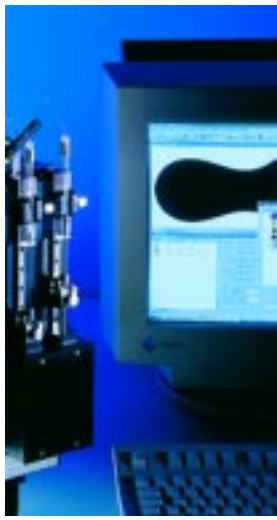
OCA 10/OCA 20

Optical Contact Angle Measuring Instruments



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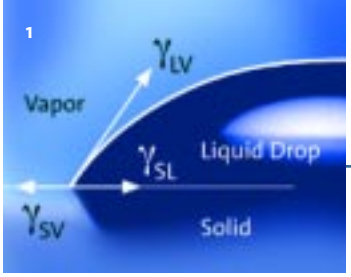


1
Liquid drop on a partially reflecting sample
2
OCA 10 with multiple dosing unit MD and 4 manual syringe units MS

OCA 10

The manual contact angle measuring instrument

How measuring and application technology act together, optically.
In a variety of technical applications the wetting behavior of liquids towards solid surfaces plays an essential role. Whether in the production and processing of paints and varnishes, in the development and production of composites, when gluing or dissolving materials or in the bio-compatibility of medical implants. In all these applications, an exact determination of the static or dynamic contact angle, as well as the surface and interfacial tension of liquids and solids is needed.

The most up-to-date optics, precise mechanics and a high resolution video measuring technique ensure that the user of DataPhysics contact angle measuring instruments obtains the right view in any measuring situation. Our development engineers benefit from many years practical experience in these measurement techniques. We would like you to benefit from this knowledge that is incorporated into our technical instruments.

Contact angle measurement – From theory to practice
Today, modern contact angle measuring instruments can do more than just determine the contact angle. They permit the precise determination of surface or interfacial tension of liquids as well as the surface free energies of solids. Beside the standard evaluation methods, e.g. Owens-Wendt, Wu, Schultz, Zisman, evaluations according to new and extended theories e.g., Acid-Base, Extended Fowkes, Equation of State, have been included in the software developed for Windows 9x/NT available for the OCA 10 and OCA 20 instruments.

The starting point is always the simplified Young-Dupré's equation for the balance of forces in the so-called three phase point between liquid, solid and vapor.

The smaller the measured contact angle Θ, the better is the wetting between liquid and solid.

Much more detailed statements can be made by calculation the dispersion and nondispersion force contributions to the surface tension or to the surface free energy of the solids. The obtainment of this additional information is made possible by the comprehensive test liquid database of the DataPhysics SCA software for the contact angle measuring instruments that are part of the OCA construction kit.

Your application – Our challenge
Some important applications for measuring contact angle and interfacial tension with the OCA systems are:
• the painting, printing and coating of metals, plastics and papers
• the development of high performance composites
• the determination of the surface cleanliness of semi-conductor wafers and video screen glass substrates
• the development of cosmetic and pharmaceutical products, e.g. pastes and creams or powder coatings

• the surface finish and textile cleaning
• the development of surface-active plant protectives
• the optimization of the adsorption behavior of absorbent papers

Modular and user-friendly – The OCA 10
The contact angle measuring instrument OCA 10 permits the determination of the static contact angle by means of a precision protractor eyepiece. Focus and six-fold power zoom can be easily adjusted on the measuring lens with one hand. The particularly high-contrast image quality of the OCA lenses coupled with the homogeneous back lighting will impress every user. The contact angle measuring results can then be documented and evaluated with the SCA 10*) software.

Temperature measurement and display included
The measurement of the precise temperature is important for all thermodynamic quantities, DataPhysics has integrated temperature measurement and display in the range from -10 to 400°C in all OCA systems**).

