KRÜSS
Advancing your Surface Science



PRODUCT OVERVIEW

20/19

DROP SHAPE
TENSIOMETERS
FOAM ANALYSIS
SURFACE ROUGHNESS

EDITORIAL



Thank you very much for reading our product overview. I am optimistic that you will find solutions that support you in your research and QC.

Learn about ADVANCE, our innovative software platform covering all our methods for contact angle, surface and interfacial tension as well as foam analysis. Have a look at our versatile instruments with their large portfolio of accessories. Get acquainted with our new Surface Roughness Analyzer – SRA, which completes the picture of the surface of solid materials.

Over and above that, we are proud to introduce our new Bubble Pressure Tensiometer – BPT Mobile for fast and reliable quality control of cleaning and coating baths. In this diverse range of solutions, precision, ease of use, and durability are what all our products have in common.

Your Technical Consultant at KRÜSS or one of our appreciated distribution partners will be happy to provide you with further information on any instrument or accessory presented here and to find the best solution for your individual task.

Yours sincerely,



Gordon Peters
Head of Global Sales



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METHOD OVERVIEW

Tensiometers



Wilhelmy contact angle

Contact angle using the wetting force of a liquid at a solid sample



Sorption

Contact angle between a liquid and porous material using the capillary force



Liquid density

Density determination of a liquid using the buoyancy of a probe immersed in the sample



Solid density

Density determination of a solid using the buoyancy of the sample immersed in a liquid



Sedimentation

Sedimentation speed of a dispersion



Penetration

Penetration resistance of a sediment against a probe



Bubble pressure

Dynamic surface tension using the Laplace pressure of a gas bubble at a capillary in a liquid



Drop volume

Dynamic surface or interfacial tension using the volume of a drop when it detaches from a capillary



Surface free energy

Surface free energy of a solid using contact angle data



Spinning drop IFT

Interfacial tension using the diameter or curvature of a drop of a light phase inside a heavy phase in a rotating capillary



Ring SFT

Surface tension using the tensile force of a lamella underneath a ring



Ring IFT

Interfacial tension using the tensile force of a lamella underneath or above a ring



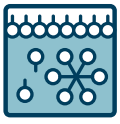
Lamella tear-off SFT

Surface tension using the tensile force of a lamella which is stretched until it disrupts



Lamella tear-off IFT

Interfacial tension using the tensile force of a lamella which is stretched until it disrupts



CMC

Automated determination of the critical micelle concentration by measuring the SFT at different concentrations



Wilhelmy SFT

Surface tension using the wetting force of a liquid at a platinum plate or rod



Wilhelmy IFT

Interfacial tension using the two-phase wetting force at a platinum plate or rod

Drop Shape



Sessile drop

Contact angle of a drop on a solid surface



Roll-off measurement

Roll-off behavior and advancing/receding contact angle of a drop on a tilted surface



Double sessile drop

Contact angles of two drops dosed in parallel



Surface free energy

Surface free energy of a solid using contact angle data



Sessile drop mapping

Automated position-dependent contact angle measurement and evaluation



Pendant drop

Surface or interfacial tension using the curvature of a drop or bubble at the tip of a needle



Sessile drop top view analysis

Contact angle of a drop viewed from the top



Oscillating pendant drop

Interfacial rheological behavior of a pendant drop or a bubble with periodically alternating volume



Captive bubble

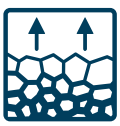
Contact angle using a gas bubble beneath a solid surface in a liquid

Foam



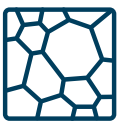
Foam height

Foamability and foam stability using the optically detected height of foam created reproducibly



Foam flash

Foam formation behavior of heavily foaming liquids using stirring cycles



Foam structure

Optically detected foam bubble sizes and their statistical distribution



High pressure foam

Foam height and foam structure simultaneously analyzed under high pressure



Liquid content

Moisture and drainage behavior of foam using its electrical conductivity



Ross-Miles

Foamability and foam stability according to ASTM D 1173

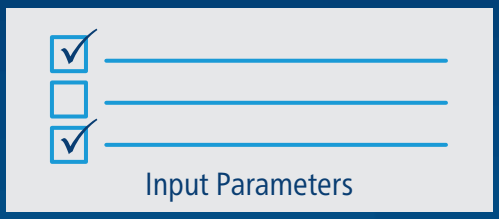
ADVANCE

THE SOFTWARE THAT BRINGS OUR INSTRUMENTS TO LIFE

ADVANCE is our innovative software which maximizes the performance and versatility of our instruments. Users of ADVANCE especially benefit from its outstanding functionality and its new standards in intuitive operability. By clearly organizing the context-relevant functions in tiles and avoiding menus and pop-ups, ADVANCE eliminates unnecessary clicks and time-consuming searches for hidden elements. Easy-to-create automation programs make analyses repeatable and results user-independent. All modules can also be used in the ADVANCE Touch mode with its specially optimized user interface.

THE ADVANCE PRINCIPLE

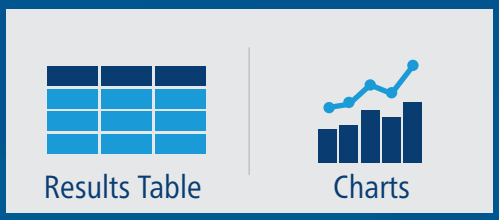
The operating concept of ADVANCE follows a universal workflow from preparation to evaluation on which every scientific measurement is based in principle. The software mirrors this workflow organically, thus making software operation intuitive.



Step 1: Preparing the measurement
The process starts with editing information on the sample as well as setting parameters. Automated procedures make it possible to create measurements for even the most complex tasks in order to carry out analyses without user interference.



Step 2: Performing the measurement
Now the instrument enters the stage. Depending on the degree of automation, ADVANCE takes complete control. During the measurement, displayed raw data and video images, if appropriate, make it easy to monitor the measurement in life view.



Step 3: Reviewing results
The measurement is finished. ADVANCE shows all measuring data in clearly arranged tables and charts. Moreover, the software offers features to re-analyze raw data with new settings to make measurements more flexible and independent from initial decisions.



Step 4: Evaluating and exporting results
Finally, ADVANCE uses scientific models to calculate conclusive results from raw data. With a few clicks, comprehensive reports or export files are created for further processing or archiving. To gain a maximum of information from your results, measurements can be compared at will with just a few clicks.

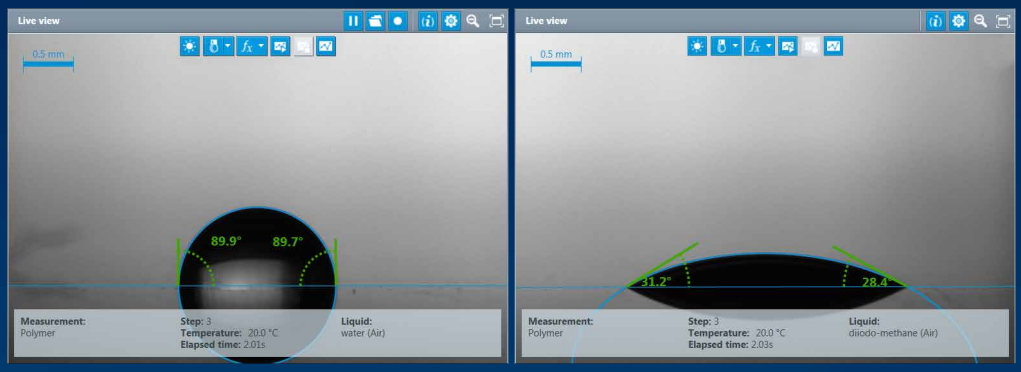
ALWAYS STAY UP TO DATE WITH THE ADVANCE SOFWARE ASSURANCE

We continuously extend the range of functions with new powerful features in at least one and usually two annual releases. With regular upgrades in the framework of the optional ADVANCE Software Assurance you will never miss a new development and always work with the latest version.

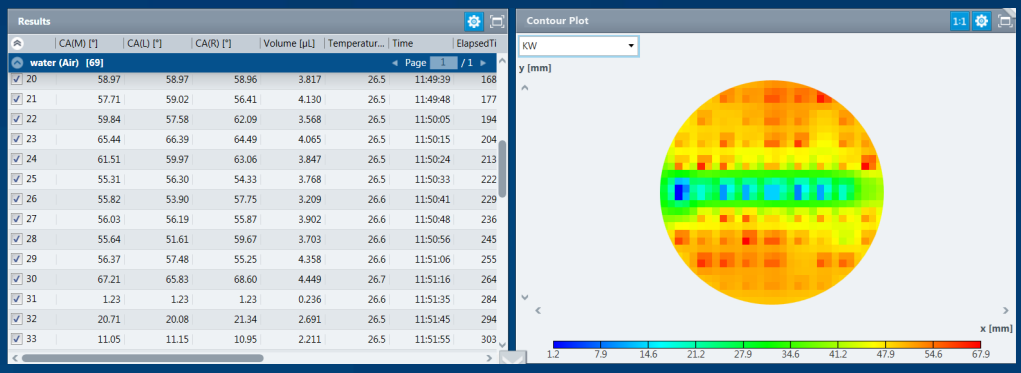
Related products	
Drop shape	DSA100 | DSA30 | DSA30R | DSA25 | MSA | LSA | TVA100
Foam	DFA100 | RMFA | HPFA
Tensiometer	SDT | K100

ADVANCE – AN INSIGHT FOR DIFFERENT INSTRUMENTS

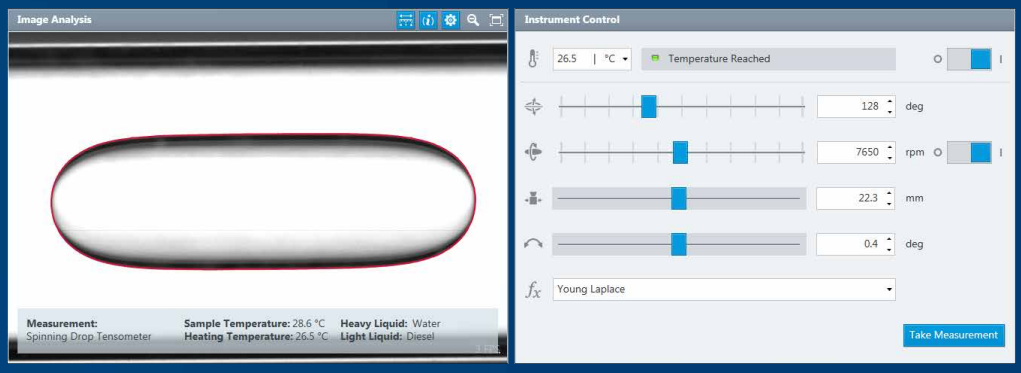
With our Liquid Needle dosing unit, ADVANCE displays and analyzes two dispensed drops in parallel. When controlling a fully automated measurement a surface free energy determination is carried out within a second.



