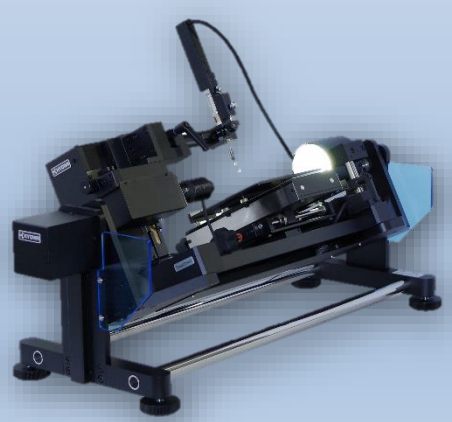
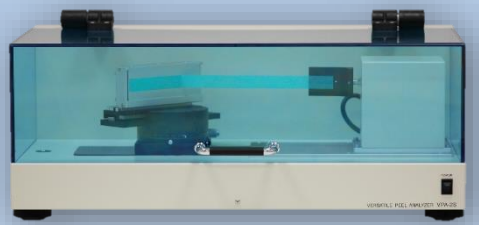
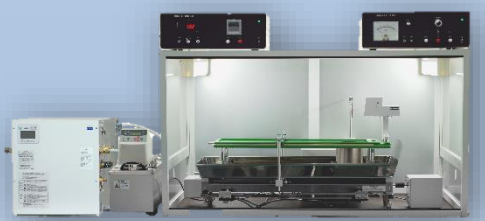
Kyowa Interface Science Co., Ltd.

KYOWA
Leading to answers

Kyowa Interface Science Co., Ltd. is one of the world's leading companies in its field and for almost 70 years and the KYOWA brand stands for superior quality products of interface science measuring instruments, including contact angle meters, surface tensiometers, peel analyzers and friction meters, among others.

Kyowa Interface Science Co., Ltd. contributes to the development of science and industry, by providing its customers with reliable and easy-to-use scientific instruments and by supporting them to solve the problems they face in research & development and quality control.

Contact Angle Meters	Surface Tensiometers	Peel Analyzers	Friction Analyzers	Special Instruments
				

Contact Angle Meters

DMe-211

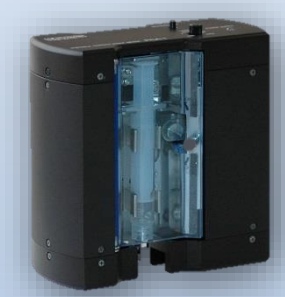
The DMe-211 is an economical yet fully-featured contact angle meter with computer image analysis system. It combines a fixed focus CMOS camera with manual droplet volume regulation and manual stage up/down motion for gentle deposition of droplets.
Measurements of static contact angles and surface and interfacial tension of liquids are possible.
Optional, the analysis of surface free energy of solids is also available.

DMo-WA-series

The three models of the DMo-WA-series are special designed high performance contact angle meters for measurements of disk-shaped substrates such as wafers with a diameter of up to 12inches.
Differing only in their grade of automation, the models may combine automatic droplet analysis with computer-controlled droplet deposition and computer-controlled rotation sample stage movement in x and rotation-axes.
The high-speed camera and the computer-controlled dispenser allow for precise measurements of static and dynamic contact angles, as well as analysis of surface free energy of solids. Optional, a external tilting stage for measurement of sliding angles is also available.

DMs-401

The DMs-401 is a reasonable and compact sized high performance contact angle meter for measurements of static and dynamic contact angles, surface and interfacial tension of liquids and analysis of surface free energy of solids.
The sample stage can be precisely moved in x and z axis with help of a rotation knob for quick and easy positioning and gentle deposition of droplets.
Options, such as high speed camera, computer-controlled dispenser, temperature control devices and external tilting stage are also available.