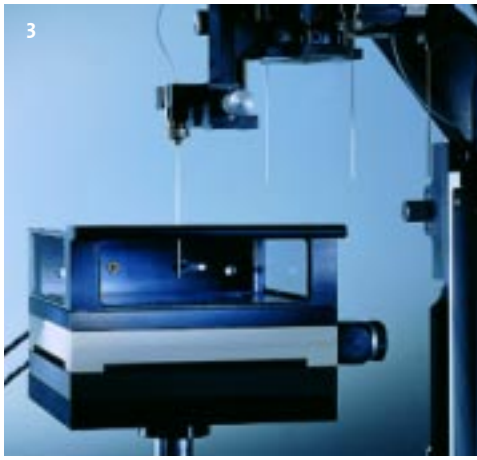
Precise sample positioning and dosing
Adjustable in three degrees of freedom, the sample stage can be easily adjusted for measuring all angles of the sample. Additionally, the dosing needles for the test liquids can be individually adjusted vertically and horizontally to the optical axis. For manual dispensing of up to four liquids, the OCA 10 user can choose between single and multiple dosing units.

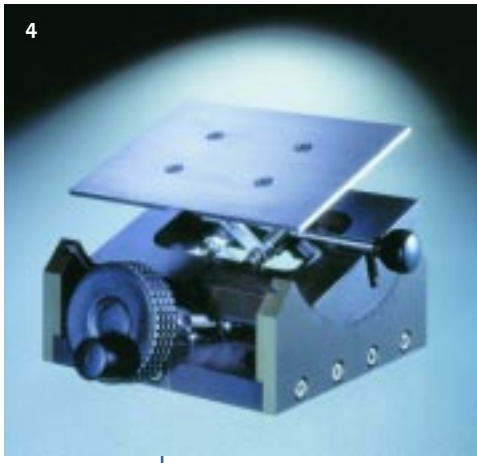
Upgrades and extensions
In addition, temperature controls and special sample stages, for instance for wafers, foils, textiles and printing cylinders are available from the OCA construction kit. The OCA 10 and OCA 20 are designed for maximum customer-specific adaptation of the basic units and the system components. With the versions OCA 10L and OCA 20L, DataPhysics offers solutions even for unusual sample shapes and sizes.

*) optional
**) resistance temperature probes Pt 100 optional

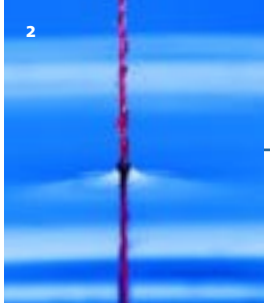
$$\gamma_{SV} = \gamma_{SL} + \gamma_{LV} \cos\Theta$$

The smaller the measured contact angle Θ, the better is the wetting between liquid and solid.





3
Thermal chamber TFC 100 with multiple dosing unit MD
4
Manually tilting base assembly



1
Suspended liquid drop to be evaluated with the Pendant Drop method
2
Fiber bundle with liquid lamella to calculate the contact angle
3
OCA 20 with multiple dosing unit MD, 4 electronic syringe units ES and software SCA 22 for calculation of the surface and interfacial tension

Das OCA 20

Video-supported measuring with method and precision

Increased performance – The OCA 20

With the video-supported contact angle measuring instrument OCA 20 we go a few steps furher. The micro-controller module in the OCA 20 allows automation of the liquid handling as well as measurement. Up to four motor-driven dosing units are easily connected to the OCA 20 and the control software. The static contact angles and the dynamic wetting angles i.e. advancing and receding angles, can be measured with these devices using a fixed dosing volume. For particularly small or large contact angles, the system provides an increased measuring accuracy as well as an automatic detection of the solid surface.

The Plug and Play principle

Microprocessors are used in the OCA 20 to manage complex tasks even in the smallest components, like for instance in the electrically driven sample stages for wafers up to a diameter of 300 mm, in the positioning drives for the program-controlled immersion of solids as well as in the tilting stages for measuring the contact angle hysteresis. They are connected to the basic unit in seconds and are immediately ready for use. Via a flexible and quick bus system a master controller monitors the communication between the individual system components and of course, the correct timing. The OCA electronics can always be extended by adding new components. At DataPhysics, we take the Plug and Play principle seriously.

$$\gamma_L \left[\frac{1}{R_1} + \frac{1}{R_2} \right] = \Delta\rho \cdot g \cdot z(x,y)$$

The equilibrium shape of liquid drops is described by the Young-Laplace equation

Methodical application
Whatever substances you examine, whether they are surfactant solutions, liquid phases of micro-emulsions or molten metals and polymers, the OCA 20 will calculate the surface and interfacial tension from the contours of pendant and sessile drops as well as of liquid lamellae on plates, bars and fibers. How?