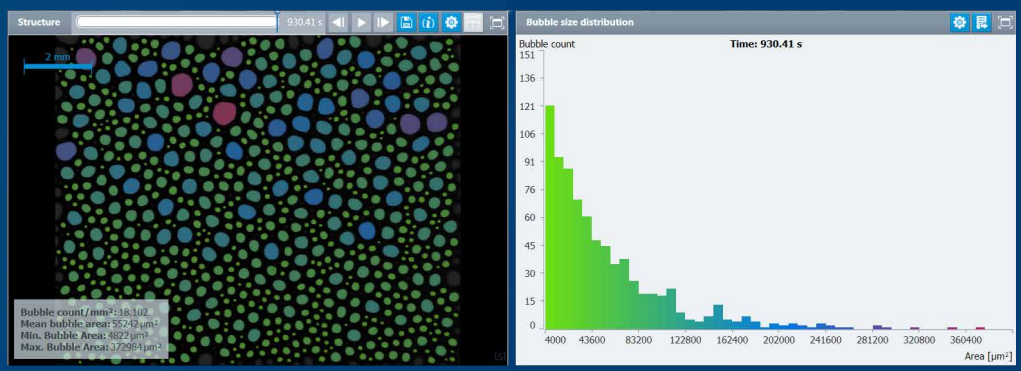
ADVANCE uses automated axes of our Drop Shape Analyzers to provide a position-dependent evaluation (Mapping) of a sample's wettability. The intuively programmed position map results in a contour plot, which clearly displays the effect of a plasma treatment along the diameter.



With our Spinning Drop Tensiometer – SDT, ADVANCE analyzes an image of a drop in a rotating capillary to measure the interfacial tension using the drop's diameter or curvature. The panel to the right gives complete control over the instrument, including a fully automated Drop Positioning feature which keeps the drop in the center of the image on the left.



With our Dynamic Foam Analyzer – DFA100, ADVANCE makes it possible to simultaneously measure the amount of foam, its liquid content, and its bubble structure with respect to time. Here, the foam structure is analyzed in a video and the resulting bubble size distribution is shown in parallel.







DROP SHAPE

MOBILE SURFACE ANALYZER – MSA



Measuring surface free energy in a second with only one click

Our innovative Mobile Surface Analyzer – MSA measures surface free energy with two liquids and fully automatically using our new "One-Click SFE" method. The MSA doses two parallel drops with one click, followed by the direct analysis of the contact angles and the derived results of the surface free energy. All steps are automated and happen within a second. The results enable well-founded statements about wettability by aqueous or organic liquids. The MSA supports you in your quality assurance in the pre-treatment and coating of solid materials in an ideal way.

Tasks and applications

- Measurement on large workpieces and finished products such as automobile parts
- Determination of the wettability of solid materials before coating or bonding
- Quality assurance of cleaning steps as well as pre-treatment and coating processes
- Testing the effectiveness of hydrophobic coatings

Measuring methods and options

- Measurement of contact angle
- Calculation of surface free energy according to Owens-Wendt-Rabel-Kaelble, Wu, Zisman, Fowkes and van Oss & Good



Non-destructive quality control



For vertical, overhead and curved samples



Technical specifications

Camera system	
Connection	USB 3.0
Performance	10 fps at 1000 × 700 px
Illumination	
Type	high power LED, adjustable
Dosing system	
Dosing	double pressure dosing or single direct dosing
Resolution	0.1 µL
Contact angle	
Range	0 to 180°
Resolution	0.01°
Instrument dimensions	
Footprint	106 mm × 59 mm (W × D)
Height	112 mm
Weight (without accessories)	0.85 kg

LARGE SURFACE ANALYZER – LSA



The robotic system for very fast wetting analysis of sizable samples

Fully automatic measurements on many positions of large sample areas: Our Large Surface Analyzer – LSA combines a precise positioning robot with our Mobile Surface Analyzer – MSA for measuring surface free energy within a second. The system is especially suitable for quality control of cleaned, pre-treated or coated large surfaces due to its easy handling and programming as well as high measuring speed for samples from 565 × 495 mm up to 2900 × 3150 mm.

Upon request customized systems in other sizes are possible.

DROP SHAPE ANALYZER – DSA100



Drop Shape Analyzer – DSA100E
(Expert configuration)

The universal, high-quality instrument for analyzing wetting and coating processes

Our Drop Shape Analyzer – DSA100 is our high-quality system solution for almost all tasks in the analysis of wetting and adhesion on solid surfaces. From the basic unit for precise measurement of the contact angle to the fully automatic expert instrument for series measurement of surface free energy (SFE), we have the suitable DSA100 for your special requirements. With our modular product philosophy, we are able to exactly match our instruments and accessories to your needs based on your specific surfaces and processes.

Measuring methods and options

- Contact angle between a liquid and a solid
- Surface free energy from contact angles of several test liquids using all common models
- Static contact angle, advancing angle, and receding angle
- Roll-off behavior on hydrophobic and superhydrophobic surfaces
- Measurement of surface tension and liquid-liquid interfacial tension using the Pendant Drop method
- Temperature-controlled measurements from -30 to 400 °C
- Measurements at controlled humidity
- Interfacial rheological measurements (elasticity and viscosity)
- Measurements on inclined surfaces



Tasks and applications

- Characterization of surface pre-treatment processes
- Investigation of the adhesion and stability of bonding and coating processes
- Investigation of coating substances in accordance with DIN 55660
- Checking the wettability of plastic, glass, ceramic, wood or metal
- Quality control for wafers and microelectronics
- Validating surface cleanliness
- Elasticity of liquid films
- Wetting of microscopically small surfaces



Drop Shape Analyzer – DSA100L
for large samples



Drop Shape Analyzer – DSA100W
for wafers

Technical specifications

Camera system	
Performance	CF03: up to 2000 fps CF06: up to 3400 fps
Illumination	
Type	high power monochromatic LED
Dosing system	
Dosing	up to 8× software-controlled + 1× manual
Double pressure dosing system	
Resolution	0.1 µL

Internal and external tilting	
Range	0 to 90°
Resolution	internal tilting: 0.01° | external tilting: 0.1°
Contact angle	
Range	0 to 180°
Resolution	0.01°
Interfacial and surface tension	
Range	0.01 to 2000 mN/m
Resolution	0.01 mN/m

DROP SHAPE ANALYZER – DSA30



Drop Shape Analyzer – DSA30E
(Expert configuration)

Contact angle measurement in quality control

Our Drop Shape Analyzer – DSA30 is a robust instrument which can be used flexibly for the precise measurement of contact angle and surface free energy (SFE). With high-quality components and various automation options, the DSA30 analyzes wetting and adhesion on solid surfaces. Fast measurements and simple operation make the instrument a valuable part of your routine quality control.

Measuring methods and options

- Contact angle between a liquid and a solid
- Surface free energy from contact angles of several test liquids using all common models
- Static contact angle, advancing angle, and receding angle
- Measurement of surface tension and liquid-liquid interfacial tension using the Pendant Drop method
- Measurements on inclined surfaces
- Temperature-controlled measurements from -30 to 400 °C
- Measurements at controlled humidity
- Interfacial rheological measurements (elasticity and viscosity)

Tasks and applications

- Characterization of surface pre-treatment processes
- Investigation of the adhesion and stability of bonding and coating processes
- Checking the wettability of plastic, glass, ceramic, wood or metal
- Validating surface cleanliness
- Wetting of microscopically small surfaces





Drop Shape Analyzer – DSA30B
(Basic configuration)



Drop Shape Analyzer – DSA30S
(Standard configuration)

Technical specifications

Camera system	
Performance	CF03: up to 2000 fps CF06: up to 3400 fps
Illumination	
Type	high power monochromatic LED
Dosing system	
Dosing	up to 4× software-controlled + 1× manual
Double pressure dosing system	
Resolution	0.1 µL

Internal tilting	
Range	0 to 90°
Resolution	0.01°
Contact angle	
Range	0 to 180°
Resolution	0.01°
Interfacial and surface tension	
Range	0.01 to 2000 mN/m
Resolution	0.01 mN/m

DROP SHAPE ANALYZER – DSA25



Drop Shape Analyzer – DSA25E
(Expert configuration)

The basic instrument for wetting investigations

Our Drop Shape Analyzer – DSA25 is an easy-to-use, reliable instrument for measuring contact angle. From a simple wetting test to the accurate measurement of surface free energy (SFE), the robust instrument provides flexible options for analyzing wetting and adhesion on solid surfaces. Its rapid, manual operation makes our DSA25 outstandingly suitable for occasional wetting measurements with changing tasks and sample types.

Measuring methods and options

- Contact angle between a liquid and a solid
- Surface free energy from contact angles of several test liquids using all common models
- Static contact angle, advancing angle, and receding angle
- Measurement of surface tension and liquid-liquid interfacial tension using the Pendant Drop method
- Temperature-controlled measurements from -30 to 400 °C
- Measurements at controlled humidity
- Measurements on inclined surfaces



Tasks and applications

- Characterization of surface pre-treatment processes
- Checking the wettability of plastic, glass, ceramic, wood or metal
- Validating surface cleanliness



Drop Shape Analyzer – DSA25B
(Basic configuration)



Drop Shape Analyzer – DSA25S
(Standard configuration)

Technical specifications

Camera system	
Performance	CF03: up to 2000 fps CF06: up to 3400 fps
Illumination	
Type	high power monochromatic LED
Dosing system	
Dosing	manual or software-controlled
Double pressure dosing system	
Resolution	0.1 µL

External tilting	
Range	0 to 90°
Resolution	0.01°
Contact angle	
Range	0 to 180°
Resolution	0.01°
Interfacial and surface tension	
Range	0.01 to 2000 mN/m
Resolution	0.01 mN/m

TILTING TABLES

EXTERNAL TILTING TABLES



DSA100 with External Tilting Table PA3220



DSA25 with External Tilting Table PA4020

The tilting device is our special unit for the flexible analysis of inclined surfaces. Measuring the resulting drop deformation and the tilt which leads to the drop running off enables conclusions to be drawn relating to roughness and adhesion. The roll-off angle is informative for ultrahydrophobic samples and is accurately measured with slow tilt movements.

As the whole instrument is tilted, the surface is always in the same position relative to the lens. This makes the video evaluation very easy and changes in the drop can also be tracked visually. Almost all other measuring methods and options provided by your instrument can be used without changing the setup.

- Angle of inclination up to 90° with a resolution of 0.1° for DSA100 and 0.01° for DSA25
- Accuracy of 1.0° for DSA100 and 0.5° for DSA25
- Tilt speed from 0.1°/s to 4.5°/s
- Video recording starts automatically when tilting begins

	DSA100	DSA25
Model name	PA3220	PA4020

INTERNAL TILTING TABLE



DSA30 with Internal Tilting Table PA4240

We have developed the internal tilting table for software-controlled wetting analyses on inclined surfaces with high dosing flexibility. With this tilting solution the dosing unit remains vertical, thus enabling drops to be deposited or dropped onto the already inclined surface in a defined way. This is a common method for measuring the roll-off angle. Furthermore, the system also reliably analyzes drop deformation.

The low weight enables angular resolution, precision and possible tilt speed to be maximized. The internal table is also ideal when little space is available for the frame of an external tilting device.

- Angle of inclination up to 90° with a resolution of 0.01°
- Accuracy of 0.3° ± 0.1°
- Tilt speed from 0.5°/s to 50°/s
- Video recording starts automatically when tilting begins
- Optional tilting table support ST13 can be fitted for finely adjusting the dosing position

	DSA100	DSA30
Model name	PA3240	PA4240

MEASUREMENT MODULES

MICRO-DROP ANALYSIS



DSA100 with Micro-Drop Analysis Module



DSA30 with Micro-Drop Analysis Module

The modules for drop volumes down to 20 pL or down to 60 pL equip your DSA100 and DSA30 for precisely analyzing the wetting of tiny samples. The conversion option enables you to switch the measuring mode from conventional drop dosing to micro-drop analysis without the need for a second instrument frame.

