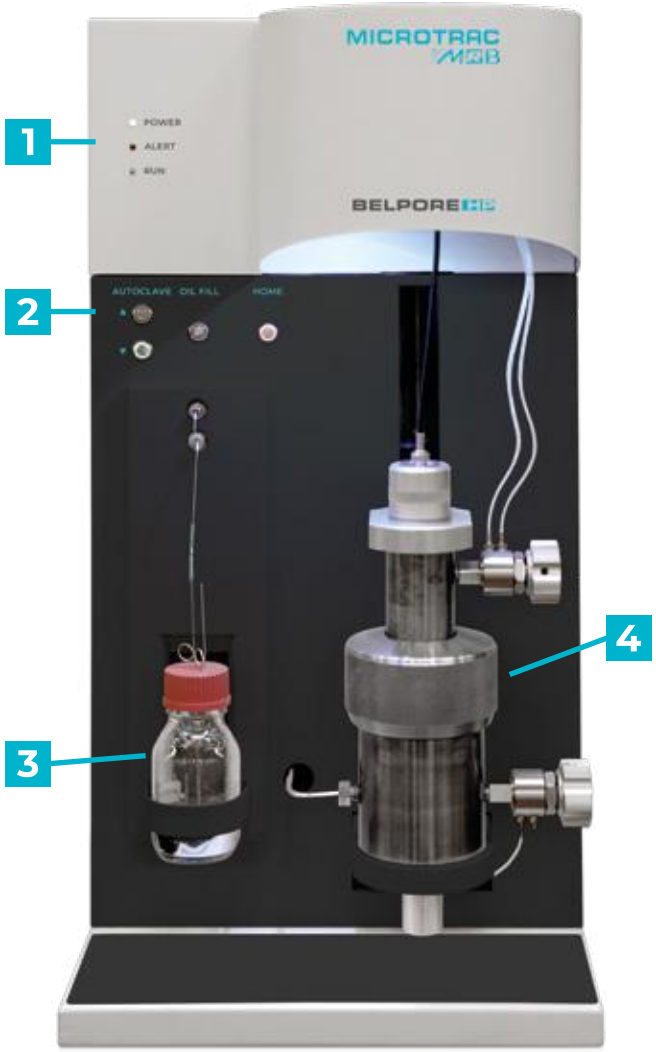
BELPORE SERIES

COMPACT SAFE AUTOMATED

Features

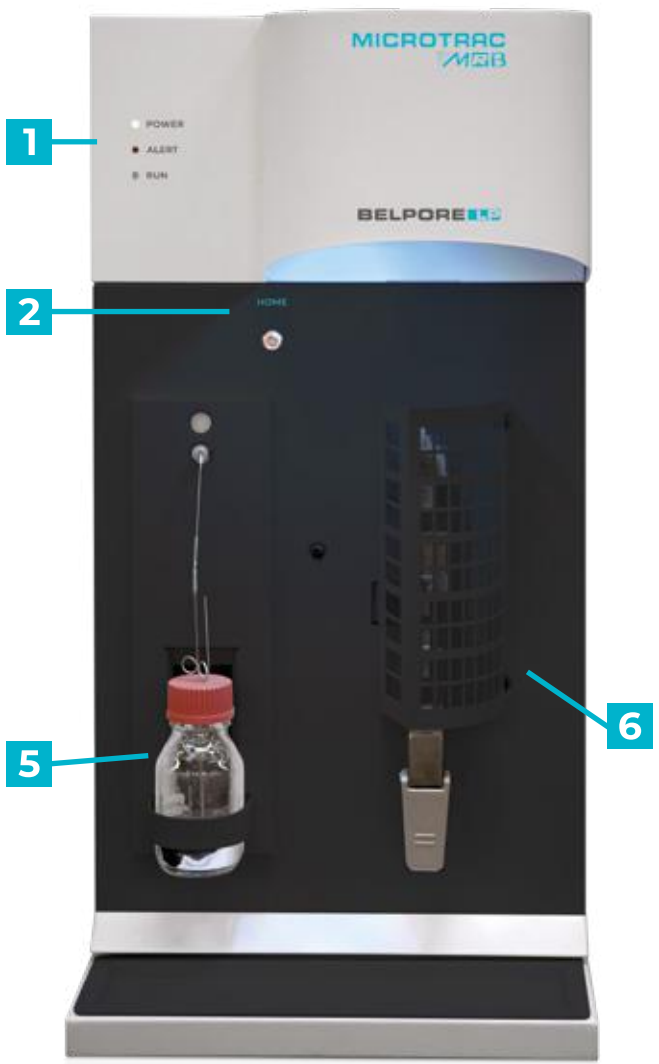
- Fully automatic vertical filling under constantly high vacuum
- High resolution enables detection of up to 20,000 measuring points
- Secure and full functionality without gas connection and liquid nitrogen
- Low space requirement due to compact design
- Vertical arrangement of the dilatometers ensures safe handling
- Efficient re-use of mercury via cleaning set
- All devices are CE-certified and ISO 9001-accredited

