Kino

SL150

Optical Dynamic / Static Interfacial Tensiometer & Contact Angle Meter

– Basic Interface Chemical Measurement System Based on Drop Shape Analysis

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Optical Dynamic / Static Interfacial Tensiometer & Contact Angle Meter

– Basic Interface Chemical Measurement System
Based on Drop Shape Analysis

SL150 series, developed by USA KINO in terms of its long–term experience, are basic and entry type contact angle goniometer. It may be most handy and lightest (only 8kg) one around the world, and owns high quality & most reasonable price. Their modularized design makes tens of thousands of possible different combinations available, which is undoubtedly your above–all choice for the high precision and accuracy in interface chemical analysis. The integrated instrument consists of sophisticated optical mechanism, optical vision system, high–precision dosing system as well as CAST® 3.0–USA KINO's professional interface chemical analytical software. SL150 series are applicable to measure static / dynamic contact angle, surface free energy of solid and its distribution (dispersive force, polar force and hydrogen bond force, etc.), interface tension of liquid–gas / liquid–liquid as well as interface viscidity & elasticity of liquids (oscillating and expanding drop), etc. We provide clients cost–effective instruments with best performance – the most professional contact angle meters & interfacial tensiometers and technical assurance in R&D and quality control.

$$\sigma_{SV} = \sigma_{SL} + \sigma_{LV} \cdot \cos\theta$$

$$\sigma \cdot \left\{ \frac{1}{R_1} + \frac{1}{R_2} \right\} = \sigma \cdot \left\{ \frac{\sin\phi}{X} + \frac{1}{R_1} \right\}$$

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What's Contact Angle?

Contact angle, θ , is defined as the angle between tangent of gas–liquid interface and that of solid–liquid interface formed at the three phases' boundary where liquid, vapor and solid intersect.

Fields of Application

- Surfactant, soap & detergent
- Emulsion
- Analysis of polymer and surface modification
- Pharmaceutical, e.g. wettability analysis of artificial bone
- Spray, painting & coating
- Paper, film & ink
- Cosmetic
- Hydrophilicity contact angle determination of air conditioner's aluminum foil
- Wettability analysis of rock core, coal mine stone and electrical insulator
- Wettability analysis of polaroid, film and wafer surface
- Hydrophilicity and hydrophobicity transformation by UV irradiation
- Analysis of hydrophilicity and hydrophobicity of fabric
- Food industry
- Effect analysis of surface treatment
- Cleanness analysis
- Stability analysis of emulsion & foam
- Adsorption and competition of surfactant, protein & polymer
- Characterization of interface rheological properties
- Surface cleanness analysis of PCB, chips (wafer), LCD/LED and high precision machinery elements
- Wetting analysis of carbon fiber, glass fiber and resin
- Electro–wetting transformation and the relevant change of its contact angle

International norms and standards

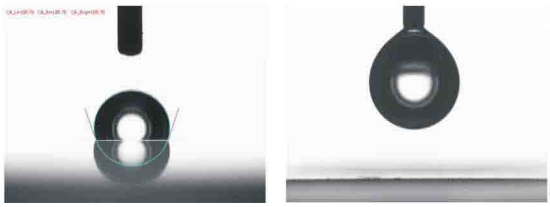
ASTM D 724: Standard Test Method for Surface Wettability of Paper (Angle–of–Contact Method)

ASTM D 5946–2004: Standard Test Method for Corona–Treated Polymer Films Using Water Contact Angle Measurements

ISO 15989: Plastics– Film and sheeting – Measurement of water – contact angle of corona–treated films

Performance Features

SL150 series are our update products in terms of long–term experience in R&D and on–site production based comprehensive analysis of both merit and demerit of various optical contact angle meter around the world. For the purpose of cost control and performance improvement, comprehensive optimization has been made in mechanism and optical system; Software design to maintain movement of sample stage and lens stability and to provide high definition and performance images.



$$\sigma \cdot \left\{\frac{1}{R_1}+\frac{1}{R_2}\right\} = \sigma \cdot \left\{\frac{\sin\phi}{X}+\frac{1}{R_1}\right\}$$

More accurate, stable and diversified mechanical system

1.Precision positioning stage, linear guide, screw technology used in mechanical system, with precision up to 0.01mm by manual and 0.5μm by software control respectively.