The high-quality microscope lens and the particularly powerful special lighting ensure a clear, sharp image of the drop. The different dosing units of the two modules produce drops from 20 pL and 60 pL respectively, which are placed with pinpoint accuracy with the help of a micro-positioning unit. A micro-sample table supplied with each unit enables the sample to be finely positioned with great accuracy. Both modules also include practical accessories for cleaning and liquid degassing.

Drops	DSA100	DSA30
≥ 20 pL	CK3232	CK4232
≥ 60 pL	CK3234	CK4234

Alternatively, we have put the necessary accessories for micro-drop analyses together in the instrument configuration DSA100M and DSA30M.

INTERFACIAL RHEOLOGY



DSA30 with Oscillating Drop Module

The Oscillating Drop Module for the DSA100 and DSA30 is used for analyzing drops to measure interfacial rheological properties of liquids. In doing so, the change in the surface or interfacial tension is measured as a drop specifically changes in size. The magnitude of the change is mathematically divided into an elastic and viscous component (elasticity and viscosity modulus). The results provide information on the mechanical and time-dependent stability of foams, films, and emulsions.

During the measurement, a pendant drop is produced, the size of which is changed periodically with accurately controlled amplitude and frequency. The piezo unit of the module produces an exactly sinusoidal oscillation which guarantees a reliable evaluation. The camera of the instrument then records a video of the oscillating drop with very high image quality. This video is automatically evaluated, frame by frame, to precisely calculate the elasticity and viscosity modulus.

The module includes the following components:

- Piezo unit for dosing drops and specifically changing their size with associated electronics board
- Software for calculating interfacial rheological parameters from the raw data

The module is already included in the instrument configuration DSA30R, which we have specially put together for interfacial rheology.

DOSING UNITS

MANUAL DOSING UNIT FOR ONE LIQUID



DSA30 with manual dosing unit for one liquid

With the dosing unit, drops of a single liquid can be manually dosed in a simple way. The slowly advancing forward feed with a micrometer screw ensures that dosing is carried out gently and the shape of the drop is not mechanically affected. The high-quality glass syringe SY20 is suitable for almost all substances and also enables low-viscosity liquids to be dosed in a controlled manner. Tubeless direct dosing and the option of using disposable syringes make the dosing unit suitable for hazardous substances and contaminating liquids.

	DSA100	DSA30	DSA25
Model name	DS3205	DS3205	DO3205

SOFTWARE-CONTROLLED DOSING UNIT FOR ONE LIQUID

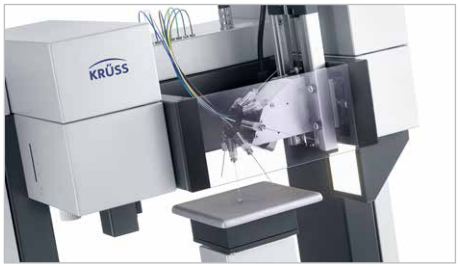


DSA100 with software-controlled dosing unit for one liquid

The software-controlled dosing unit produces drops with accurately reproducible volume for measuring contact angle and surface tension. The uniform dosing feed can be set to a very slow speed in order to accurately measure the advancing angle and the receding angle. Tubeless direct dosing and the option of using disposable syringes make the dosing unit suitable for hazardous substances and contaminating liquids.

	DSA100	DSA30	DSA25
Model name	DS3210	DS4210	DO4011

SOFTWARE-CONTROLLED MULTI-DOSING UNITS



DSA100 with software-controlled multi-dosing unit

Our multi-dosing units equip the DSA100 for the fully automatic dosing of 2 to 8 liquids and the DSA30 of 2 to 4 liquids. The motorized lift automatically actuates the dosing height or places the drop carefully on the sample. The software organizes even highly complex dosing and measuring sequences and, when combined with motorized axes, enables solids to be analyzed fully automatically. For example, the surface free energy of a solid can be determined based on contact angles with several liquids in a single measuring sequence.

The uniform dosing feed has a large dynamic range (10 to 1400 µL/min with a volume resolution of 0.1 µL). It can be set to a very slow speed in order to accurately measure the advancing angle and the receding angle. On the other hand, service functions such as filling a syringe are carried out very quickly.

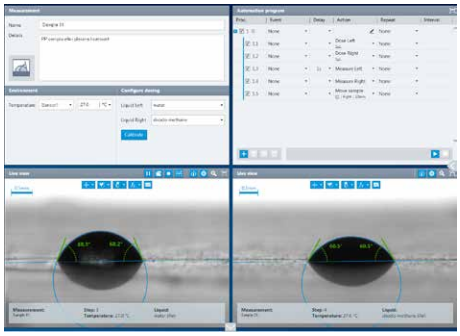
An additional manual syringe can be used for other substances, for example for measuring surface tension or analyzing contaminating liquids.

Number of Liquids	DSA100	DSA30
2	DS3222	DS4222
3	DS3223	
4	DS3224	DS4224
5	DS3225	
6	DS3226	
7	DS3227	
8	DS3228	

LIQUID NEEDLE DOSING UNIT FOR FAST AND AUTOMATIC SFE MEASUREMENTS



Double-dosing unit for extremely fast SFE measurements



Software screenshot of the parallel drop evaluation

Our double-dosing module performs fully automated surface free energy (SFE) determinations, using our Liquid Needle technology. The dosing unit has two pressure dosing mechanisms working in parallel, each simultaneously dispensing one drop of the test liquids water and diiodomethane onto the sample.

For carrying out the drop shape analysis, the image field of the high resolution camera is split into two video windows for viewing both drops at the same time in order to analyze the drops in parallel. The software then uses the resulting contact angles to calculate the SFE of the solid. The entire process, from the point when dosing starts up to the SFE calculation, is fully automatic and complete within a second. For this innovative measuring method, we hold a patent regarding the novel dosing technology.

The kinetic energy of the dosing process – despite its speed – is equivalent to gently dispensing a drop from a dosing needle. Most importantly, this noncontact method eliminates the risk of contamination or damage caused by inadvertently touching the sample. Cartridges that operators can remove quickly and fill directly with test liquids make the dosing system easy to handle. One filling is enough for approximately 1000 SFE determinations.

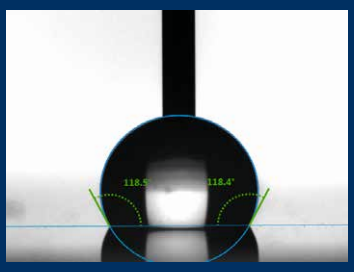
The double dosing unit requires our CF03 USB camera.

	DSA100	DSA30	DSA25
Model name	DS3252	DS3252	DO3252

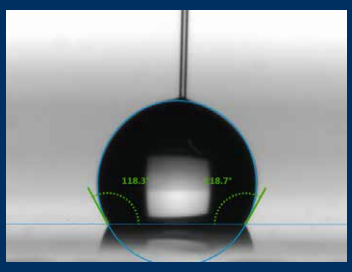
LIQUID NEEDLE

Revolutionary dosing technology for optical contact angle measurement developed by KRÜSS

The Liquid Needle is an extremely thin jet of liquid which is created through a dosing nozzle using pressure. The dynamics are just sufficient to form a continuous stream of liquid while dosing, but small enough to avoid influencing the contact angle.



Dosing with solid needle



Dosing with Liquid Needle

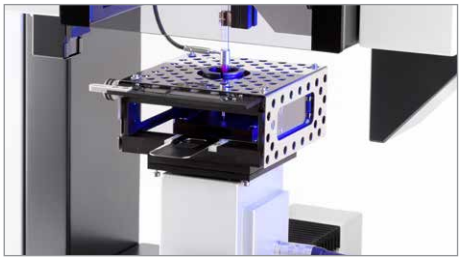
Dosing can be carried out much faster (< 0.1 s) with the Liquid Needle compared to a solid needle. Due to standardized dosing conditions, the dynamics and thus the reliability of the method are independent from decisions of the user. Furthermore, dosing drops on very hydrophobic samples is easier because the drop does not have to detach from another medium (the needle).

The validity of the Liquid Needle method compared to the classic solid needle was proven in a thorough scientific study in which contact angles were measured on a broad range of samples, giving the same contact angle results for both dosing methods.

Find out more: **kruss-scientific.com/liquidneedle**

TEMPERATURE CONTROL EQUIPMENT

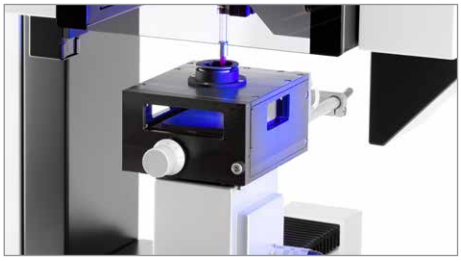
TC11 – TEMPERATURE CONTROLLED CHAMBER FOR LARGE SAMPLES



- **For sample sizes up to 132 × 132 × 27 mm (W × D × H)**
- **Temperature range between -10 and 130 °C (suitable thermostats are available)**
- **Precision temperature sensor included**
- **Inert gas connector provided**

The temperature controlled chamber TC11 has been specially developed for measuring the contact angle on large samples at temperatures up to 130 °C. The slide-in sample tray is conveniently loaded outside the chamber and can be moved from the outside when the chamber is closed and at the required temperature. Small samples are prevented from shifting by means of removable holding clamps. The front viewing window simplifies dosing in the required sample position.

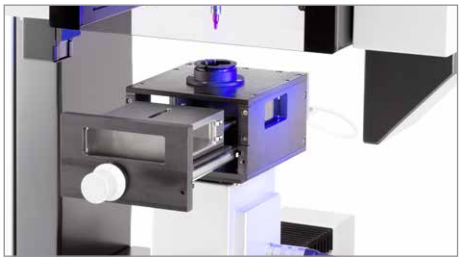
TC30 – TEMPERATURE CONTROLLED CHAMBER UP TO 90 °C



- **Temperature range between 5 and 90 °C (suitable thermostats are available)**
- **Precision temperature sensor included**
- **Inert gas connector provided**
- **Can be ideally combined with the humidity chamber HC10**

The wettability of solid samples can be reliably analyzed at temperatures up to 90 °C with the help of the temperature controlled chamber TC30. The well-sealed and insulated plastic housing and a copper heat-conducting hood ensure stable thermodynamic equilibrium. Gas purging of the viewing windows is effective against condensation. The dosing position can be conveniently adjusted from the outside when the chamber is closed and at the required temperature.

TC40 – TEMPERATURE CONTROLLED CHAMBER FOR RAPID CHANGES



- **Fast electrical temperature control between -30 and 160 °C**
- **Precision temperature sensor included**
- **Inert gas connector provided**
- **Can be combined with the humidity chamber HC10 between 5 and 90 °C**

With rapid temperature changes between -30 and 160 °C, the temperature control chamber TC40 is our flexible solution for wettability analyses under different thermal conditions. The insulating plastic housing and a heat-conducting copper hood ensure a uniform, stable internal temperature. A gas flow can be connected in order to avoid condensation and icing of the viewing windows. The dosing position can be conveniently adjusted from the outside when the chamber is closed and at the required temperature.

