

ACA 50

Fully automatic, video-based contact angle measuring instrument

What you can measure with the ACA 50

The fully automatic contact angle measuring system ACA 50 is the optical instrument with the highest degree of automatic comfort for the measurement of wetting properties. The extensive control software is designed for ease of use, coupled with fast access to all control elements.

The ACA 50 provides the following functions:

- measurement of static and dynamic contact angles with max. six different test liquids,
- measurement of surface and interfacial tensions,
- automatic needle selection and positioning,
- determination of absorption properties on absorptive papers and non-wovens,
- easy repetition of measurements,
- automatic calculation of surface free energies on solids and liquids as well as their contributions without user intervention.

The automatic sequence of measurements and the optical image processing facilitate fast and highly reproducible measurements on both simple and complex sample structures at "the push of a button".

In addition, the ACA can be expanded with robots from the DataPhysics RCC series for the fully automatic loading and unloading of samples.

Components and accessories

- high performance lens with software controlled motorized 7x zoom, focus, aperture, and tilt,
- video measuring system with high-resolution CCD camera and high-performance digitizing adapter (for max. 1280 x 1024 pixels),
- AM-D electronic multiple dosing system with max. six dosing needles and ES-A electronic syringe units (optional),
- software controlled motorized x-y-z measuring stage,
- electronic tilting base unit (TBA 60E), wafer tables with up to 12" (300 mm), and temperature control systems (optional),
- refill and rinse system with liquid pump cleaner RRS-LPC 3/1 (optional).

Windows software

The 32-bit software developed for Windows NT / 2000 / XP is available in various configurations for the following functions:

- controlling of the sample position along the x, y, and z axis, of the selection and positioning of needles, of the optics, of the illumination, of the electronic syringe units, of the tilting and wafer tables, and of the electric temperature control systems from -20 °C to 400 °C,

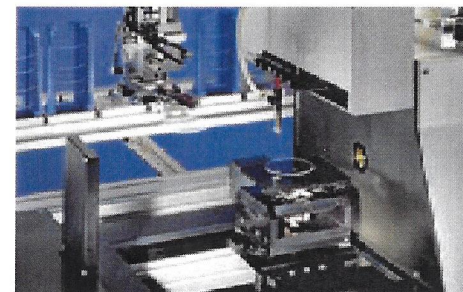
- generation, management, and execution of measuring procedures,

- measurement of static and dynamic contact angles on flat, convex, and concave surfaces,

- determination of surface and interfacial tensions based on pendant and sessile drop contours and on the interaction between liquid lamellae and test spheres or rods,

- calculation of surface free energies on solids and their contributions with specified error limits,

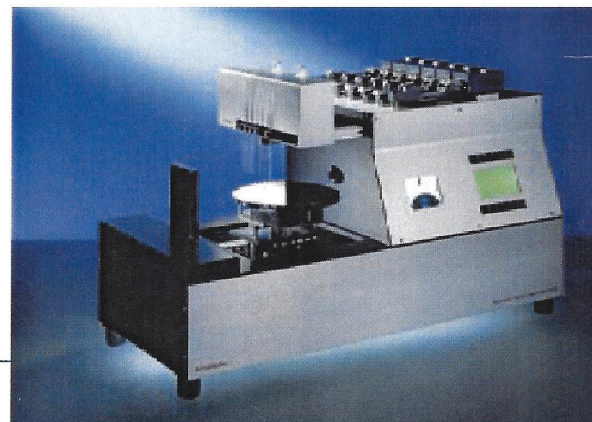
- generation of wetting envelope



ACA 50 with the RCC robot system automatically loading coated glass wafers for measuring

standard deviation, consistency checks within the specified limits, histograms, etc.

- access and management to a liquids and solids database with currently over 170 records for all surface energy analysis methods plus references to further reading.



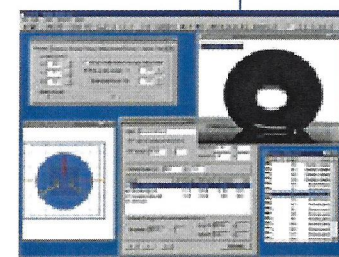
ACA 50 with A-MD electronic dosing system and WT 200E wafer table

diagrams and work of adhesion / contact angle diagrams derived from surface free energies,

- calculation of dispersive and polar contributions of liquids based on measured surface and interfacial tensions and on contact angles with error limits,