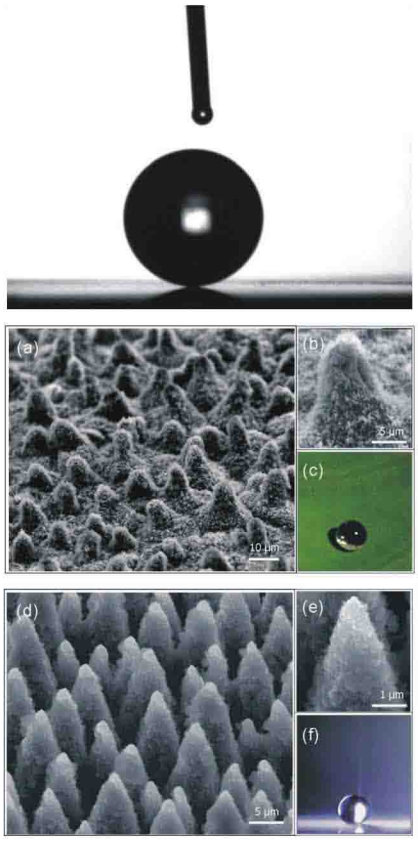
2.Uniquely–designed mechanism of up to multi axis control, coordinate the operation of sample stage, lens, camera and dosing system.

3.Zero–backlash and low error on–axis optical positioning stage guarantees stability, repeatability and exceptionally smooth motion.

4.Professional high–precision syringe pump system with accuracy of droplet control down to 0.02μL or even nL (optional), which can be applied to high–precision repetitive liquid dosing.

5.Flexible focus control system and micro distance of needles moving (about 0.01mm) makes more accurate and easier operation of transferring drops, especially for super–hydrophobic biomimetic material surface test.

6.Integrate designed instrument with mainframe made of high–grade aviation aluminum guarantees its handiness and fastness.



More professional and comfortable design of mechanism

1.Unique mechanism of fixed focal distance and high–precision adjustable positioning stage, with easier and more accurate focal distance obtaining and clearer image shape.

2.Soft light plate made of frosted quartz glass achieves clearer, sharper and softer background light and better drop shape.

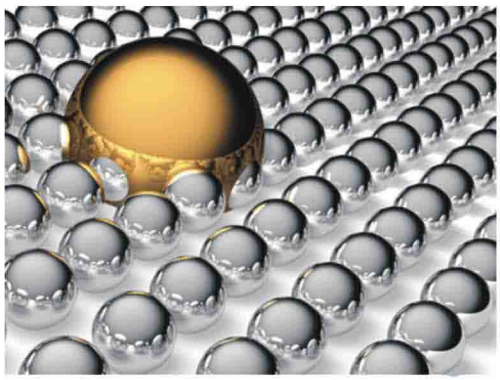
3.Unique design of syringe replaceable direct dosing system makes it easy to hold KINO's OEM syringe or special syringe with PTFE needle, ultra–thin needle (OD:0.23mm) for measuring hydrophobic material and syringe measuring medium / high viscosity sample.

4.System with four levelness adjustment units:

Except one complete machine levelness adjustment via quadrupled tuning knob and one precision tilting angle adjustment of lens and camera via 1 axis tilt platform stage with micrometer, we provide one multi–axis tilt platform with micrometer to adjust the levelness of sample stage. All these guarantee the accuracy of base line detection and the measurement of roll–off contact angle.

5.Adjustment both by hardware and software with better base line detection.

The levelness adjusting mechanism, illumination–adjustable LED cold light source as well as CAST® 3.0 software system provide you strong assurance of better base lines detection, and more convenient measurement of roll–off contact angle and advancing/receding contact angle.



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Sharper edge and high–speed optical vision system

1.Illumination–adjustable cold LED light source technology with sharper and clearer drop contour profile shape, effectively avoiding drop evaporation caused by excessive heat.