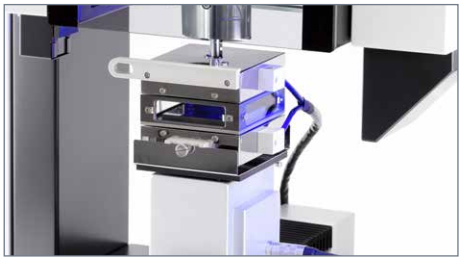
TC3213 – TEMPERATURE CONTROLLED UNIT FOR LIQUIDS



- **Temperature range -10 to 130 °C (suitable thermostats are available)**
- **Precision temperature sensor included**
- **Also suitable in combination with temperature controlled chambers TC11, TC30 and TC40**

The unit TC3213 brings liquids for measuring contact angle or surface tension to the required temperature of up to 130 °C. Embedded in a heat-conducting metal sleeve, the filled syringe (additionally available) quickly reaches the desired temperature. With the help of a sensor, the temperature is measured directly at the syringe and assigned to the measurement in the software. The unit is easy to fit and ideally complements your software-controlled or manual single dosing unit.

TC21 – TEMPERATURE CONTROLLED CHAMBER FOR HIGH TEMPERATURES



- **Electrically controlled temperature between 50 and 400 °C**
- **Precision temperature sensor included**
- **Ideal in combination with the high-temperature dosing unit DS3241/DS4241**

The temperature controlled chamber TC21 enables liquid and solid surfaces to be analyzed at temperatures up to 400 °C. The target temperature is easy to specify and is reliably achieved at defined heating rates. The chamber's excellent insulation ensures stable equilibrium during the measurement. With the help of the accurate temperature sensor, the current value is recorded by the software together with the contact angle or the surface tension.

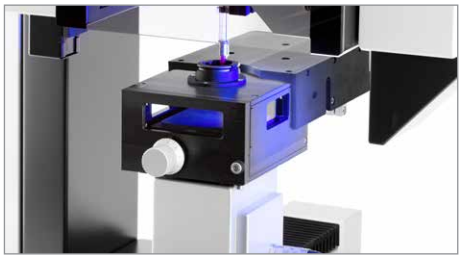
DS3241/DS4241 – HIGH-TEMPERATURE DOSING UNITS



- **Large temperature range of 50 to 400 °C**
- **For polymers, hotmelts or any other melts**
- **Exchangeable melting chamber for easy cleaning**

We have designed the dosing units DS3241 for DSA100 and DS4241 for DSA30 specially for analyzing the wetting and surface tension of melts at temperatures between 50 and 400 °C. The melting cylinder is conveniently filled in the cold state and then heated rapidly in a controlled way. Dosing is carried out precisely with the help of a micrometer screw, thus easily producing a drop of the desired size. The DS3241 or DS4241 are ideal when used in combination with the temperature controlled chamber TC21 for temperature control of samples to measure the contact angle.

HC10 – HUMIDITY CHAMBER



- **Relative humidity (without insulating hood): 15 to 85% at 22 °C, up to 89% at 10 to 15 °C, up to 5% at 70 to 90 °C**
- **Time to achieve target value: 20 to 300 s**
- **External compressed air supply required (3 to 6 bar, very dry air), a suitable compressor is available**
- **Temperature range between 5 and 90 °C (suitable thermostats are available)**

The wettability of a surface is affected by the climatic ambient conditions. Using the humidity chamber HC10 in combination with the temperature control chamber TC30 or TC40 enables you to measure contact angles at precisely controlled humidity and temperature. At temperatures above 50 °C and humidities above 65%, we recommend using the insulating hood TC3200. Inserted into the temperature controlled chamber, this enables the target humidity to be reached even more quickly and maintained with increased stability.

The temperature equipment is available for:	DSA25	DSA30	DSA100
TC11	■	■	■
TC30	■	■	■
TC40	■	■	■
TC3213	■	■	■
TC21	■	■	■
DS3241	-	-	■
DS4241	-	■	-
HC10	■	■	■

TOP VIEW ANALYZER – TVA100



Instrument for measurements in depressions and on concave surfaces

Our Top View Analyzer – TVA100 is the only instrument in the world to use the top-view reflection method for measuring the contact angle of a liquid on a solid from above. The innovative measuring method is particularly suitable for measurements in depressions and on concave surfaces where drops cannot be analyzed using the conventional side view.

Measuring methods and options

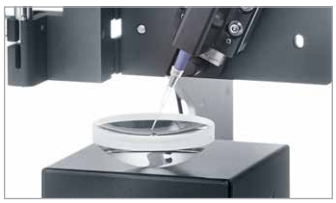
- Measuring the contact angle using our Top View Distance method
- Special contact angle method for measuring in recesses
- Surface free energy from contact angles of several test liquids using all common models
- Especially good resolution in the range of small contact angles
- Available as stand-alone instrument or as a measuring head module for DSA100, DSA30 or DSA25
- Easy measurements in patterns such as well plates

Tasks and applications

- Measurements in depressions of well plates
- Measurement between electronic components on populated boards
- Measurement on concave optical lenses
- Surface investigations for the interior of tubes and hoses



Precision dosing unit



Measuring on a concave surface

Technical specifications

Camera system	
Connection	USB 3.0
Performance	CF03: up to 2000 fps
Optics	
Zoom	6.5× zoom, manual
Illumination	
Type	LED, adjustable

Dosing system	
Dosing	electronic pipette for precise drop generation
Resolution	0.2 µL
Minimum drop volume	0.5 µL
Capacity	10 µL
Contact angle	
Range	3.5° to 75 °
Resolution	±0.1° (for contact angles from 3.5° to 23°) ±1° (for contact angles from 23° to 75°)

DROP SHAPE ANALYZER – DSA30R



Analyses in interfacial rheology – time-saving and reproducible

Emulsions and foams are constantly in motion during production or transport. The interfaces of droplets or bubbles are stretched during these processes. How such deformations impact on the stability of food and bodycare products or influence the yield in tertiary crude oil production depends on how the surface tension or interfacial tension (SFT/IFT) responds to the stretching. Interfacial rheology measurements with the Drop Shape Analyzer – DSA30R provide the key to answering this question.

Measuring methods and options

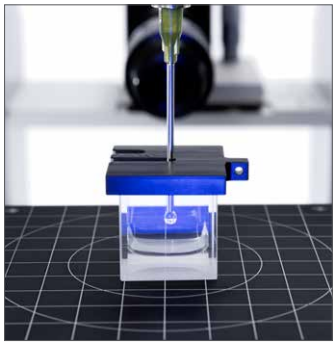
- Measurement of interfacial rheological parameters such as the elastic modulus E′ and viscous modulus E′′
- Analysis of oscillating pendant or rising drops in a gaseous and liquid surrounding phase
- Measurements on oscillating rising gas bubbles
- Static surface and interfacial tension
- Measurement at temperatures ranging from -10 to 70 °C

Tasks and applications

- Emulsions and foams for food or body care
- Flooding mixtures and foam in enhanced oil recovery
- Demulsifiers
- Defoamers and antifoamers
- Surfactant research



Oscillating Drop Module – ODM of the DSA30R



Analysis of oscillating pendant drop in a solvent-saturated atmosphere

Technical specifications

Camera system	
Performance	CF03: up to 3000 fps CF06: up to 3400 fps
Illumination	
Type	High power monochromatic LED
Dosing system	
Dosing	Software-controlled
Maximum volume variation	2.5 µL
Viscosity range	max. 5000 mPas with NE45, max. 10 mPas with NE44
Frequency	0.001 to 20 Hz

Interfacial and surface tension	
Range	0.01 to 2000 mN/m
Resolution	0.01 mN/m
Oscillating drop	
Results	E, E′, E″, phase shift
Programmable waveform	sine
Model	Lucassen

DROP SHAPE ANALYZER – DSA100HP



Wetting and surface tension under extreme pressures and temperatures

Our DSA100HP is our high-quality solution for the precise measurement of contact angle as well as surface and interfacial tension under high pressures and temperatures, primarily for tertiary oil recovery. The DSA100HP combines our Drop Shape Analyzer – DSA100 for optical drop shape analysis with a measuring cell for high-pressure applications up to 1750 bar. It determines the surface tension and analyzes the wetting of oil-bearing rock by surfactant solutions under the extreme pressure and temperature conditions found in reservoirs. The results help in the extraction of oil from layers of rock in the most effective manner using tertiary oil recovery (EOR) methods such as steam or surfactant flooding and thereby increase the yield. The instrument also reliably measures the wettability of gases which liquidize under pressure, for example for the optimization of extraction processes with carbon dioxide.

Measuring methods and options

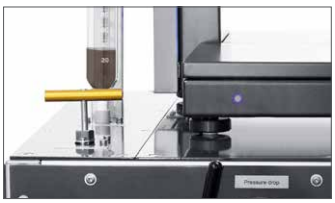
- Contact angle measurement using a sessile drop
- Surface tension of a liquid in gas or interfacial tension between two liquids using a pendant drop
- Upside-down pendant drop measurement of an oil drop in water
- Measurements at pressures up to 1750 bar and temperatures between -10 and 250 °C

Tasks and applications

- Surface tension of flooding solutions and their interfacial tension with oil under reservoir conditions
- Wettability and extraction of oil from oil-bearing rock
- Pressure extraction by means of liquified gases, e.g. carbon dioxide
- Development of surfactants for liquid gases



Sample positioning with closed pressure chamber



Either a gas or a liquid can be added as surrounding phase

Technical specifications

Camera system	
Connection	USB 3.0
Performance	CF03: up to 2000 fps CF06: up to 3400 fps
Optics	
Zoom	7× zoom, manual
Pressure control	
Maximum pressure	40 to 1750 bar (580 to 25000 psi)
Temperature control	
Range	up to 250 °C

Material	
Type	stainless steel, Hastelloy, or Inconel
Contact angle	
Range	0 to 180°
Resolution	0.01°
Interfacial and surface tension	
Range	0.01 to 1000 mN/m
Resolution	0.01 mN/m

DROP SHAPE ANALYZER – DSA HIGH TEMPERATURE



Get deep insights into the thermal behavior of materials

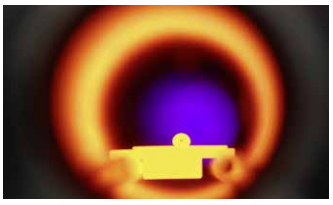
Our Drop Shape Analyzer – DSA High Temperature goes to the extreme when it comes to wetting and deformation analysis of melts and combustion residues. With temperatures up to 2000 °C in a various range of atmospheric conditions, the instrument analyzes melting solids and helps to understand the interactions that occur when melts come into contact with solid material. This knowledge supports you in optimizing combustion, firing, or coating processes in order to create stable end products, save energy during the process or prolong the service life of your furnaces.

Measuring methods and options

- Contactless wetting analysis using contact angle measurement at temperatures up to 2000 °C
- Observing and recording material deformation as a function of temperature and time
- Measurement in oxidizing or reducing atmosphere, under inert gas, or in vacuum

Examples of applications

- **Smelting plants:** The liquid metal or slag should not adhere to walls they come in contact with. Contact angle measurements with the DSA High Temperature reveal the degree of wetting.
- **Glass production:** Reactions between the glass and refractory bricks lead to material fatigue. The change in the contact angle over time indicates the extent to which such reactions are taking place.
- **Enamels:** Optimal wetting of enamel coatings to the carrier material during processing is essential. A small contact angle is a prerequisite for a formulation with good wetting properties.
- **Ceramics:** The behavior of the green body – the gradual changes of shape from a cone or cylinder to a flattened drop – can be observed and recorded as a function of temperature and time.