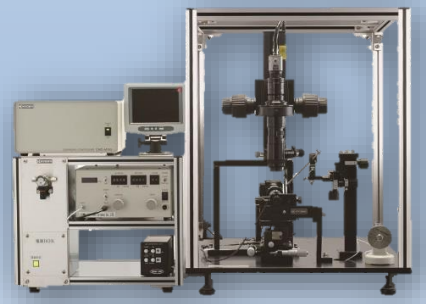


PCA-11

The PCA-11 is a portable contact angle meter featuring single-click fully automated measurements of contact angles even on slopes of up to 90°. Measurements of surface and interfacial tension of liquids and analysis of surface free energy of solids are also possible.
Weighing only 650g and with the visible needle tip allowing for fast and precise capture of the target point, the PCA-11 is the perfect device for non-destructive measurements on-site in the field or in production lines to evaluate the cleanliness of large panels, hydrophobic and hydrophilic surfaces from automobiles parts, windshields, buildings, etc.

DMo-series

The four models of the DMo-series are high performance contact angle meters. Differing only in their grade of automation, the models may combine automatic droplet analysis with computer-controlled droplet deposition and computer-controlled sample stage movement in x, y and rotation-axes.
The high-speed camera and the computer-controlled dispenser allow for precise measurements of static and dynamic contact angles, surface and interfacial tension of liquids as well as analysis of surface free energy of solids.
A wide range of options are available and lower grade models can also be upgraded later.



MCA-3

The MCA-3 is a microscopic contact angle meter to measure the contact angles of tiny droplets in narrow spaces. Using a special glass capillary with an inner diameter of about 5μm together with the sophisticated pneumatic dispenser system, droplets with volumes of only a few picolitres can be generated.
The top-view camera, the dispensing manipulator and the high-precision micro stage in x, y and z axis allow for pin-point deposition of the droplets
Evaluation of wettability is possible in an area with a width of only 100μm and even the contact angle of a droplet on a human hair can be measured.

Surface Tensiometers

DY-200

The DY-200 is a smal footprint stand-alone type semi-automatic tensiometer with internal processor. It is an easy-to-use basic model for use in quality control, operated with simple function keys and a LC display.
Measurements of surface and interfacial tension using the plate (Wilhelmy) method or the ring (Du Noüy) method are possible.
Test reports can be printed out on the optional terminal printer.

DY-300

The DY-300 is a fully automatic and precise tensiometer for measurment of surface and interfacial tension of liquids using the plate (Wilhelmy) method or ring (Du Noüy) method. With its user-friendly video guidance for each measuring method, it is ideal for use in quality control.
Measurements of lamella length, liquid density and sedimentation behavior can also be performed.
Optional, jacket or heater type stages and thermometer are also available.

DY-500

The DY-500 is a fully automatic and precise tensiometer for measurments of surface and interfacial tensions of liquids for use in research & development and quality control using the plate (Wilhelmy) method or ring (Du Noüy) method.
It features a jacket type sample stage with stirrer function and a built-in thermometer.
Measurements of lamella length, liquid and solid density, sedimentation behavior and evaporation rate can also be performed.
Optional, measurements of dynamic contact angle and powder contact angle are possible.

DY-700

The DY-700 is a fully automatic and high-precision tensiometer for measurements of surface and interfacial tensions of liquids for use in research & development. using the plate (Wilhelmy) method or ring (Du Noüy) method.
The fine motion jacket type sample stage with stirrer function in combination with the built-in thermometer ensures reliable measurements of even very small forces.
Measurements of dynamic contact angle using the Wilhelmy method and powder contact angle using the Washburn-method can also be performed.

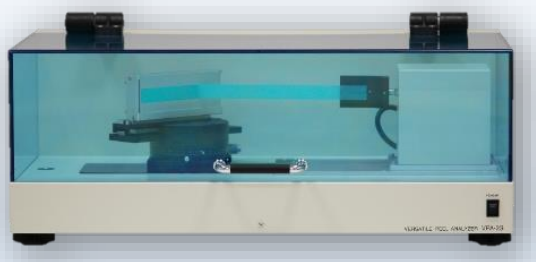
BP-D5L

The BP-D5L is a manual bubble pressure tensiometer for measuring the dynamic surface tension of aqueous surfactant solutions in a time function.
For monitoring the bubble formation, the bubble pressure waveform is displayed in real-time.
Optional, a jacket type stage and thermometer for temperature dependent measurements, and ultrasonic cleaner for cleaning of the capillaries are available.