- conversion of recorded video sequences to AVI and MPEG formats,

- statistical evaluations and error analysis (SPC) with averaging,



Software SCA 50 - dialog for test parameters

ACA 50 with wafer table and six electronic syringe units

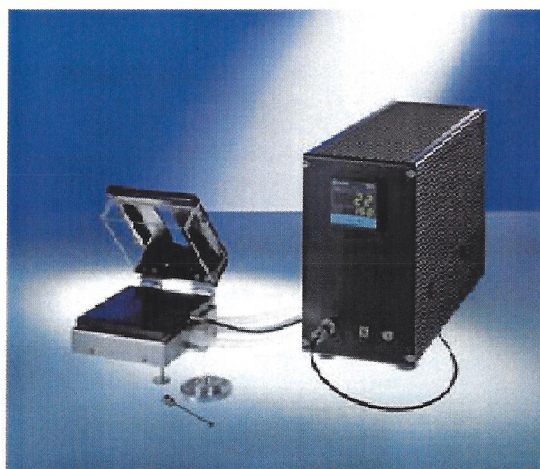
Accessories for OCA and ACA

A construction kit for diverse combinations

The contact angle measuring instruments from the OCA and ACA series share a common feature – the combined OCA/ACA accessories construction kit. This extensive range of accessories consists of various dosing systems, temperature control systems, wafer and tilting tables, and tilting base units.

Advanced dosing technology

The most important accessories include electronic syringe units and multiple dosing units.



TPC 150 Peltier temperature control unit

The instruments from the OCA standard series work with up to four dosing systems, and the special variants up to six. From the OCA series of contact angle measuring instruments, the OCA 20 and higher can also operate the

ODG 20 oscillating drop generator. Accordingly, liquid drops can be driven to controlled oscillations in a frequency range from 0.01 to 20 Hz.

In the basic version, the ACA 50 can take up to six optional dosing syringes to dispense predefined quantities of liquid through a multiple dosing system. The smallest volume of liquid to be dispensed with the E-MD and A-MD multiple dosing units ranges from 30 to 50 nL, depending on the liquid and the diameter of the dosing needle.

The easy automatic measurement of the contact angle hysteresis

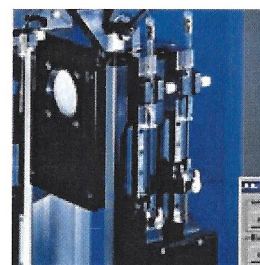
(ARCA) works both with the software SCA 20 and the SCA 50.

Temperature control – to become hot or cold

The user can choose from a wide range of temperature control systems that operate in conjunction with the OCA and ACA systems for the most diverse applications at temperatures from -20 °C to 1700 °C.

The following temperature control systems for the OCA 20 and higher can be controlled by software:

- TPC 150 (temperature control chamber with electric Peltier system for -20 to 150 °C),
- TEC 400 (temperature con-



ES electronic syringe units



SCA 20 software for defining ARCA

trol chamber with twin electric resistance heater for ambient to 400 °C),

- NHD 400 (electrically heated needle and dosing system for polymers and hot melts up to 400 °C),
- high temperature furnace HTFQ 1200 and other customer specific systems (up to 1700 °C), can also be controlled with the OCA 15LHTplus.

can be used in combination with the optional Pt 100 temperature sensors.

Rolling drops

For the measurement of rolling angles on inclined surfaces DataPhysics provides manual or electronic tilting assemblies and tilting base units. The tilting base assemblies TBA 60M (manual) and TBA 60E (electronic) can be used with the contact angle measuring instruments of the

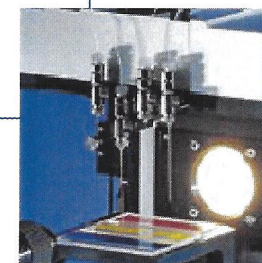
In addition to the software interface, the temperature control systems can be operated manually as well.

The following temperature control units are also suitable for use with the ACA 50:

- TFC 100 thermal liquid temperature control unit from -10 to 110 °C with installed Pt 100 temperature sensors,
- TPC 150 (Peltier system) and TEC 400 (electric heating system with optional counter flow gas cooling).

All OCA (from OCA 15 plus with TDU 450) and ACA systems are equipped with two independent temperature measuring channels for the range of -60 to 450 °C that

OCA and ACA series. The tilting base unit TBU 90E was designed for use with the OCA series (from OCA 20). The TBA 60E and the TBU 90E can be fully controlled by software.