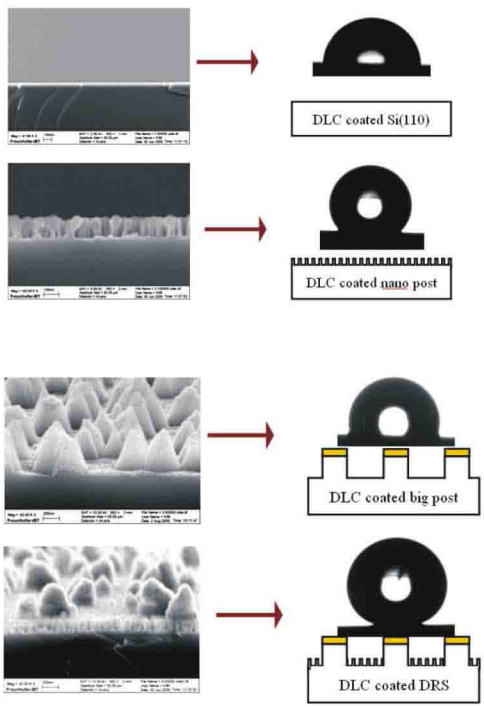
2.Higher quality camera with speed of 87–340FPS made in Germany (standard WVGA format). (Optional with cameras of 130M, 300M, 500M)

3.Fixed –zoom industrial telecentric lens of high–magnification, with magnification 0.8X.

4.USB2.0 standard interface provides faster speed and higher compatibility with laptops and newly designed desktops, free from incompatibility or inconvenience of inserting image capture cards or 1394B PCI express card.

5.Optional with high–speed cameras with AOI technology (speed of 100FPS, 300FPS, 1000FPS are available)

6.Optional with GigE or CameraLink cameras for faster data transmission and better stability.



Interfacial chemical analytical system (ADSA™) CAST® 3.0 with more functionalities and more comfortable user interface

1.Six drop shape states for analysis:

Sessile drop (liquid/gas, liquid/liquid/gas), pendant drop, captive drop, tilted plate and oscillated drop

2.Seven methods to calculate contact angle and nearly 20 kinds of curve–fitting technologies:

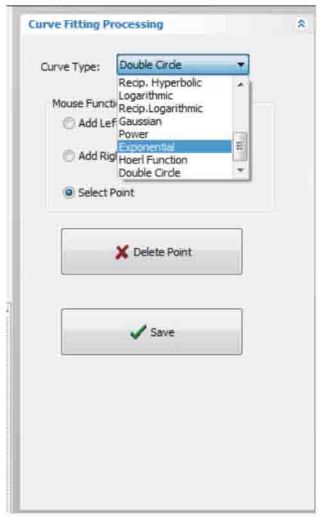
(1)Exclusive methods of θ /2, circle fitting, ellipse fitting, RealDrop™, spline curve–fitting, Young–Laplace equation fitting, curve ruler (tangent method);

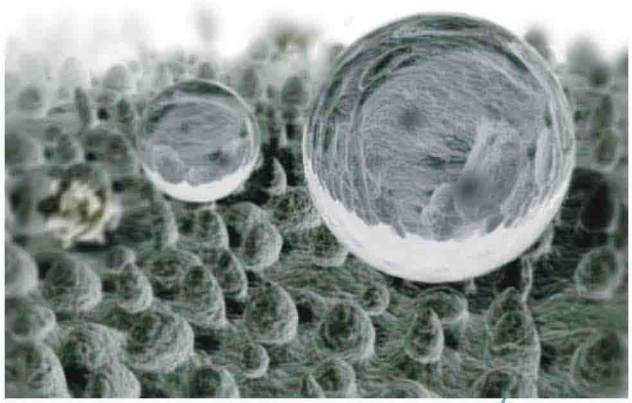
(2)Dynamic / static contact angle measurement

(3)20 exclusive curve ruler methods, such as circle, spline, Gaussian and Power, enable you to analyze:

–Advancing / receding contact angle

–Irregular angle



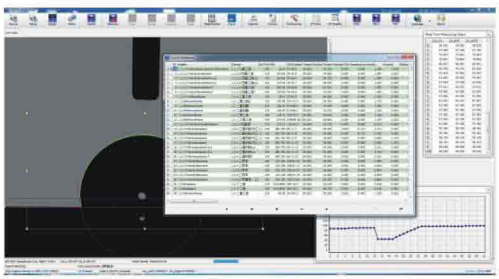


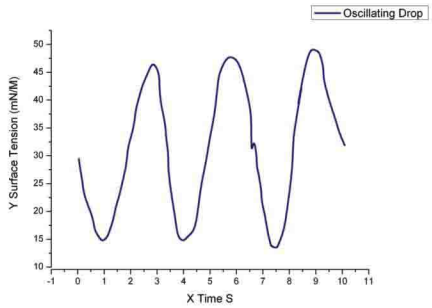
$$\sigma\cdot\left\{\frac{1}{R_1}+\frac{1}{R_2}\right\}=\sigma\cdot\left\{\frac{\sin\phi}{X}+\frac{1}{R_1}\right\}$$

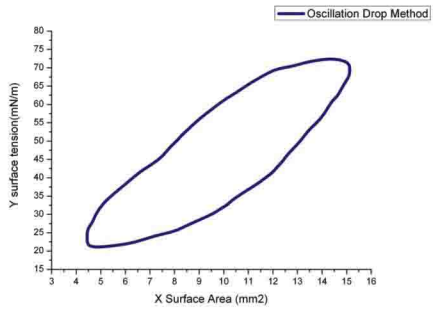
3.Twelve surface free energy calculating models, providing you more options to estimate surface free energy and its distributions.

Exclusively provided 12 methods for estimating surface free energy, e.g. Equation of State (Neumann et al.), Good–Girifalco, Owen–Wendt–Rabel, Simple Fowkes, Extended Fowkes, WU method 1–2, Schultz method 1–2, Acid–base (Van OSS & Good), Jhu, and Zizman Plot (critical surface tension) method, can be used to measure surface free energy and its distribution (dispersive force, polar force and hydrogen bond value, and Lewis acid–base, etc.) of low / high energy solid surface.

4.300 kinds of liquids with 800 data values of liquid surface tension and its contributions as reference data or for faster analysis of surface free energy of solid.







5.Unique interfacial tensiometer of liquid–gas / liquid–liquid with Young–Laplace equation fitting method based on Bashford–Adams table and Realdrop™, used for oscillating drop tests, surface tension measurement of medium to high viscosity sample, dynamic surface / interface tension measurement of surfactant, and oscillating & expanding drop measurement (corresponding modules are required).

6.Unique curve base line correction technology for measurement of contact angle of lower / upper convex.

Exclusive curve base line based circle–fitting or curve–fitting of unilateral arbitrary curve shapes with easier operation and more accurate result.

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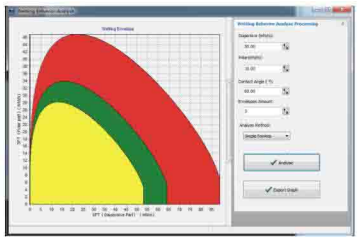
7.Rod, thread and tilted plate method based interface tension and contact angle measurement for analysis of contact angle of single fiber. (Need to choose and buy related accessories)

8.Dual–software triggering technology for analysis of complicated dynamic / static contact angle.

Unique dual–software triggering technology of CAST®3.0 can not only be applied to measure static contact angle but also advancing / receding contact angle, roll off angle, time–dependent (standard speed is 25 FPS, and camera with higher speed are optional) contact angle and zero–time contact angle of ultra–water absorption material (e.g. powder, fiber, paper, and artificial periosteum). It is applied more extensively with better measured result.

9.Unique technology of wetting behavior analysis (WBA / wetting envelopes).

A 2D map of wetting envelope can be constructed by using the components of surface free energy and corresponding method (such as OWEN), and a plot produces to show how wettability occurs. It is another way of understanding contact angle, hence degree of wetting, arise from an understanding of the forces existing in the material and between the materials.



Wetting behavior analysis of low–energy solid material

10.More comfortable software user interface

(1)New–generation wizard UI. Our software will implement measuring contact angle, surface free energy automatically at the touch of a finger according to wizard UI. Besides, with our 140–page user manual, you can operate the instrument easily without any professional training.

(2)Unicode based software interface. Its English user interface can easily be changed to other language (such as Simplified–Chinese), and makes it more convenient to operate.

11.Fully automatic analysis of contact angle, adhesive work and surface free energy

(1)Fully automatic. Just press "Measure", images capture, contact angle calculation, data storage and real–time display measured value will be done without manual intervention.