BP-D5

The BP-D5 is a fully automatic bubble pressure tensiometer for measurement of dynamic surface tension of aqueous surfactant solutions in a time function or at a chosen surface age.
For monitoring the bubble formation, the bubble pressure waveform is displayed in real-time and bubble formation is made visible by a built-in stroboscope.
For calculating the surface tension right after bubble generation the Rosen-fit can be used.
Temperature dependent measurements can also be carry out with the built-in jacket type stage and thermometer.

Peel Analyzers



VPA / VPA-S

The computer-controlled Versatile Peel Analyzers VPA and VPA-S with their unique 'Flat Plate Cross Stage method' can easily perform horizontal peel strength and adhesion tests at any peel angle from 0° to 180° under certain peel rates with simple settings without using any jigs or tools.
Both models can be equipped with 6 different load cell units ranging from 0.1N to 100N and tensile tests are possible with optional available jigs.
Options, such as heated sample stages, carrier plates for non-adherent samples, camera system for peel behavior observation, are also available.
VPA: Standard size model, with peel rates up to 30.000 mm/min and a stage travel range up to 200mm.
VPA-S: Compact size model, with peel rates up to 12.000 mm/min and a stage travel range up to 100mm.

Friction Analyzers

TSf-503

TSf-503R

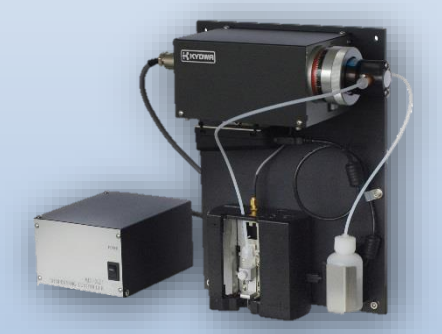
TSf-503D

The Triboster TSf-series is designed for computer-controlled analysis of the static and kinetic coefficients of friction (COF). Each model feature the crank shaped biaxial balance technology for precise and reliable measurements. Different loads, speeds, contact parts and up to 9 different measuring methods, as well as the wide range of options allow customers to set up the instruments to meet their special needs.
The Triboster TSf-series is available in three different designs:
TSf-503/TSf-303: Versatile models for the analysis of friction properties with linear reciprocating stage.
TSf-503D: Analysis of friction properties with constant rotation speed of the ϕ150mm stage in two directions by pin/ball-on-disk measurements.
TSf-503R: Analysis of friction properties with constant rotation speed in two directions of cylindrical samples. Sample holders are customized according to customers' requirements.

Special Instruments

SOM-A

The spread oil measuring apparatus SOM-A measures small amounts of oil, such as DOS, CSO or ATBC, coated on rolled steel or aluminum sheets by the technique called "Hydrophil Balance Method" using a Wilhelmy plate.
Small amounts of only a few µg on test samples can be detected and displayed in either mg/m^2 or g/BB.
The trough is Teflon coated for corrosion protection and easy cleaning, the measuring apparatus itself is placed in a chamber to improve accuracy of the measurements by providing protection from wind and dust.
To ensure reliable measurements, the SOM-A features two independent temperature control systems: A refrigerated and heating water circulation system for the trough and a heated water supply system for the water used for the actual measurements.



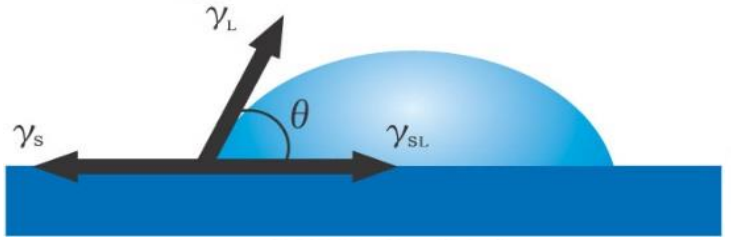
FPD-CP11 / FPD-CP21

The FPD-CP11 and FPD-CP21 consist of a measuring head based on the portable contact angle meter PCA-11 and our analysis software FAMAS to perform non-contact measurement of contact angles. The measuring heads are designed for the use on a host instrument, which usually characterizes the surface of large sized flat panels such as LCD, OLED, PDP or wafers.
The data communication between our analysis software and the host instrument is possible via RS232 or virtual COM ports.
FPD-CP11: Equipped with a metering pump, a dispensing controller and a 50ml liquid bottle, this model is ideal for applications that require large number of measurements.
FPD-CP21: Instead of a metering pump, disposable PP syringes, which can be easily exchanged, are being used. One prepared syringe can generate about 500 droplets with a volume of 1µl.