DSA High Temperature chamber



DSA High Temperature with open chamber

Technical specifications

Camera system	
Connection	ethernet
Illumination	
Type	Halogen, telecentric
Temperature control	
Heating elements	SiC, MoSi, Graphite
Measuring system	Al_2O_3, Graphite
Range	up to 2000 °C

Temperature measurement	
Accuracy	± 2.5 °C
Vacuum control	
Final value	down to 10^{-5} mbar
Contact angle	
Range	0 to 180°
Resolution	0.01°





TENSIOMETERS

FORCE TENSIOMETER – K100



The universal instrument for analyzing surfactants and solid surfaces

Our universal Force Tensiometer – K100 performs high-precision, automatic and reliable measurements of surface tension and interfacial tension, critical micelle concentration (CMC) and contact angle on solids, fibers, and powders. With high-quality components and a uniquely wide range of methods, the instrument carries out many tasks in the fields of surfactant analysis and wetting measurement for your quality assurance or research.

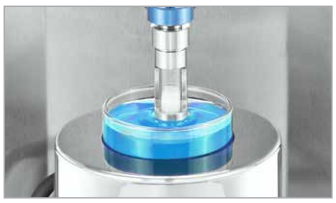
Measuring methods and options

- Surface tension and interfacial tension using the ring, plate, and rod method
- Surface tension and interfacial tension using the ring tear-off method, for example for measurements in accordance with ASTM D-971
- Critical micelle concentration (CMC) of surfactants
- Contact angle and surface free energy of solids, powders or fiber bundles
- Density of liquids and solids
- Sedimentation behavior of dispersions
- Penetration resistance of sediments
- Measurement from -15 to 300 °C, temperature measurement with internal or external sensor

Tasks and applications

- Determination of the effectiveness and efficiency of surfactants by CMC measurement
- Wetting behavior of tablets, pharmaceutical active ingredients, and excipients
- Wetting of varnishes and paints
- Decomposition product content in oils
- Tank clearance and cleaning validation in the foodstuffs industry
- Wetting and adhesion of coatings
- Development of cosmetic products
- Wetting properties of inks
- Wetting of fiber bundles and textiles
- Sedimentation and ductility of dispersions
- Checking of surface modifications





Sorption measurement with K100



Single fiber measurement with K100SF

Technical specifications

Force measurement	
Maximum load	210 g
Resolution	10 µg
Measurement rate	50 Hz
Locking mechanism	automatic

Sample stage	
Travel distance	>110 mm
Travel speed	0.1 to 500 mm/min

Temperature	control	measurement
Range	-15 to 300 °C	-60 to 450 °C

Interfacial and surface tension	
Range	1 to 2000 mN/m
Resolution	up to 0.001 mN/m

Contact angle	Washburn	Wilhelmy plate
Range	0 to 90°	0 to 180°
Resolution	0.01°	0.01°

Density	liquid	solid
Range	1 to 2200 kg/m³	1000 to 20000 kg/m³
Resolution	1 kg/m³	1 kg/m³

TEMPERATURE CONTROL AND CMC

TJ50 – PELTIER TEMPERATURE CONTROL UNIT



- **Quickly attains the target temperature between -15 to 130 °C and keeps it stable**
- **Measurement of temperature dependence as well as analysis under standard conditions**

In a range between -15 to 130 °C, our Peltier temperature control unit approaches the desired measuring temperature quickly and precisely. Next to measurements at high or low temperatures, the unit is especially suitable for analyses at accurately defined thermal standard conditions, which are hard to achieve with a simple liquid thermostat. Excellent insulation and an integrated stirrer provide for thermal stability and homogeneity.

TJ60 – HIGH TEMPERATURE CONTROL UNIT FOR UP TO 300 °C



- **Reliable analysis of samples such as polymer melts or bitumen**
- **Heats up fast to the desired temperature**
- **Disposable aluminum sample vessels avoid laborious cleaning**

With the high temperature solution for our K100, precise surface tension and dynamic contact angle data of hot liquids such as polymer melts or bitumen are easily accessible. The unit quickly heats up the sample to reach and keep a stable target temperature. Disposable sample vessels made of the good heat conductor aluminum solve the issue of persistent contaminations. Moreover, inert gas can be connected to prevent oxidation.

DS0810/DS0820 – MICRO DISPENSERS FOR CMC MEASUREMENTS



- **Fully automated measurement of the CMC of surfactants**
- **Greatly extended concentration range when using two dispenser units**

Our specially developed Micro Dispensers equip the K100 for measuring the critical micelle concentration (CMC) with the utmost precision, using one or two dispenser units (DS0810 or DS0820). The surfactant concentration range is set up and measured fully automatically.

Working with two Micro Dispensers, where one dispenses the liquid and the other extracts the same volume, has great advantages. This enables a very wide concentration range with a high density of measuring points to be created in order to measure the CMC with high accuracy. Wrong measurements due to a too highly concentrated base solution are virtually ruled out, as it can be diluted by several orders of magnitude and the CMC measured with high probability.

FORCE TENSIOMETER – K20



The flexible tensiometer for basic quality assurance

Our Force Tensiometer – K20 is a robust, semi-automatic instrument for the precise measurement of surface tension and interfacial tension. Using the ring and plate method as the main tensiometric methods, it produces reliable measurements for the routine quality assurance of your surfactant solutions and interfacial processes.

Tasks and applications

- Determination of the effectiveness of wetting media
- Checking the surfactant content in solutions below the critical micelle concentration (CMC)
- Tank clearance and cleaning validation in the foodstuffs industry
- Measurement of interfacial tension for the quality assurance and optimization of emulsifiers
- Decomposition product content in oils according to ASTM D-971

Measuring methods and options

- Surface tension using the ring and plate method
- Interfacial tension using the ring and plate method
- Surface tension and interfacial tension using the ring tear-off method
- Evaluating insulating liquids in accordance with ASTM D-971 and IEC FDIS 62961
- Measuring the density of liquids
- Measurement from -10 to 90 °C, temperature measurement with internal sensor



Technical specifications

Force measurement		
Maximum load	50 g	
Resolution	100 µg	
Measurement rate	5 Hz	
Sample stage		
Travel distance	90 mm	
Travel speed	2.4 to 14 mm/min	
Temperature	**control**	**measurement**
Range	-10 to 90 °C	-20 to 150 °C
Interfacial and surface tension		
Range	1 to 999 mN/m	
Resolution	up to 0.1 mN/m	
Liquid density		
Range	1 to 2200 kg/m³	
Resolution	1 kg/m³	

FORCE TENSIOMETER – K6



The manual tensiometer for clear and reliable basic measurements

Our Force Tensiometer – K6 is a robust and reliable manual instrument for measuring surface tension and interfacial tension using the ring method. As a quality product from our precision mechanical workshop, it produces fast, easy and accurate measurements for surfactant solutions and solvents.

As well as simple investigations of liquid and liquid-liquid interfaces, our K6 is also suitable for training purposes in schools and universities for demonstrating the action of the surface tension force in a comprehensible manner.

BUBBLE PRESSURE TENSIOMETER – BP100



Analysis of surfactant solutions for dynamic processes

Our Bubble Pressure Tensiometer – BP100 measures dynamic surface tension with high accuracy. It reliably analyzes the mobility of surfactants, thus enabling high-speed processes such as spraying, coating, printing, and cleaning to be optimized.

Tasks and applications

- Surfactant development
- Optimization of spray processes
- Development of washing and cleaning processes
- Optimization of painting and printing processes
- Checking the surfactant content in galvanic and cleaning baths

Measuring methods and options

- Measurement of surface tension as a function of surface age
- Long-term measurement of surface tension at constant surface age
- Determination of adsorption coefficient and diffusion coefficient
- Calculation of the surface tension of the solvent and the equilibrium surface tension (extrapolation in accordance with Hua & Rosen)
- Temperature control from -10 to 130 °C, temperature measurement with internal sensor

Technical specifications

Pressure measurement		
Maximum pressure	3000 Pa	
Measurement rate	20 kHz	
Sample stage		
Travel distance	>110 mm	
Travel speed	0.1 to 500 mm/min	
Temperature	**control**	**measurement**
Range	-10 to 130 °C	-10 to 130 °C
Surface tension		
Surface tension range	15 to 100 mN/m	
Resolution	0.01 mN/m	
Surface age range	5 to 200,000 ms	

DROP VOLUME TENSIOMETER – DVT50



Analysis of emulsions under dynamic conditions

Surfactants as emulsifiers reduce the interfacial tension between liquids which otherwise do not easily mix. As this takes a certain time, the effect of an emulsifier depends on the mixing dynamics. With our Drop Volume Tensiometer – DVT50, you can measure the speed with which emulsifiers act at the interface. The wide speed range of the analysis enables the dynamic mixing behavior as well as the stability of an emulsion to be determined. The analyses help you to precisely optimize and dose emulsifiers and can also be used to evalute insulating liquids in accordance with IEC FDIS 62961.

BUBBLE PRESSURE TENSIOMETER – BPT Mobile



Mobile quality control for cleaning and coating baths

Industrial quality assurance is about reliability, speed, and ease of use. When it comes to regular checks of the cleaner or wetting agent content in a bath, our Bubble Pressure Tensiometer – BPT Mobile is prepared for these demands.

Immerse – click – read out: Capture the surfactant content of your bath within seconds using surface tension with our BPT Mobile. The quality inspector using it knows immediately if the bath is okay thanks to an ad-hoc evaluation. Moreover, for proactive adjustment of the bath, the BPT Mobile shows how the surfactant content decreases over time due to removed parts, for example. With the intuitive touch display, working with the BPT Mobile is almost like doing quality tests with a smartphone.

Measuring methods and options

- Bubble Pressure method: SFT is measured using the internal pressure of a bubble at an immersed capillary
- Monitoring at a single surface age with evaluation based on predefined limits
- Determination of surfactant concentration based on SFT
- Continuous measurement of SFT while changing the concentration
- Determination of the SFT dependent on surface age between 10 and 30,000 ms
- Temperature measurement and documentation

Tasks and applications

Checking the content of cleaner or wetting agent in a bath is an important QC task in many industrial processes:

- Cleaning as a preparation step before coating or bonding
- Electroplating
- Coating of solar cells
- Etching, e.g. for circuit boards



The touch display responds without any problems when using gloves



Works independently from immersion depth

Technical specifications

Pressure measurement	
Maximum pressure	1.25 kPa
Temperature measurement	
Range	0 to 100 °C
Surface tension	
Surface tension range	15 to 100 mN/m
Resolution	0.1 mN/m
Surface age range	10 to 30,0000 ms

Touch display	
Integrated color IPS display	480 × 854 px, size 5“
Power supply	
Battery	10 h operating time
Dimensions	
Size	85 mm × 55 mm (W × D)
Height	220 mm
Weight (without accessories)	600 g

SPINNING DROP TENSIOMETER – SDT



Measurement of interfacial tension in an extremely wide range with especially simple sample exchange

Our Spinning Drop Tensiometer – SDT measures interfacial tension with a high degree of accuracy and a particularly wide measuring range. The SDT is the ideal solution for the quality control and development of emulsions and surfactants thanks to its enormous bandwidth, small sample volumes and simple handling during preparation. Exact capture of extremely low interfacial tensions also makes the SDT an instrument particularly well-suited for analyzing the interfacial behavior of mini- and micro-emulsions, for example for tertiary oil recovery or the pharmaceutical industry.