(2)Manual modification function. Double–click "Modify", you can modify measured values by captured image, and software saves the record of operation traces conveniently to avoid errors of automatic measured value.

(3)Real–time graph. Left / right contact angle, average contact angle, adhesive work, surface free energy used equation of state method can be real–time displayed without extra calculation.

12.Powerful database management for convenient storage, query, and exporting data:

√ Access database technology provides you more powerful functions

√ Real–time saving and indexing of measured values

√ One–to–one correspondence between measured data and image; corresponding drop image is automatically displayed when the data is selected

√ Historical data query

√ Modification of historical data

√ Importing and backup of historical data

√ Database compression

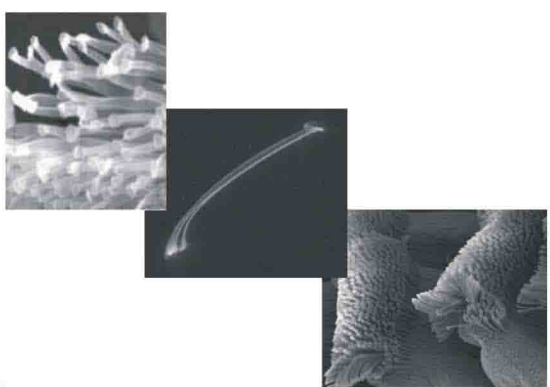
13.Measured data exportable.

All measured data can be exported into Excel file and image file into BMP file, which can be easily imported into scientific article and testing report.

14.Standardized windows® technology based video capture technology with better compatibility.

The standardized design of video capture method with the windows®multimedia technology enables compatibility of various contact angle meters around the world. Just enjoy the convenience brought by CAST® 3.0.

15. Unique video recording function. Measurement process can be recorded into AVI format for later use.



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Technical Specification

"*" marks the major differences between variants.

			SL150S	SL150B
Appearance				
Subject			Standard dynamic / static contact angle meter / interfacial tensiometer	Basic dynamic / static contact angle meter / interfacial tensiometer
Hardware Specifications	Sample Stage Control	X–Axis Y–Axis	Manual, travel range: 50mm, accuracy: 0.01mm; Max. travel range 150mm for option	N.A.
		Z–Axis	Manual, travel range: 40mm; accuracy: 0.01mm	
		Levelness Adjustment	Levelness adjustment of sample stage used micrometer, whole instrument levelness adjustment and camera lens tilting unit	
		Sample Stage Size	120*120mm	
		Max Samples Size	150(W)*∞(L)*50(H)mm	
		Max Samples Weight	6.0 kg	
	Other Control	Dosing Control	X,Y–Axis movable, for adjusting the droplet position and focal distance	
		Dosing Control(Z)	Manual, travel range: 12.5mm, accuracy: 0.01mm; for drop transferring	
		Tilting of Camera Lens	One–dimensional tilting unit with micrometer and locking function	
		Anti–dazzling	anti–dazzling plate for option	
		Accessories	Optional: Special holders for fiber, film and leaf. It is used to analyze contact angle of fiber or sample with poor planeness surface.	
	Dosing System	Model	Manual direct syringe pump	
		Accuracy	0.01mm 0.02μL	
		Drop Transfer Method	Manually–controlled	
		Needle	Disposable needle, including 0.24, 0.3, 0.5, 0.9, 2mm OD stainless steel needle, 0.2 OD needle as well as PTFE needle, etc., especially for measuring contact angle of super–hydrophobic material or contact angle between adhesive and solid material.	
	Optical Vision System	Lens	1–fold zoom telecentric lens (0.8X magnification), NA:0.01,TV Distortion:0.08%	
		Camera	Industrial mono video camera, USB 2.0 interface, resolution: 752*480 (standard WVGA format); Image speed: 87FPS (Full Screen)–600FPS (752*60) FPS,FOV:1.33–17.14mm; UV optical filter Cameras with higher resolutions of 130M,300M,500M are available; Available option speed: 100 FPS, 1,000 FPS or higher; Cameras with interface of GiGE, CameraLink, 1394 is optional available.	
		Background Light System	Illumination–adjustable monochromatic LED cold light source with frosted quartz glass soft light plate provides clearer image edge of drop	