BELPORE HP / BELPORE MP



1 Status display
2 Manual control
3 High-pressure oil supply

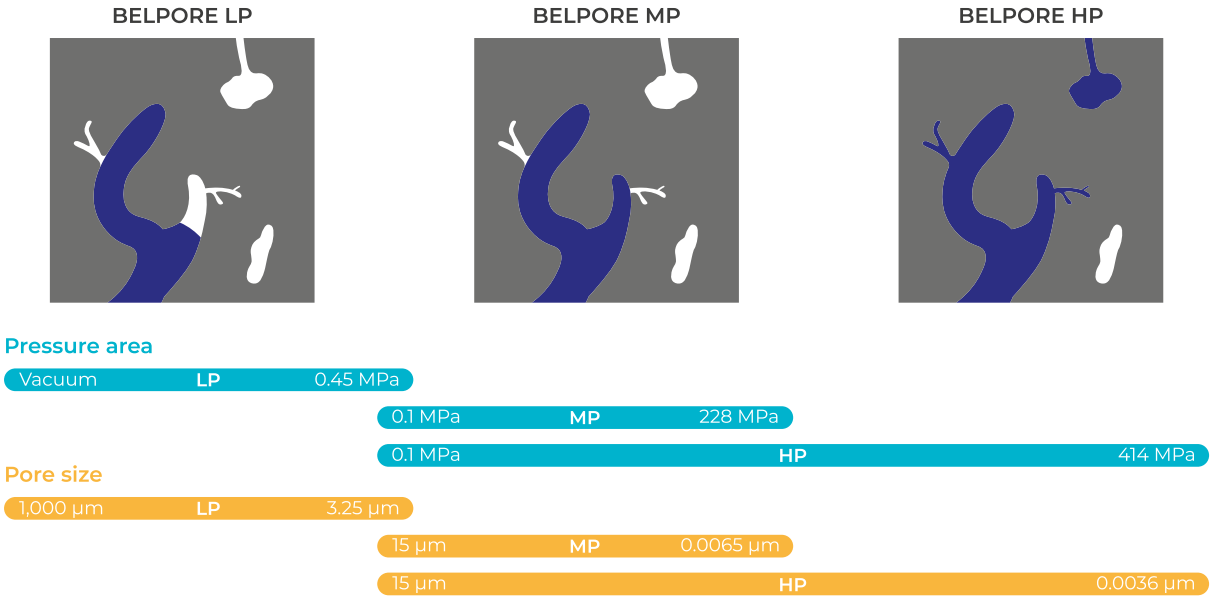
BELPORE LP



4 High-pressure autoclave
5 Mercury reservoir
6 Analysis and vacuum port

MERCURY POROSIMETRY

ACCURATE DETERMINATION OF THE PORE SIZE DISTRIBUTION



The BELPORE mercury porosimeters from Microtrac MRB reliably and reproducibly measure pore diameters from 1 millimeter to 3.6 nanometers at 414 mega-Pascals. “Pascal” is not only a pressure unit, but also stands for the equilibrium-controlled and optimized handling of the pressure build-up through the so-called “Pressurization by Automatic Speed-up and Continuous Adjustment Logic”, or P.A.S.C.A.L. for short. This automatic control is regulated by the real pore system and permits shorter measuring times under guaranteed equilibrium conditions as well as the detection of all pores within the specification - and this with up to 20,000 measuring points per analysis. Since only three types of dilatometers are sufficient for all measurement tasks and neither gases nor liquid nitrogen are required, running costs can be kept significantly low. In addition, the BELPORE LP low-pressure porosimeter is easy to use and has an extended measuring range up to pore sizes of 1 mm. The vertical degassing and filling with mercury on the BELPORE LP allows the degassing pressure to be adjusted, making it possible to measure moist samples without changing the moisture content of the material. In this way, even moist concrete samples and solvent-containing porous green bodies can be measured unaltered. The mercury porosimeters from Microtrac MRB are available for different pore ranges:

- BELPORE LP (1,000 - 3.25 µm)
- BELPORE MP (15 - 0.0065 µm)
- BELPORE HP (15 - 0.0036 µm)