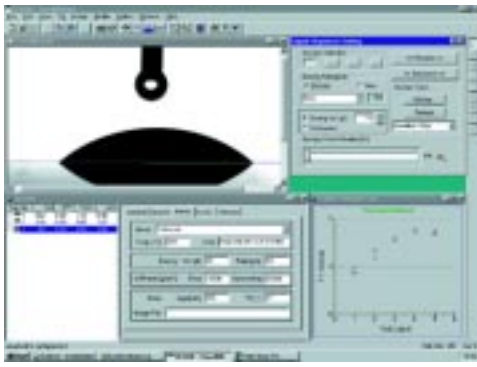
Our application specialists will answer this question for you, either by visiting your premises or at the DataPhysics offices. They will also be glad to help you solve your specific problems. Take advantage of our wide range of experience in surface chemistry. We aim to assist you through the provision of application reports, by drawing your attention to relevant special publications or with our database and e-mail information service via the Internet. Our goal is to understand your needs.

Efficient software
Intuitive software with many graphic elements is useful when setting up a test method, when taking measurements and in the evaluation and analysis of results.

Our software engineers have a wealth of experience in the development of the software packages for the SCA series, specializing in accurate and reliable methods of drop contour evaluation using statistical error analysis. Every stage of upgrade from SCA 20 to SCA 23 enables a new level of analysis to be carried out, according to your requirements.

Standards for accurate measurements
For the contact angle measuring instruments, DataPhysics offer three series of optical standards OCAS on glass carriers with standard contours (pendant drop and sessile drop) as well as liquid lamellae. Manufactured using precision methods to meet ISO 9001, these standards will ensure the user achieves accurate results, every time.

3



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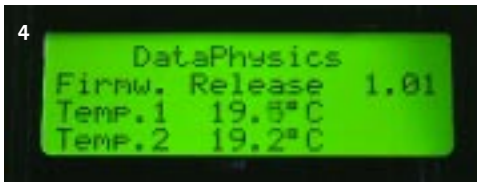

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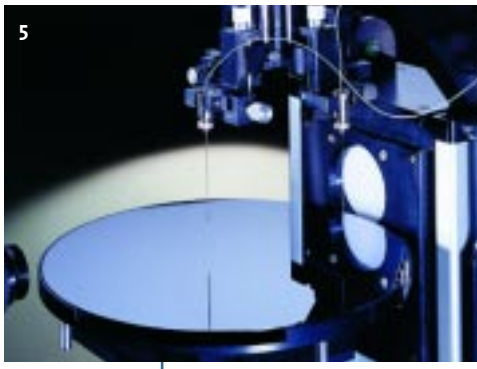

3
SCA 20 and 21 – Contact angle measurement and calculation of the surface free energy of solids
4
Display OCA 10/OCA 20
5
Manual wafer stage WT 200M with multiple dosing unit MD