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Software Specifications	5 drop shape states: pendant drop, sessile drop (liquid/gas, liquid/liquid/gas), captive drop, tilted plate, and oscillating drop.	
	7 methods to calculate contact angles: θ /2 (WH), circle fitting , ellipse fitting , RealDrop™ , curve ruler (tangent fitting), spline curve–fitting , and Young–Laplace equation fitting (ADSA™), etc.	
	Data acquisition: Combination of both full–automatic measurement and manual modification. Just press "Measure", the software will complete whole process of capture, finding edge, finding sensitive spots, fitting curves, calculating contact angle, and displaying calculation results without manual intervention so as to reduce effect of human factors.	
	Contact angle measuring technology: Mathematical model fitting and real–drop contour measurement solves the problem of measurement of asymmetric drop shape or drop without apex.	
	Automatic curve base line correction: Correction of upper convex sample surface, lower concave surface, or roughness of surface.	
	Dynamic / static contact angle measurement: Measuring advancing / receding / tilting / roll off angle.	
	Image capture methods: Single / continuous capture, e.g. 25 FPS. Higher speed of 60 FPS, 100 FPS, or 1,000 FPS are optional available.	
	Unique dual–software triggering technology: Measurement of zero–time contact angle for analyzing powder, paper and other hygroscopic materials; whole–process capture of small contact angle measurement.	
	Calculation and comparison of left and right contact angle and their average value.	
	Automatically generated data graph: Real–time observation of contact angle changes.	
	Powerful database management: One–to–one correspondence of data and drop images; backup, compression, and exporting to Excel files; measured values and curve–fitting results can all be saved into exported image, visually and clearly.	
	Video recording: Recording visual drop images in AVI format for making PPT file.	
	12 evaluation models for surface free energy Exclusively provided 12 methods for calculating surface free energy, e.g. Equation of State (Neumann et al.), Good–Girifalco, Owen–Wendt–Rabel, Simple Fowkes, Extended Fowkes, WU method 1–2, Schultz method 1–2, Acid–base (Van OSS & Good), Jhu, and Zizman Plot (critical surface tension) method, for measurement of surface free energy and its distribution (dispersive force, polar force and hydrogen bond value, and Lewis acid–base, etc.) of low/high free energy solid.	
	Wetting behavior analysis (WBA –wetting envelopes)	
	Automatic calculation of droplet volume, adhesive work and "equation of state" based surface free energy for measurement of surface tension of films, to replace Dyne test pens.	
General Specifications	Measuring Range of Contact Angle	0°< θ <180°
	Resolution	0.01°
	Accuracy	± 1° (θ /2 method) / ± 0.1° (circle fitting method)
	Measuring Range of Interface Tension	0.001–2000mN/m
	Resolution	0.001mN/m
	Methods of Interface Tension	BA table, 4th generation Young–Laplace equation fitting (ADSA™)
	Dimension and Weight	150Wx535Lx400Hmm 8kg
	Power Supply	AC100~240V 50/60H_z

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Accessories

1.Environmental chamber

– Temperature sample chamber

(1)Solid sample temperature control,

(2)Temperature control of test liquid;

(1)and (2)are two temperature control systems for controlling temperature of liquid sample and solid sample respectively. Clients can purchase either or both of them.

–The following environmental chambers for solid samples are optional:

(1)Sample chamber

Connect to water circulators to control temperature of sample

Temperature range: –40–150℃,

Resolution: 0.01℃

(2)Peltier semiconductor heating and refrigerating chamber: Temperature range:5–85℃, resolution: 0.5℃;

(3)Special temperature heating chamber:

Any special requirements for temperature control, such as 200℃ and 400℃, please contact us for confirmation.

It is recommended to use water circulator for liquid temperature control.

–Contact angle measurement in high–temperature of 1400℃, 1700℃, 1800℃, and 2000℃ can be realized; a down payment is required for customisation.

–Contact angle measurement in vacuum environment or different gas environments can be realized; a down payment is required for customisation.

–Sample chamber:

Sample can be kept completely stable and free from effect of temperature and light dazzling; a down payment is required for customisation.