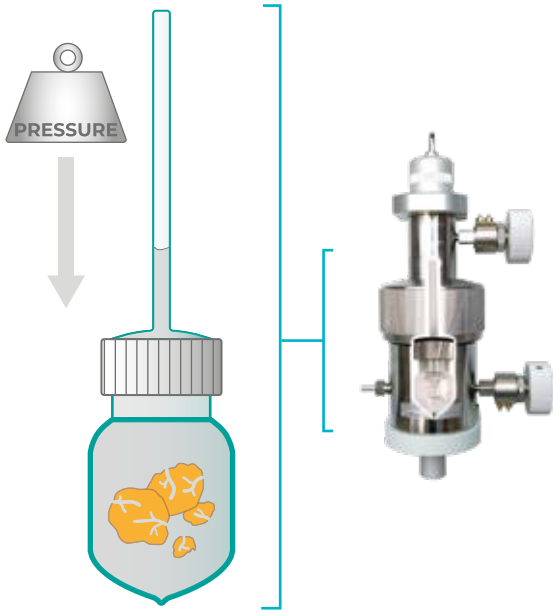
BELPORE SERIES

DILATOMETERS & ACCESSORIES

Available accessories:

- **Dilatometer (sample vessels)**
  Dilatometers in different sizes for the BELPORE series
- **Ultra-Macropore Set (UMP)**
  Extends the measuring range of the BELPORE LP for pore & particle size determination
- **Porosimeter calibration set**
  For easy calibration of capacitive volume measurement
- **Mercury cleaning set**
  Enables the efficient reuse of mercury

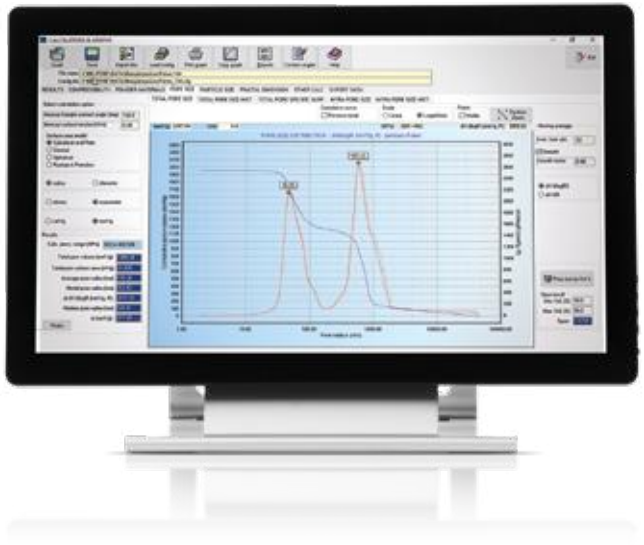
The **Professional dilatometer** offers an easy & safe handling via screw cap and integrated opening aid

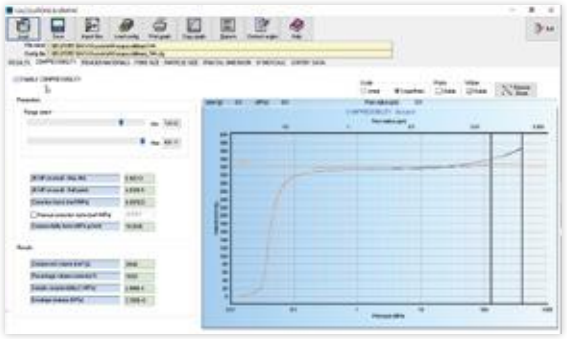


DILATOMETER	Professional	Standard	UMP (Ultra Macropore)
Capillary diameter	3 mm	3 mm 6 mm	6 mm
Sample type	Powder // solids	Powder // solids	Powder, solids
Max. sample size solid state body (d x h)	11 x 25 mm	12 x 46 mm 25 x 25 mm	25 x 25 mm
Compatible with	LP, MP, HP	LP, MP, HP LP, MP	LP
Dilatometer volume	8 cm^3	15 cm^3 35 cm^3	50 cm^3

POREINSPECT

POWERFUL & INTUITIVE EVALUATION SOFTWARE





The **PoreInspect software** offers detailed views, here for example the representation of the compression correction

Features

- Pore size distribution (differential, integral and as histogram)
- Pore volume, porosity
- Particle size distribution
- Bulk density and apparent density
- Specific surface
- Fractal dimension
- Tortuosity
- Permeability
- Frost resistance of concrete
- Compliant to DIN ISO 15901

The PoreInspect software for the BELPORE instrument series of Microtrac MRB offers a variety of functions. The software monitors and controls up to 4 measuring instruments connected via LAN completely independently with a PC and allows for individual control of all instrument parameters in real-time.

The data evaluation of the PoreInspect software not only takes the exact blank value correction into account, but also allows for a check and correction of possible sample compressibilities, guaranteeing most reliable results. Extensive evaluation options enable the selection of different pore models and their presentation as graphics and histograms. The calculations are freely selectable depending on the application and include, for example, the representation of fractal dimensions as well as calculations of tortuosity and permeability. Overlay, statistical evaluations, the creation of a method catalogue and data export are further features. The stored raw data are available at any time.