Measurement of Contact Angle

The contact angle is an easy measurement method to determine the wettability of a solid substrate by a liquid. When depositing a droplet onto a solid substrate, the liquid will form a drop shape. The point, where the solid, the liquid and vapor meet, is called the three-face point and it determines the contact angle. The contact angle is also an indicator for the wettability, which is dependent on the combination of solid substrate and liquid, as well as on the environment.

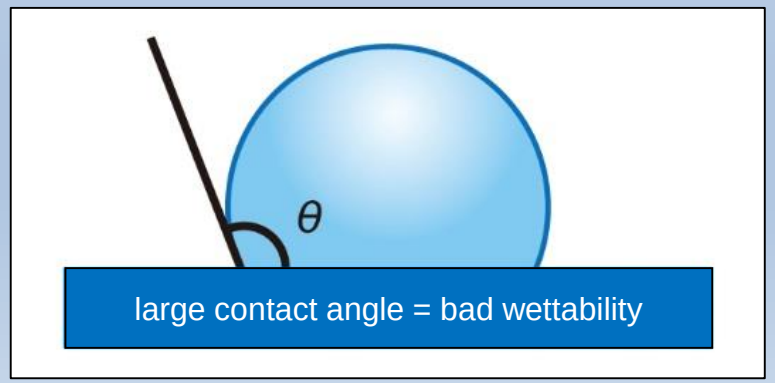
The relationship between the contact angle, the solid surface free energy, the liquid surface tension and the interfacial tension between solid and liquid is defined by the **Young's-Equation**:

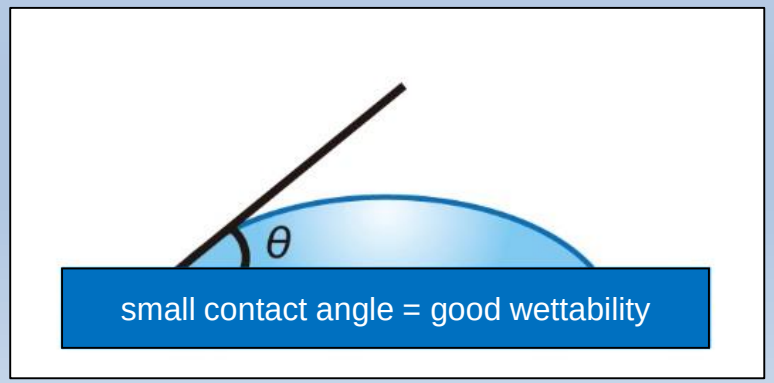


γS: Surface free energy of the solid
γL: Surface tension of the liquid
γSL: Interfacial tension between solid and liquid

$$\gamma S = \gamma L \cdot \cos\theta + \gamma SL$$

In general, the following rule applies: The larger the contact angle the worse the wettability, the lower the contact angle the better the wettability.

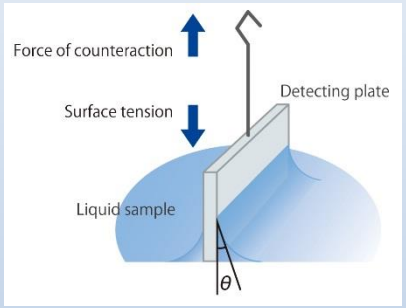




Measurement of Surface and Interfacial Tension

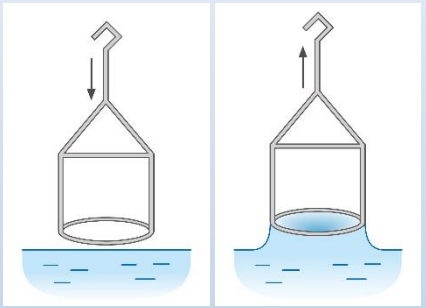
Liquid surface tension is the characteristic of liquids to minimize their surface to the smallest possible area, which would result in a perfectly spherical shape. Measuring surface tension allows characterizing different properties like wettability, permeability, solubility, foamability, emulsibility, dispersibility, etc. The different methods to determine the surface tension are as follows:

Wilhelmy-Plate Method



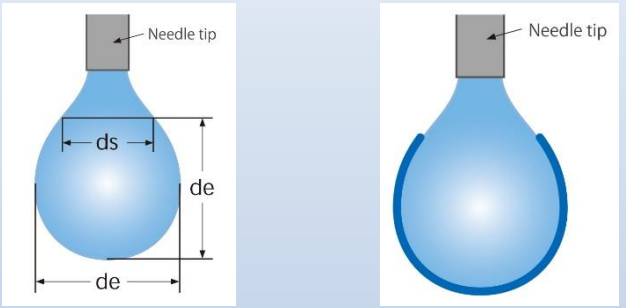
Measures the force of the liquid pulling on the plate

Du Noüy-Ring Method



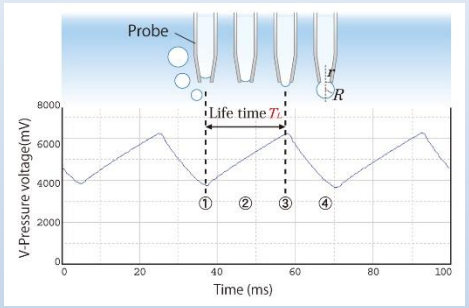
Measures the force of the liquid pulling on the ring

Pendant Drop Method (by ds/de and Young-Laplace)



Both ds/de and Young-Laplace Method analyze the silhouette of the liquid's drop

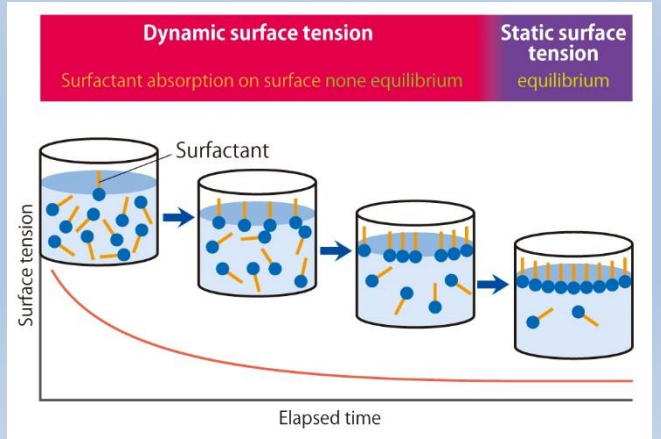
Maximum Bubble Pressure Method



Determines the maximum pressure in an air bubble, while it is formed in a probe, which is immersed in a liquid

Dynamic Surface Tension

Surfactants have the ability to lower surface or interfacial tensions over time with the molecules being absorbed to the newly created surface or interface. During the time span from a newly created surface until an equilibrium value of surface tension is reached, the Dynamic Surface Tension can be measured. While at equilibrium state of the liquid the Static Surface Tension can be measured. Detergents and solutions for coating purposes are being used in processes where new surfaces or interfaces are constantly being created, thus determination of the Dynamic Surface Tension is of high importance.