OCA construction kit

Technical Data OCA 10 and OCA 20

Device	OCA 10/OCA 10L	OCA 20/OCA 20L
Maximum sample size (L x W x H)	• 220 x ∞ x 70 mm, 8"-Wafer on WT 200M • 330 x ∞ x 60 mm, 12"-Wafer on WT 300M with OCA 10L	• 220 x ∞ x 70 mm, 8"-Wafer on WT 200M/E • 330 x ∞ x 60 mm, 12"-Wafer on WT 300M/E with OCA 20L
Size of sample stage (L x W)	• 100 x 100 mm OCA 10 • 160 x 160 mm OCA 10 L	• 100 x 100 mm OCA 20 • 160 x 160 mm OCA 20L
Range of contact angle measuring	• 2 x 0 ... 180° with goniometer • up to ± 0.1° reading accuracy	• 0 ... 180° • ±0.1° measuring accuracy of the video system
Range of surface and interfacial tension		• $1 \cdot 10^{-2}$ ... $2 \cdot 10^{3}$ mN/m • resolution: min. ± 0,05 mN/m
Optics	• high performance six-fold power zoom (0.7 ... 4.5-fold magnification) with an integrated continuous fine focus (± 6 mm) • Goniometer eyepiece with ∅ 3.8 ... 25 mm field of view (FOV)	• high performance six-fold power zoom (0.7 ... 4.5-fold magnification) with an integrated continuous fine focus (± 6 mm) • CCD camera with a resolution of max. 768 x 576 square pixel • field of view (FOV): 1.75 x 1.4 ... 11.7 x 9 mm • optical distortion: < 0,05 %
Video system		• high performance image processing system with 132 Mbytes/s data transfer rate (compliant to European standard CCIR and US standard RS-170) • up to 50 frames/s digitizing rate
Measuring methods	• Sessile & Captive Drop method • Tilting Plate method	• Sessile & Captive Drop method • Tilting Plate method • Pendant Drop method • Optical Wilhelmy Plate and Rod-/Thread method (for the measuring of polymer melts and threads for composite materials, available 3rd quarter of 1998)
Software	• **SCA 10:** Calculation of the surface free energy of solids and their components out of the measured contact angles with up to four different test liquids, analysis according to the methods of Fowkes (geometric mean), Wu (harmonic mean), Extended Fowkes (incl. hydrogen bond parts), Zisman (critical surface tension), Owens-Wendt (dispersion & polar force contributions), van Oss & Good (acid-base theory), Schultz I + II (two liquids method), Neumann's equation of state (EOS)	• **SCA 20:** Video based measurement of static and dynamic contact angles according to the Sessile & Captive Drop method, the Tilting Plate method as well as detection of the contour of drops and lamella, controlling of up to four electronic syringe units and two other optional system components (WTx00E/TBA60E) • **SCA 21:** Calculation of the surface free energy of solids and their components out of the measured contact angles with an unlimited number of different test liquids, analysis according to the methods of Fowkes (geometric mean), Wu (harmonic mean), Extended Fowkes (incl. hydrogen bond parts), Zisman (critical surface tension), Owens-Wendt (dispersion & polar force contributions), van Oss & Good (acid-base theory), Schultz I + II (two liquids method), Neumann's equation of state (EOS) • **SCA 22:** Calculation of the surface and interfacial tension out of the shape of pendant drops • **SCA 23:** Calculation of the surface tension of liquids and of the contact angle of solids out of the shape of contact lamella on plates, rods and threads (available 3rd quarter of 1998)
Temperature measuring and -range	• integrated temperature measurement with digital display • 2x Pt100-input for -60° ... 450° C (Pt100 optional), 0.1 K resolution; accuracy: 1/3 DIN IEC 751 (± 0,03 %), class B	• integrated temperature measurement with digital display • 2x Pt100-input for -60° ... 450° C (Pt100 optional), 0.1 K resolution; accuracy: 1/3 DIN IEC 751 (± 0,03 %), class B
Size of device (L x W x H)	• 590 x 220 x 550 mm OCA 10 • 700 x 280 x 550 mm OCA 10 L	• 590 x 220 x 550 mm OCA 20 • 700 x 280 x 550 mm OCA 20 L
Weight	• 18 kg OCA 10 • 20 kg OCA 10 L	• 18 kg OCA 20 • 20 kg OCA 20 L
Power supply	• 100 ... 240 VAC; 50 ... 60 Hz; 55 VA	• 100 ... 240 VAC; 50 ... 60 Hz; 55 VA

The devices are tested and found to be in compliance with the requirements defined in the EMC standards defined by 89/336/EEC as well as Low Voltage Directive (LVD) 73/23/EEC can be identified by the CE label on the side of the unit.

The Construction Kit Philosophy

The modular nature of the OCA range of instruments enables you to build exactly the instrument required for your application. From the OCA construction kit you can start with a basic instrument and add on extension modules, software, system components and other peripherals to suit your budget and application.

For more information about a tailor made solution to your surface chemistry requirements, please contact us and we can provide a quotation, obligation free, for an instrument system.

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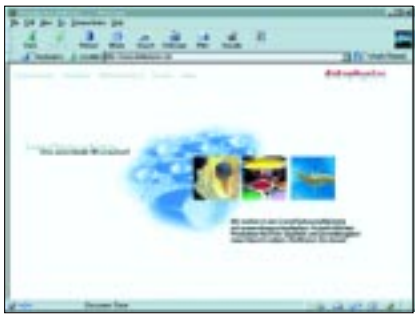

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