Model	BELPORE LP	BELPORE MP	BELPORE HP
Function	Degassing, Hg filling, low-pressure porosimetry	High-pressure porosimetry	High-pressure porosimetry
Pressure range	Vacuum up to 450 KPa	0.1 - 228 MPa	0.1 - 414 MPa
Resolution	0.001 kPa in measuring range: vacuum to 0.1 kPA 0.01 kPa in measuring range 0.1 - 450 kPA	0.001 MPa in measuring range 0.1 - 100 MPa 0.01 MPa in measuring range 100 - 228 MPa	0.001 MPa in measuring range 0.1 - 100 MPa 0.01 MPa in measuring range 100 - 414 MPa
Pressure detection accuracy	better than 0.1% F.S.	better than 0.1% F.S.	better than 0.1% F.S.
Pore size diameter	180 - 3.25 µm (UMP: 1,000 - 3.8 µm)	15 - 0.0065 µm	15 - 0.0036 µm
Particle size diameter	330 - 15 µm (UMP: 3,000 - 15 µm)	40 - 0.015 µm	40 - 0.01 µm
Max. detectable volume	0.5 cm^3 - 2 cm^3	0.5 cm^3 - 2 cm^3	0.5 cm^3
Volume detection accuracy	better than 1% F.S.	better than 1% F.S.	better than 1% F.S.
Max. number of measuring points	10.000 intrusion 10.000 extrusion	10.000 intrusion 10.000 extrusion	10.000 intrusion 10.000 extrusion
Weight & dimensions (W x D x H)	55 kg (121 lbs) 40 x 67 x 80 cm	68 kg (150 lbs) 40 x 67 x 80 cm	68 kg (150 lbs) 40 x 67 x 80 cm

See **page 5** for available dilatometer models.

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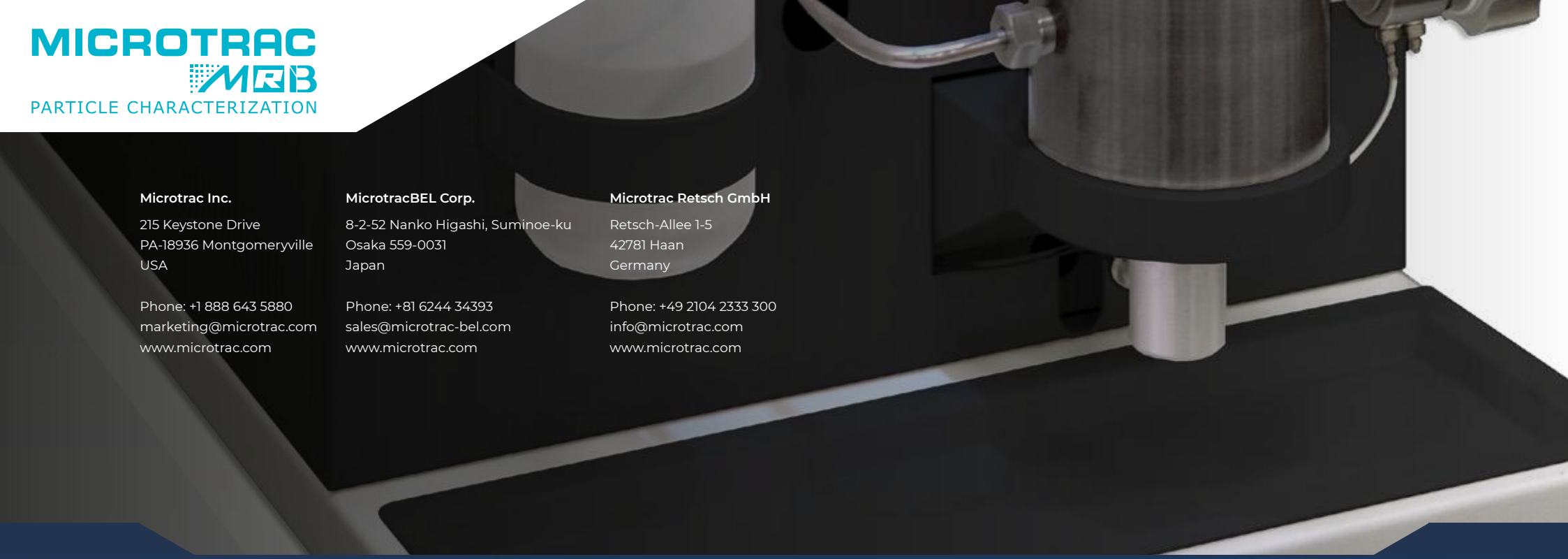

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VERDER scientific

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For several decades our companies have supplied production plants and research institutes, laboratories for quality testing and analytics, all kinds of technical specialists and scientists with modern, reliable devices to solve the many and varied challenges they face.

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