Measuring methods and options

- Measurement of interfacial tension in a wide range starting from 10^{-6} mN/m
- Analysis using the drop diameter according to Vonnegut
- Analysis using the drop shape curvature according to Young-Laplace
- Long-term measurement for analyzing surfactant dynamics
- Temperature-dependent analyses

Tasks and applications

- Development of emulsions
- Enhanced oil recovery (EOR)
- Bioavailability of drugs
- Surfactant research
- Adsorption properties at phase boundaries



Patent pending capillary concept

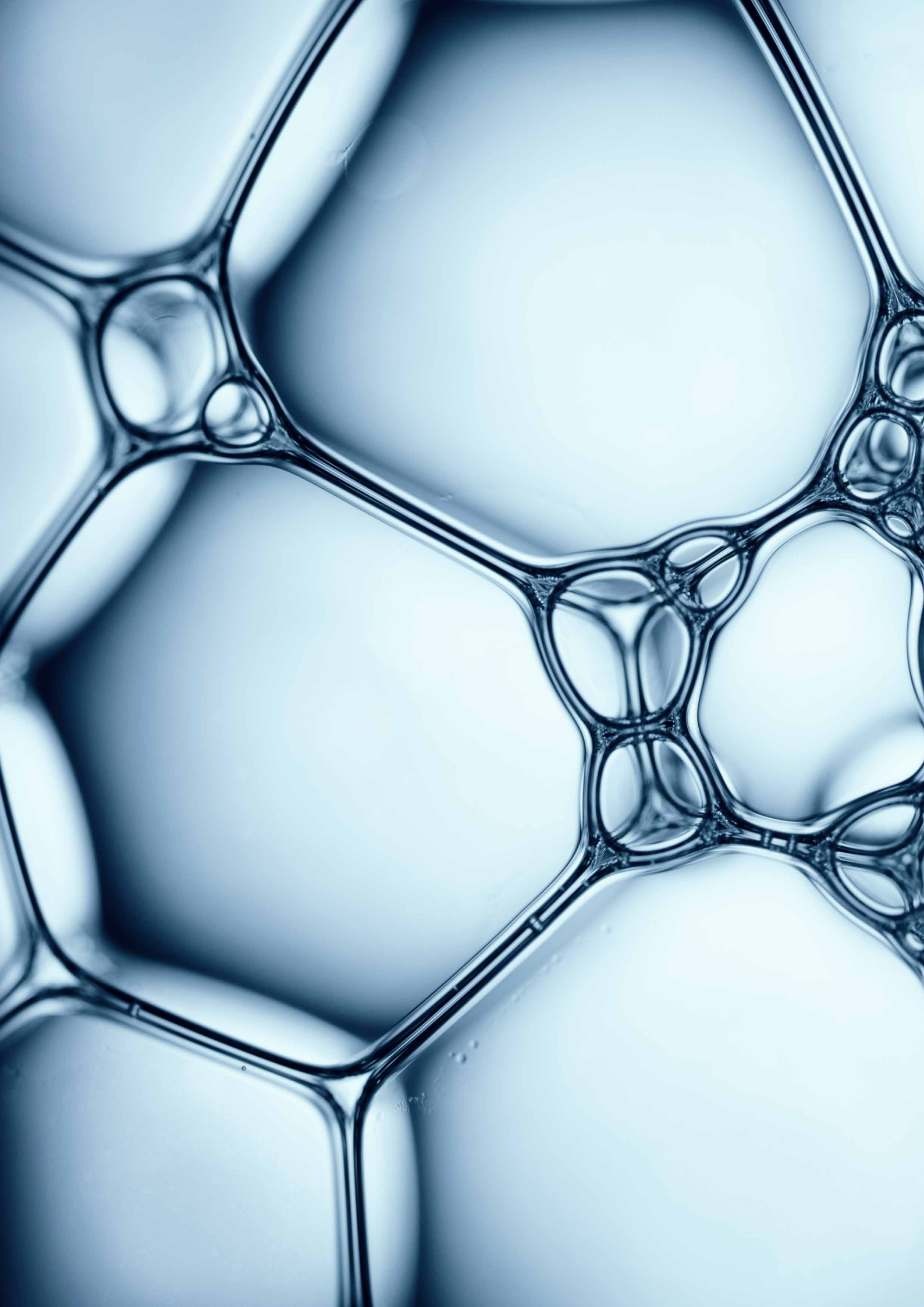


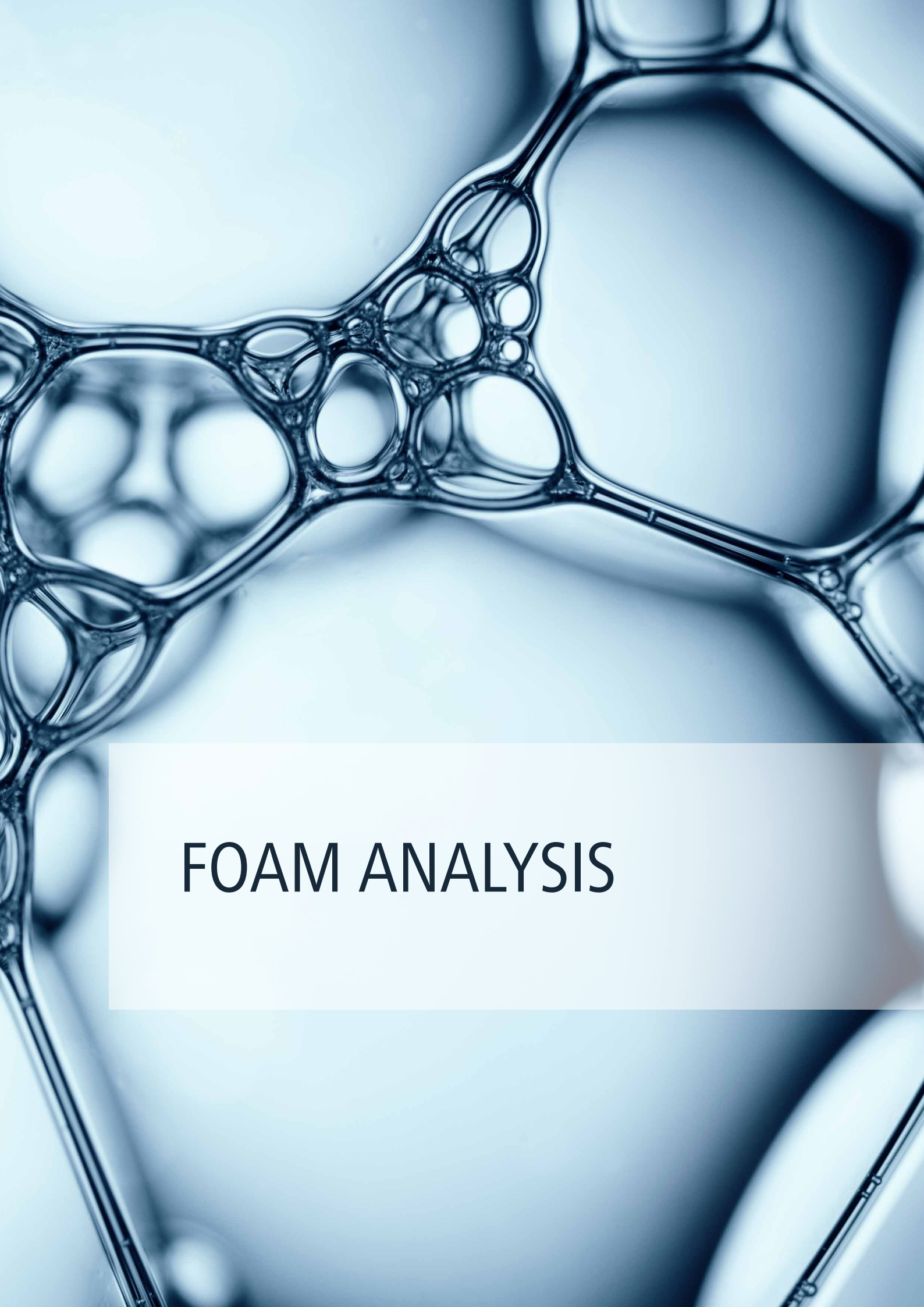
Clearly arranged display

Technical specifications

Camera system	
Performance	15 fps
Illumination	
Type	high power monochromatic LED and stroboscope
Sample stage	
Tilting	±20°
Capillary drive	
Resolution	0.1 rpm

Temperature	**control**	**measurement**
Range	-10 to 120 °C	-10 to 180 °C
Interfacial tension		
Range	10^{-6} to 2000 mN/m	
Resolution	10^{-6} mN/m	





FOAM ANALYSIS

DYNAMIC FOAM ANALYZER – DFA100



Scientific analysis of liquid foams

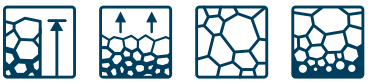
Our DFA100 instrument for analyzing foams measures the foamability of liquids and the foam stability based on precise measurements of the foam height. With optional modules, it also measures the liquid content of the foam or analyzes the foam structure with regard to bubble size and distribution. The DFA100 assists you in the optimization of foam-forming products or, in the case of unwanted foam formation, helps with specific foam prevention.

Measuring methods and options

- Measurement of foamability of liquids and foam decay
- Determination of total height, foam height, and liquid height
- Foaming by means of sparging or stirring
- Investigations of externally produced foams
- Foamability parameters, including maximum height, foam capacity, and foam density
- Temperature-controlled measurements at up to 90°C
- Foaming with externally connected gases

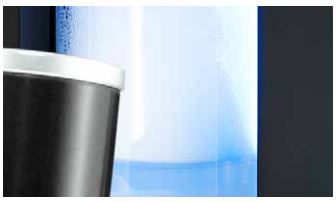
Tasks and applications

- Foams for washing and cleaning
- Firefighting
- Foams in foodstuffs and body care products
- Surfactant development
- Flotation as a method for separating solids
- Foam-inhibiting and foam-reducing agents (antifoamers/defoamers)
- Foam prevention for paints and varnishes, process and waste water, and cooling lubricants





Ergonomic sample holder


Detection of liquid-foam-boundary

Technical specifications

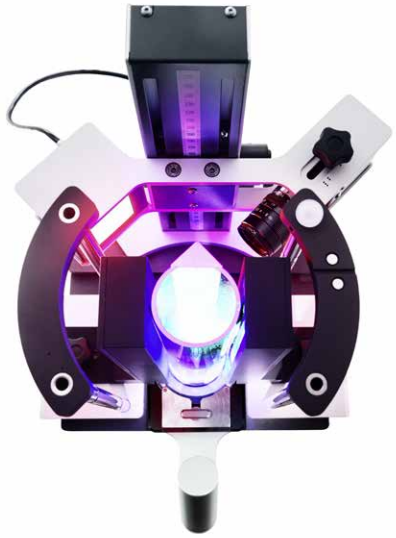
Line sensor	
Sensor resolution	1728 × 1 px
Height resolution	200 dpi | 0.125 mm
Temporal resolution	20 fps
Scanning length	216 mm

Operating system	
Gas flow rate (internal)	0.2 to 1.0 L/min
Gas flow rate (external)	0.05 to 1.0 L/min
Approved gases	air, nitrogen, carbon dioxide
Approved pressure	5 ± 0.5 bar
Stirring speed	up to 8000 rpm
Approved temperature	4 to 90 °C

Illumination	
Type	LED
Wave length, dominant	469 nm (IR: 850 nm)

Analyzed foam characteristic	foamability and foam stability
Results	■ foam height ■ liquid height ■ total height ■ foam capacity ■ maximum foam density ■ expansion rate ■ foam half life time ■ drainage half life time ■ sample temperature

DFA100 WITH FOAM STRUCTURE MODULE – FSM



Time-dependent analysis of bubble size in liquid foams

The Foam Structure Module – FSM of our Dynamic Foam Analyzer – DFA100 reliably analyzes the size distribution of bubbles of liquid foam and the variation of this distribution with respect to time. The measuring method helps you to quantify and specifically optimize the consistency of a foam based on precise and intelligent video image analysis.