–Sample chamber for measurement of high–temperature interface tension:

Method of pendent drop or sessile drop is used for measuring interface tension between melted solid materials and air; a down payment is required for customisation.

2.Full set of syringes and needles.

– Full set of high–precision micro syringes: 25μL, 100μL, 500μL, and 1000μL, etc.

– Full set of needles: PTFE, stainless steel (various OD such as 2mm, 1mm, 0.5mm,0.3mm, 0.23mm,etc.), plastic, and curved needles for captive drop method etc.

3.Software–controlled dual–channel syringe pump of high–precision

4.Special sample holders for holding fiber, film and paper etc.

5.Sample vessel made of quartz glass for captive drop method and pendant drop in interface tension measurement

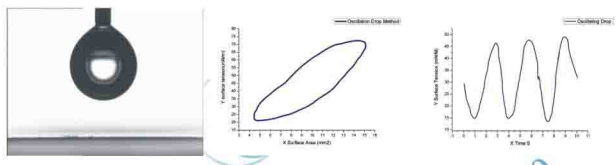
6.Module of oscillating drop method (interface rheology ODM/EDM)

(1)The leading–edge high–frequency oscillator and oscillation control system designed by USA KINO enable higher control precision and more flexible control mode. Oscillator with different oscillation frequencies and amplitudes is available at your option.

No.	Oscillation amplitude	Max. oscillation frequency
1	2μL	100Hz
2	10μL	100Hz
3	10μL	60Hz
4	20μL	60Hz

(2)Optional sample dosing syringe: 0.5μL, 1μL, 5μL, 15μL, 100μL, 500μL and 1,000μL etc.

(3)The Oscillation waveforms cover sine wave, cosine wave, triangular wave, linear wave and saw tooth wave without attenuation or distortion when below 2K Hz.



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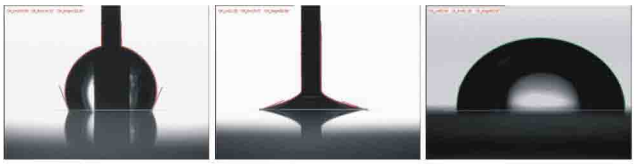
Actual Measurement Examples of CAST® 3.0 Image Analytical System

1.Advancing/receding contact angles analysis

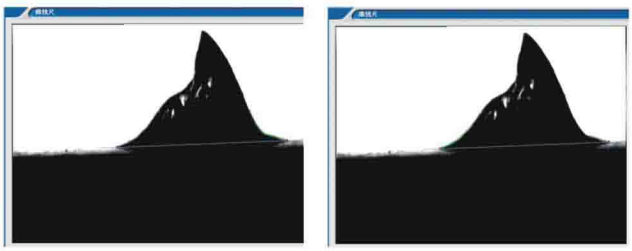


Analyzing methods used in Chart 1: circle fitting, spline fitting, and conic curve–fitting

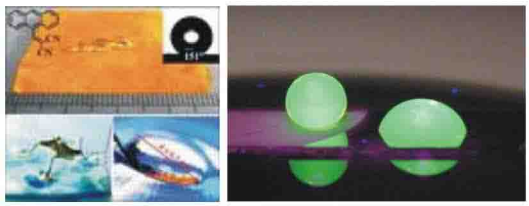
It is recommended to purchase syringe pumps or peristaltic pumps for advancing/receding contact angle measurement. There are two ways of forming advancing / receding contact angles as shown above: (1) by increasing / reducing droplet volume; (2) by tilting sample stage.

2.Irregular contact angles analysis (Asymmetric drop shape or drop without apex)

The photo shows actual result of silica gel test, in which the contact angle values are calculated by curve ruler fitting technology. The fitting factor is above 90%.



Analytical method used in chart 2: spline curve fitting method



Special Statements

1, The above pictures and technical specification are subject to change without notice, and the latest confirmed product information shall prevail.

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State of the art interface chemical analytical instruments from USA KINO provide you professional solutions. For more information, please visit
http:// www.uskino.com www.kinochina.com

Kino

USA KINO Industry Co.,Ltd

Strategic Investment Company: Shanghai Solon Information Technology Co.,Ltd
E–mail: sales@uskino.com
sales@kinochina.com