Measurement of Peel Strength and Adhesion

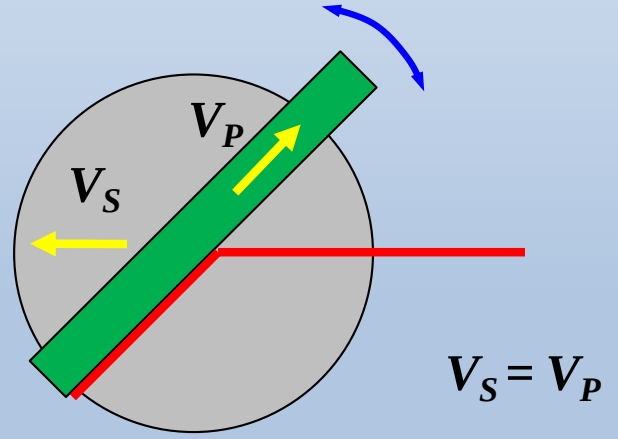
Pressure-sensitive adhesive tapes, or PSA, plays significant roles in various forefront industries such as in the production of flat panel displays, semiconductors, optical instruments, solar batteries, automobiles, as well as in medical treatments, architecture, etc. as constitutive parts and integral parts of their production process.

The performance of a PSA can be characterized by peel adhesion, shear resistance and tack tests. Among them, peel adhesion tests are conducted widely to make an objective appraisal with quantitative evaluation following ISO 8510-1 and 2, the 90˚ peel test and the 180˚ peel test. The 180˚ peel test is tend to be affected slightly by the thickness and elasticity of PSA tape, and the 90˚ peel test may experience elongation and sagging of PSA tape due to rather complicated structure of the jigs.

Demands on peel adhesion, peel angle and peel rate for the optimization of adhesive tapes used in production processes vary widely depending on the applications.

KYOWA's patented Flat Plate Cross Stage Method

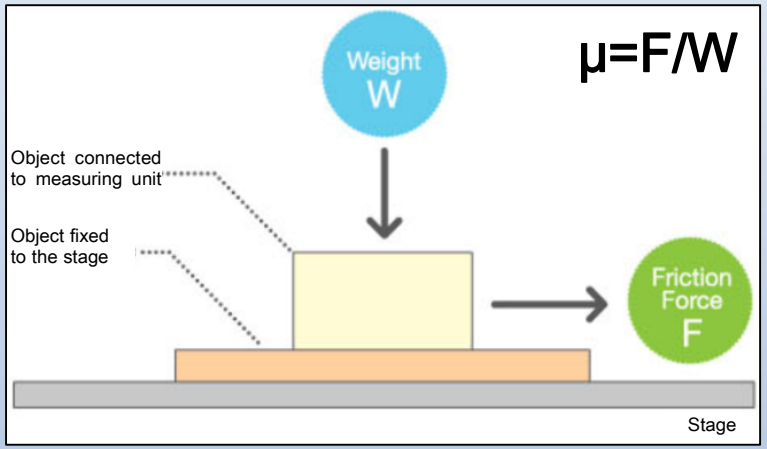
The flat specimen stage sits on a rotary table, with which the peel angle can be simply and swiftly adjusted from 0˚ to 180˚ without using any jigs or tools. The employed synchronized actuator mechanism enables to maintain the same peel rate and peel angle during the stage travel. No complex adjustments and calculations are required.



Measurement of Friction

A Friction Analyzer or Friction Tester measures the resistance, or friction force, of two objects, which slide against each other. The magnitude of the friction and the abrasion, depends on factors such as material composition, contact geometry, load (normal force), sliding speed, temperature, humidity, surface roughness, etc.
The value of the Coefficient Of Friction (COF) “μ” is defined by the relationship between the required force ”F” to slide an object and the load “W” perpendicular to the surface the object is resting on. As the COF is a dimensionless scalar, it has no unit and the direction of the force does not change its magnitude.

Measuring the COF with a KYOWA instrument
When the stage with the fixed object moves, the load “W” of the object connected to the measuring unit generates the frictional force “F” between the two objects. The measuring unit detects this force and the software calculates the coefficient of friction ”μ”.



When the static COF is overcome, the kinetic COF follows, so the COF “μ” can be 1) static or 2) kinetic.
1) The static COF “μs” describes the friction force between two objects when neither of the objects is moving.
2) The kinetic COF “μk”, also known as sliding or dynamic COF, describes the friction force between two objects if one object is moving, or if two objects are moving against each other.

Non-moving objects experience more friction than moving ones, requiring more force to put them in motion than to sustain them in motion. Thus the static COF is larger than its kinetic counterpart.