Tasks and applications

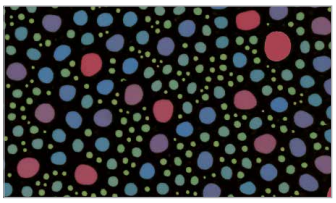
- Foams for washing and cleaning
- Foams in foodstuffs and body care products
- Surfactant development
- Flotation as a method for separating solids

Measuring methods and options

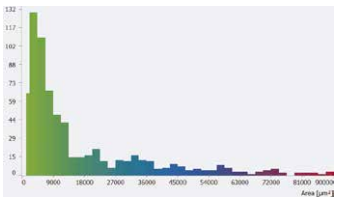
- Live analysis of foam structure in software ADVANCE
- Foam structure analysis at any position of column
- Measurement of bubble size distribution and the change in this distribution in different resolution ranges
- Calculation of mean bubble size and standard deviation
- Output of a histogram for each individual image in the series of measurement

Technical specifications

Illumination	
Type	LED
Wave length, dominant	633 nm
Camera system	
Connection	USB 3.0
Performance	2 fps at 1280 × 1024 px
Diameter of minimum detectable bubble	50 µm
Mean field of view size	position 1: 285 mm² position 2: 140 mm² position 3: 85 mm²
Focus	manual
Analyzed foam characteristic	**foam structure: homogeneity, stability, and aging**
Results	■ mean bubble area ■ bubble count per mm² ■ standard deviation of mean bubble area ■ bubble size distribution ■ bubble count half life ■ Sauter mean radius ■ initial foam structure ■ final foam structure



Foam structure analysis



Bubble size distribution histogram

DFA100 WITH LIQUID CONTENT MODULE – LCM



Analyzing the liquid content of foams

The Liquid Content Module – LCM for our Dynamic Foam Analyzer – DFA100 measures the liquid content of foams and its change with respect to time by evaluating the conductivity of foam. The results provide information on the foam formation and help you to specifically optimize the liquid content and stability of foams.

ROSS MILES FOAM ANALYZER – RMFA



Automatic foam analysis – following the standard and going beyond

Our Ross Miles Foam Analyzer – RMFA is the world's first instrument for automatic measurements of foamability and foam stability in accordance with ASTM D 1173.

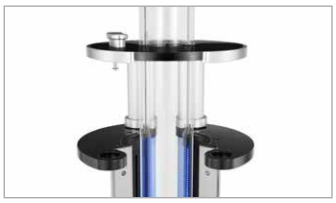
The RMFA uses standardized vessels in a newly-developed measuring set-up for electronic, optical foam height detection. Measuring the initial foam height does not have to be coordinated with the discharge of the reservoir solution anymore, but is registered electronically. Thanks to narrowly observed measuring times as per Ross-Miles of one, three, and five minutes and a height resolution of 0.4 mm, analyses in accordance with ASTM D 1173 achieve precision that was previously unheard of.

Tasks and applications

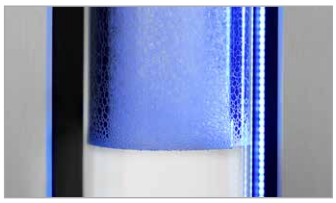
- Foams for washing and cleaning
- Foams in body care products
- Surfactant development
- Foaming beverages

Measuring methods and options

- Automatic foam height measurement in accordance with ASTM D 1173 with a resolution of 0.4 mm
- Automatic measurement of time-dependent values after initial foam height was detected
- Exact measurement of foam height after 60, 180, and 300 seconds
- Recording of the entire height curve
- Recording of the liquid level for measuring drainage
- Quick compilation of multiple measurements in comparison tables and charts



Easy-to-use and safe column support



Additional liquid height detection

Technical specifications

Line sensor	
Maximum measurable height	620 mm
Sensor resolution	1654 × 1 px
Height resolution	67 dpi | 0.375 mm
Temporal resolution	20 fps
Scanning length	620 mm
Illumination	
Type	LED
Wave length, dominant	469 nm
Sample volume	
Minimum required sample volume	250 mL

Instrument dimensions	
Footprint	245 mm × 275 mm (W × D)
Height	1360 mm
Weight (without accessories)	18.5 kg
Analyzed foam characteristic	electronic foam height detection
Foaming and measurement	according to ASTM D 1173

HIGH PRESSURE FOAM ANALYZER – HPFA



Our innovative solution for foam analysis under oil and gas reservoir conditions

Our High Pressure Foam Analyzer – HPFA is the world's only measuring instrument for simultaneously analyzing the amount and structure of liquid foams under high pressure. The instrument provides various options for investigating foam behavior under the real process conditions of foam-assisted flooding methods in EOR as well as hydraulic fracturing.

Measuring methods and options

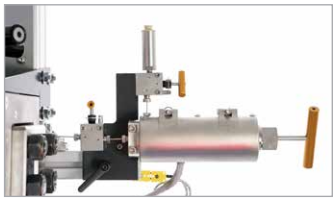
- Measurement of foamability and foam stability based on the foam height and volume with respect to time
- Analysis of foam structure and its variation with respect to time based on the number, size, and statistical size distribution of the foam bubbles
- Measurements at pressures up to 350 bar and temperatures up to 120 °C
- Foaming with a diverse range of gases such as air, N_2 or CO_2
- Option of adding liquids during the measurement

Tasks and applications

- Foam-assisted gas flooding
- Foam as fracking and stimulation liquid



Camera recording foam structure



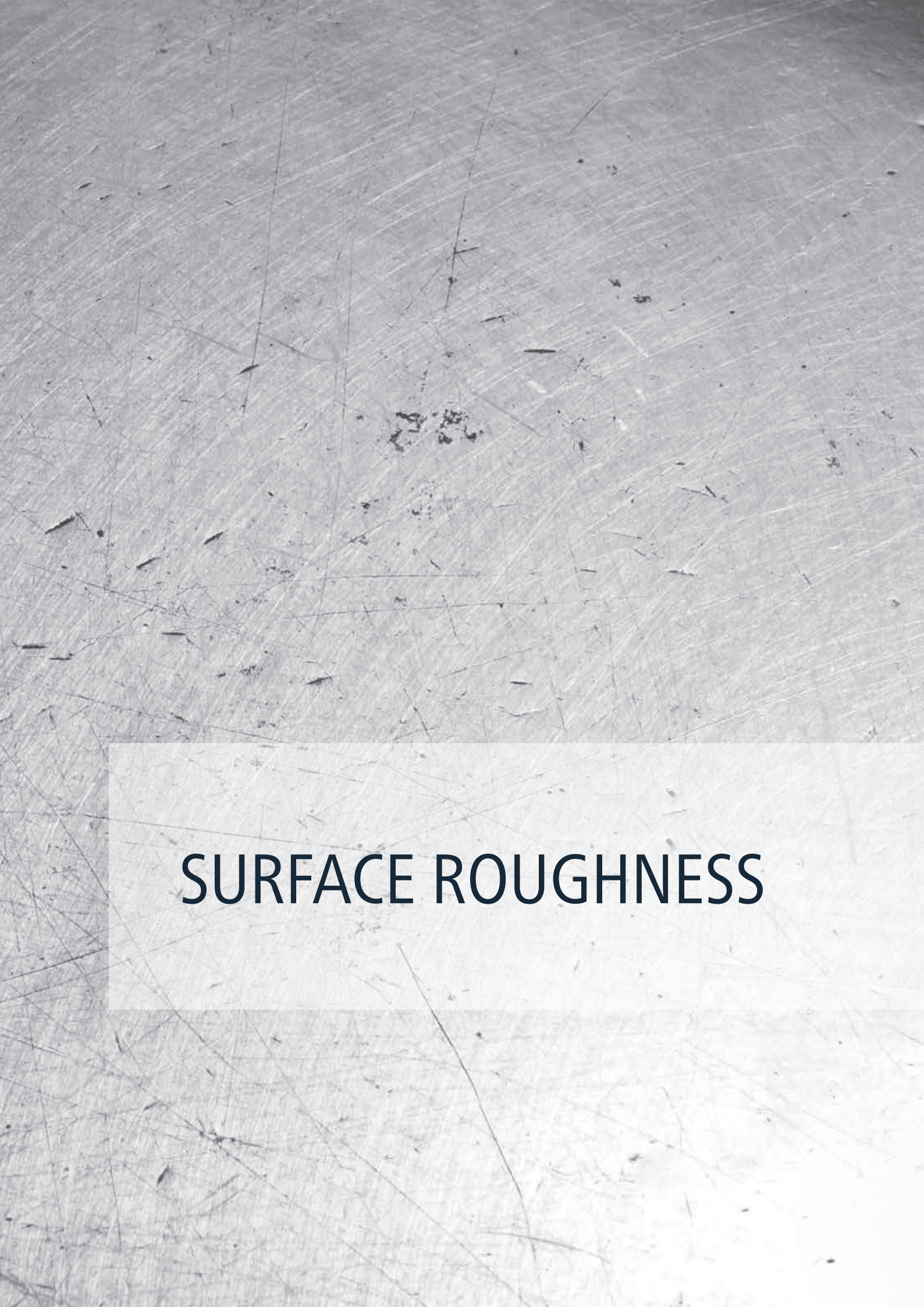
Micro Dosing System for adding liquids during measurements

Technical specifications

Measuring technique	
Type	foam height foam structure
Pressure measurement	
Maximum pressure	350 bar (5000 psi)
Temperature control	
Temperature range	room temperature up to 120 °C

Mini dosing system	
Dosing	manual
Temperature	maximum 180 °C
Environment	
Temperature	operating: 10 to 40 °C
Interfaces	
PC	1 × USB 3.0





SURFACE ROUGHNESS

SURFACE ROUGHNESS ANALYZER – SRA



Comprehensive analysis of your material's texture

Whether your surface must be very smooth or show a certain texture and degree of roughness, our Surface Roughness Analyzer – SRA supports you in optimizing your material or production process. Contactless, quickly, and with an extremely high resolution, the SRA gives you a 3D image of your sample's surface and provides you with data which exactly describe its topography.

When combined with contact angle measurements, analyses with the SRA help you evaluate the contribution of roughness to the wettability of your sample or to the adhesion of coatings. This is particularly important for optimizing coating or bonding processes by roughening the surface.