E-MD electronic multiple dosing unit



TBA 60E electric tilting base assembly

Technical data

	OCA 30/OCA 30L/OCAH 230/OCAH 230L	OCA 20/OCAH 200/OCA 15 plus/OCAH 150 plus and L-variants	OCA 10/OCA 5	ACA 50
Max. sample dimensions (L x W x H):	• 220 x ∞ x 70 mm, max. 8" wafer on WT 200M/E with OCA 30/OCAH 230 • 330 x ∞ x 60 mm, max. 12" wafer on WT 300M/E with OCA 30L/OCAH 230L	• 220 x ∞ x 70 mm, max. 8" wafer on WT 200M/E with OCA 20/15+/OCAH 200/150+ • 330 x ∞ x 60 mm, max. 12" wafer on WT 300M/E with OCA 20L/OCA 15L+/OCAH 200L	• 220 x ∞ x 70 mm, 8" wafer on WT 200M with OCA 10/OCA 5 • 330 x ∞ x 60 mm, 12" wafer on WT 300M with OCA 10L	• 320 x ∞ x 70 mm, max. 12" wafer on WT 300M/E with auxiliary lens • active measuring surface: 150 x 150 mm, with swivel diameter 300 mm
Sample table dimensions:	• 100 x 100 mm OCA 30/OCAH 230 • 160 x 160 mm OCA 30L/OCAH 230L	• 100 x 100 mm OCA 20/15+/OCAH 200/150+ • 160 x 160 mm OCA 20L/15L+/OCAH 200L	• 100 x 100 mm OCA 10/OCA5 • 160 x 160 mm OCA 10L	• 100 x 100 mm
Traversing range of x-y-z sample table:	• 100 x 100 x 50 mm OCA 30/OCAH 230 • 220 x 155 x 50 mm OCA 30L/OCAH 230L	• 100 x 100 x 42 mm OCA 20/15+/OCAH 200/150+ • 220 x 155 x 42 mm OCA 20L/15L+/OCAH 200L	• 100 x 100 x 42 mm OCA 10/OCA5	• 150 x 150 x 40 mm
Measuring range for contact angles:	• 0...180°; ± 0.1° measuring precision of video system			• 0...180°; ± 0.1° measuring precision of video system
Measuring range for surface and interfacial tensions:	• 1·10 ⁻² ...2·10 ³ mN/m resolution: min. ± 0.05 mN/m			• 1·10 ⁻² ...2·10 ³ mN/m resolution: min. ± 0.05 mN/m
Electronic positioning accuracy:	• ± 0.01 mm in the sample plane • ± 0.005 mm perpendicular to the sample plane	—	—	• ± 0.01 mm in the sample plane • ± 0.005 mm perpendicular to the sample plane
Max. sample weight:	3.0 kg	3.0 kg 15.0 kg (clamped)	—	3.0 kg
Optics:	• 6-fold zoom lens (0.7 - 4.5 magnification) with integrated continuous fine focus (± 6 mm) • CCD camera with a resolution of max. 1600 x 1240 pixels (768 x 576 pixels standard) • FOV 1.75 x 1.4–11.7 x 9 mm, image distortion < 0.05%	• 6-fold zoom lens (0.7 - 4.5 magnification) with integrated continuous fine focus (± 6 mm) • goniometer eyepiece with 3.8–25 mm diameter FOV	—	• high performance lens with software controlled motorized 7 fold with zoom (0.7–5.25 magnification), focus (±5 mm), aperture, and tilt (± 5°), • CCD camera with a resolution of max. 1600 x 1240 pixels (768 x 576 pixels standard), • FOV 1.2 x 0.9–8.5 x 6.4 mm, image distortion < 0.05%
Video system:	• high-performance image processing system with 132 MB/s data transfer rate (compatible with Euronorm CCIR and US standard RS-170), 50 (optionally 60) images per second with OCA 20/15+ • variable digitizing rate with max. 360 images per second for OCAH 200 / 150+ / 230 (2000/4000 images per second with OCAH 2000 / 2030 planned)	—	—	• high-performance image processing system with 132 MB/s data transfer rate (compatible with Euronorm CCIR and US standard RS-170), • variable digitizing rate 50 (optionally 60) images per second
Measuring techniques:	• Sessile and captive drop method, tilting table/base method • pendant and oscillating drop method, lamella method on test spheres and rods	• Sessile and captive drop Method • Tilting table method	—	• Sessile and captive drop method, tilting table method • pendant and oscillating drop method, lamella method on test spheres and rods