Measuring methods and options

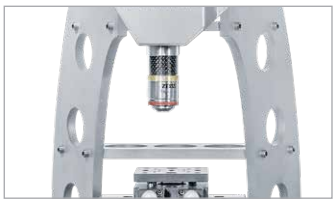
- Displaying the topography of samples on a wide scale from surface roughness up to the shape of whole workpieces
- Evaluation of how surface roughness contributes to wettability
- Calculation of sample parameters such as dimensions, angles, radii
- Analyses according to different standards, such as ISO 25178
- Very fast measurements making it optimal for QC
- Available as lab instrument or as measuring head for robotic systems

Tasks and applications

- Coatings and other surface modifications
- Biocompatibility of implants
- Bonding processes
- Construction and building material
- Roughness contribution to paper wettability



Contactless optical measurement



Wide measuring range thanks to easily exchangeable lenses

Technical specifications

Camera system	
Performance	60 fps at 1280 × 1024 px
Optics	
Focus	software-controlled
Lens magnification	2,5× up to 100× nominal magnification
Field of view	0.2 mm × 0.16 mm to 8.0 mm × 6.4 mm
Resolution	lateral, pixel based: 0.16 µm to 6.25 µm axial: 10 nm to 2.6 µm
Illumination	
Type	laser diode
Wave length, dominant	450 nm

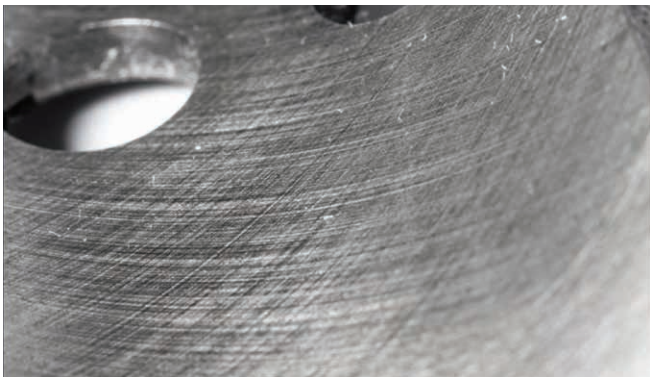
Analyzed characteristics	topography	area roughness	linewise roughness
	■ spike-filter ■ median-filter ■ Gauss-filter ■ clip values ■ cut boarders ■ region of interest ■ mirror/ rotate values ■ fill invalid pixels ■ step height	■ waviness parameters: W_a, W_q, W_{z10}, W_v, W_p, W_z ■ roughness parameters: S_a, S_q, S_{z10}, S_v, S_p, S_z	■ waviness parameters: W_a, W_q, W_z, W_{max} ■ roughness parameters: R_a, R_q, R_z, R_{max}

Technical innovations for precision and speed

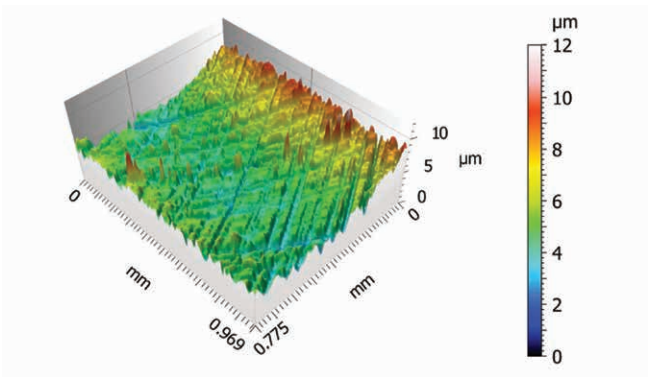
The SRA uses the confocal microscopy technique to create the spatial representation of the surface. This happens by stacking layers of 2D images, each one with a very small depth of focus, while lowering the optics with extremely tiny increments, leading to a height resolution of down to 10 nanometers. To scan an area of the sample, usual confocal microscopes use a rotating pinhole disk to create an image at each height level. The disk inside the SRA has micro lenses instead of just holes, increasing the light yield and making it possible to analyze low-reflectivity or even transparent surfaces.

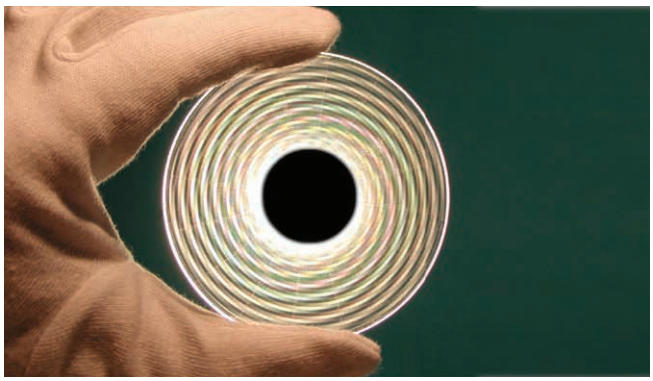
The vertical transport of the measuring head uses an ultrasonic instead of a common piezo drive. Thus, while combining speed with a high resolution, the usual height range of the measurement is widely exceeded. To reach a vast scope of tasks from roughness analysis to imaging the exact shape of whole products such as screws or tooth implants, lenses with magnifications from 2.5 to 100-fold can be exchanged quickly and easily.

Examples of presice 3D analysis at different scales

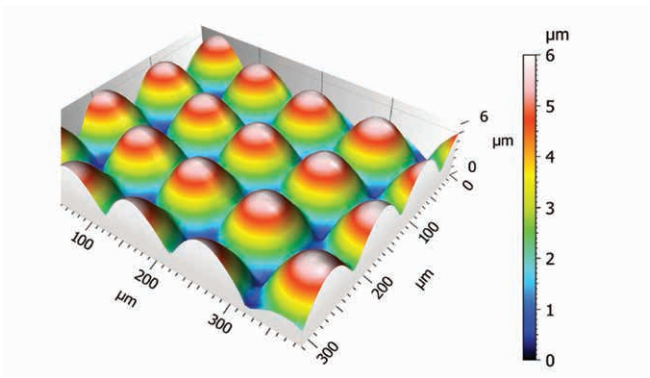


Cylinder running surface





Microlens disc



MEASURING HEAD FOR ROBOTIC SYSTEMS



Ready for in-line quality control

With its small size and low weight, the SRA can be used at almost any place as a lab instrument, but is also available as a measuring head to be used for automatic processes in the production line. This makes real-time sample evaluations for QC checks of work pieces possible.

Adding to the versatility of the SRA itself, the software can be linked to programs such as Matlab® in order to integrate it in information systems. You can count on extensive support when it comes to incorporating the SRA into your process.


DELL



SERVICES

TECHNICAL SERVICES



Ensuring your investment is our personal concern

Precision, quality, and long-term functional reliability is the standard for us at KRÜSS Technical Support. We take care of you and your instrument from the very beginning, ensure its operational readiness with regular maintenance, and act quickly and dependably whenever you need our support.

We maintain the reliability of our measuring instruments constantly – significantly longer than is normal in the industry. Even when KRÜSS has long since developed a successor for your instrument, we will make every technical effort to repair and even modernize it.

For a support request visit: **kruss-scientific.com/supportrequest**

Installation and training (IAT/RIAT)

Do you want to use your instrument with maximum efficiency and expert knowledge from day one?
We will arrange this and provide an installation and training (IAT/RIAT) for you and your staff.

Maintenance contract

Do you want to maintain the precision and reliability of your instrument at the same high level in the long term?
We will maintain, adjust, and calibrate it as part of regular service visits.

Remote support

Are you facing a technical issue and relying on a quick solution?
We will provide direct support from screen to screen.

On-site service

Are you confronted with a failure of your instrument, or do you want to move it, recommission it or train new staff to use it?
We will respond quickly and flexibly with our on-site service.

Qualification (IQ/OQ)

Do you want to use your instrument and its methods as part of a standardized quality management system?
We will carry out Installation/Operation Qualification (IQ/OQ) and create documentation tailored to your purpose.

Extended warranty

Would you like our promise of long-term functional reliability in writing?
We can offer you an extension of the legal warranty.

SEMINARS



Expertise you can use

Our seminar team is made up of experienced scientists who love sharing what they know. They provide individual support and offer their services as expert contacts for theoretical and practical questions. Our seminars also leave plenty of room for sharing and dialog.

We regularly host respected guest speakers with relevant insights into interfacial chemistry. Their presentations shed light on technical content by offering practical examples from the latest research and development.

Check our seminar dates online: **kruss-scientific.com/seminars**

Overview seminars

Get an outline of the most important measuring methods and instruments for surface tension, contact angle, and foam analysis.

Methodology seminars

Deepen your knowledge in the areas of surface tension, contact angle measurement, and foam analysis on one day each.

Practical seminars

Attend professionally supported measuring exercises in center of an intensive training course.

Focus seminars

Get deep into one important industrial application area of interfacial chemistry.

APPLICATION SERVICES



Have a look at our whole range of application services:
kruss-scientific.com/measurement-services

Let us take care of your measuring tasks

Our application labs carry out analyses of your samples and provide application-related advice. Having the whole portfolio of equipment and methods you find in this product overview at hand, we can solve virtually any task in the area of interfacial and foam analysis. This comprises measurements in accordance to international standards, but also complex questions which require a combination of methods and activate the scientific creativity of our application team.

Draw from our vast resoucres

- Analysis of liquid and solid surfaces as well as interfacial rheological and foam behavior
- Strict accordance to a vast number of ASTM, DIN, or other standards
- Comprehensive measurement reports and professional consultancy on your application



ABOUT KRÜSS

Advancing your Surface Science

At KRÜSS, we see ourselves as a company which generates something new from technical know-how, scientific expertise and an abundance of passion every single day. With this background, we do not only produce first-class measuring instruments for surface and interfacial chemistry – we also offer a unique combination of product and scientific advice. In this way, we help our partners to optimize and make better use of their technologies.

Technology meets science

With our internally produced, high-precision mechanical systems and innovative technical solutions, we satisfy in a highly complex market. We help people in research, development, and industrial quality control in a wide variety of company sectors and with the most diverse requirements. As a full-range supplier with a wide product portfolio, software-controlled measuring technologies for the contact angle and static and dynamic measurement of surface and interfacial tension are just as much part of our range as measuring instruments for investigating foams. At our qualified contract measurement laboratories, we repeatedly set ourselves the challenge of researching and finding new ways and measuring methods for our customers.

Global market leader thanks to innovation and know-how

The combination of unique products and highly qualified advice has made us the global market leader in the field of surface tension and interfacial tension measurement. But we also know that we cannot rest on our laurels: for this reason, we are always searching for better solutions together with our customers. Our experience of the surfaces and interfaces of liquid and solid substances is what we provide on a personal basis in form of knowledge: in consultancy, seminars, technical service, and our Applications & Science Center.

We can be found wherever theory and practice meet

Our responsibility does not stop with the delivery of our measuring systems. Installation, instruction and training are just as much a matter for us as continuous contact and interaction with our customers – worldwide.

We're always close to you

Our company is based in and originates in Hamburg (Germany). We have further subsidiaries in the USA, China, the United Kingdom, and France in order to be as close as possible to our customers. Furthermore, we have a dense distributor network which works flexibly and quickly to ensure that our products and our expertise are always close at hand.



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ALWAYS CLOSE TO YOU

At KRÜSS, we combine technical know-how and scientific expertise with plenty of passion. That is why we not only produce high-quality measuring instruments for surface and interfacial chemistry – we offer a unique combination of product and scientific consulting. Our continuous know-how transfer ensures that not only we at KRÜSS keep pace with scientific developments, but also our customers.

In this way, we help you to optimize and make better use of your technologies. This has made us the global market leader in the field of surface and interfacial tension measurement. As a matter of course, we will gladly support you with further information as well. Feel free to ask us about publications, application cases, and helpful information about other KRÜSS products. We are always close to you.

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