Software:	• SCA 20 : video measurement of static and dynamic contact angles according to the sessile and captive drop as well as tilting table / base methods, measurement of drop and lamella contours, manipulation of max. 4 (6) ES electric dosing modules and other system components (E-MD/4(6), WT x00E/TBA 60E/TBU 90E, LDU) and of temperature control systems (TPC 150, TEC 400, NHD 400, HTFC 1200, HTFC 1500) • SCA 21 : calculation of surface free energies on solids and their contributions with error limits based on measured contact angles with any number of test liquids, evaluation according to Fowkes (geometric mean), Wu (harmonic mean), extended Fowkes (including H bonds), Zisman (critical surface tension), Owens-Wendt (dispersive and polar), van Oss and Good (acid-base theory), Schultz I + II (two-liquid method), Neumann's Equation of State (EOS), calculation of dispersive and polar contributions of liquids based on measured surface and interfacial tensions as well as contact angles with error limits, calculation of wetting envelopes and other diagrams • SCA 22 : calculation of surface and interfacial tensions based on pendant drop contours and rising bubbles • SCA 23 : calculation of surface tensions of liquids based on liquid lamellae on test spheres and rods • SCA 26 : calculation of complex interfacial dilatational moduli based on oscillating drop contours (with OCA 30 / 230 / 20 / 200 / 2000 and oscillating drop generator ODG 20 only)	• SCA 10 : calculation of surface free energies on solids and their contributions with error limits based on measured contact angles with any number of test liquids, evaluation according to Fowkes (geometric mean), Wu (harmonic mean), extended Fowkes (including H bonds), Zisman (critical surface tension), Owens-Wendt (dispersive and polar), van Oss and Good (acid-base theory), Schultz I + II (two-liquid method), Neumann's Equation of State (EOS), calculation of dispersive and polar contributions of liquids based on measured surface and interfacial tensions as well as contact angles with error limits, calculation of wetting envelopes and other diagrams	• SCA 50 : video measurement of static and dynamic contact angles according to the sessile and captive drop as well as tilting table / base methods, measurement of drop and lamella contours, manipulation of max. 6 ES-A electric dosing modules and other system components (WT x00E / TBA 60E / LDU) and of temperature control systems (TFC 100, TPC 150, TEC 400) • SCA 51 : calculation of surface free energies on solids and their contributions with error limits based on measured contact angles with any number of test liquids, evaluation according to Fowkes (geometric mean), Wu (harmonic mean), extended Fowkes (including H bonds), Zisman (critical surface tension), Owens-Wendt (dispersive and polar), van Oss and Good (acid-base theory), Schultz I + II (two-liquid method), Neumann's Equation of State (EOS), calculation of dispersive and polar contributions of liquids based on measured surface and interfacial tensions as well as contact angles with error limits, calculation of wetting envelopes and other diagrams • SCA 52 : calculation of surface and interfacial tensions based on pendant drop contours and rising bubbles • SCA 53 : calculation of surface tensions of liquids based on liquid lamellae on test spheres and rods	
Temperature measurement and range:	• integrated temperature measurement and digital display 2 x Pt 100 inputs for -60 – 450 °C For OCA 15+/150+ as option	Pt 100 (as option), 0.1 K resolution, precision 1/3 DIN IEC 751 (±0.03%), Class B For OCA 5 as option	—	—
Dimensions (L x W x H):	• OCA 30 / OCAH 230 / OCA 10 / OCA 5 OCA 20 / OCA 200 / OCA 15+ / OCAH 150+ • OCA 30L / OCAH 230L / OCA 10L OCA 20L/OCAH 200L/OCA 15L+ 700 x 280 x 550 mm	590 x 220 x 550 mm	• OCA 5 / 10 590 x 220 x 550 mm • OCA 10L 700 x 280 x 550 mm	• 830 x 330 x 450 mm
Weight:	• OCA 30 / OCAH 230 / OCA 20 / OCA 200L • OCA 30L / OCAH 230L • OCA 20 / OCAH 200 / OCA 15L+ • OCA 15+ / OCAH 150+ 20 kg 21 kg 18 kg 16 kg	20 kg 21 kg 18 kg 16 kg	• OCA 5 16 kg • OCA 10 18 kg • OCA 10L 21 kg	• 35 kg
Power supply:	• 100...240Vac; 50...60Hz; 80 W	• 100...240Vac; 50...60Hz; 55 W	• 100...240Vac; 50...60Hz; 55 W	• 100...240Vac; 50...60Hz; 100 W