Kino

SL200HP

High Pressure & Temperature Optical Contact Angle Meter/ Interfacial Tensiometer / Interfacial Rheometer

– Max Pressure 100MPa Temperature range:-30-200℃

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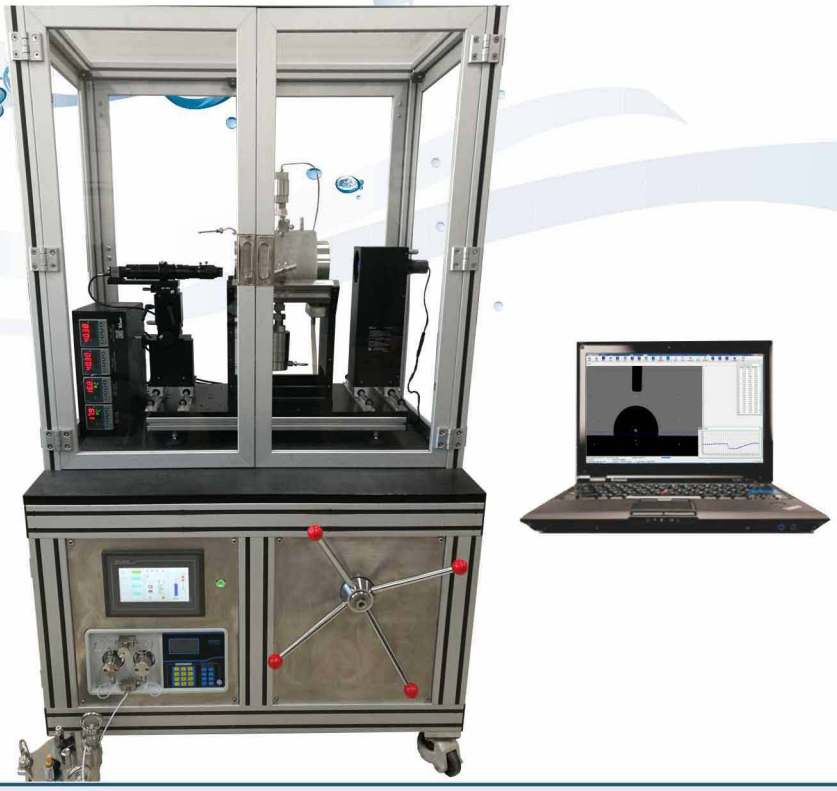


Drop shape analysis system model SL200HP is designed for measurement of contact angle, surface tension (liquid–gas) or interfacial tension (liquid–fluid) under such special conditions as ultra–high pressure (max 100Mpa) and high temperature (max 200℃) . Thanks for its heating cell for such viscous sample as crude oil, SL200HP is the only instrument that can be used for application of tertiary oil recovery (EOR) especially for measurement of interfacial tension between ASP–crude oil. With constrained sessile drop method, IFT lower to 0.001mN/m can also be measured by ADSA–Realdrop method. With special air connect port, surface tension or interface tension under CO_2 can be measured too.

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

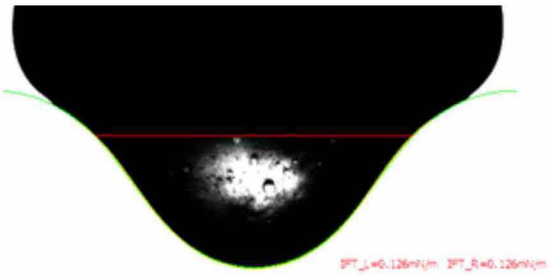
$$\sigma\cdot\left\{\frac{1}{R_1}+\frac{1}{R_2}\right\}=\sigma\cdot\left\{\frac{\sin\phi}{X}+\frac{1}{R_1}\right\}$$

Measurement of contact angle /surface tension under ultra–high pressure and high temperature environment

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.

1. Contact angle measurement: The drop formed under high pressure is usually shaped into an approximate ellipsoid in 3D due to its gravity, hence we adopt Young–Laplace equation fitting technology (ADSA®–RealDrop) to fit its shape in 2D, and then calculate its contact angle between liquid drop and solid under gas or fluid surroundings.

2. Surface tension measurement under pressure and high temperature: For drop under high pressure and high temperature, its surface chemical properties can be characterized by its drop shape profile; hence we here analyze it using Young–Laplace equation fitting method (ADSA®–RealDrop) via sessile drop method; volume and surface tension can be calculated then by pendant drop, sessile drop or constrained sessile drop method. And then, Interfacial rheological properties can also be achieved.

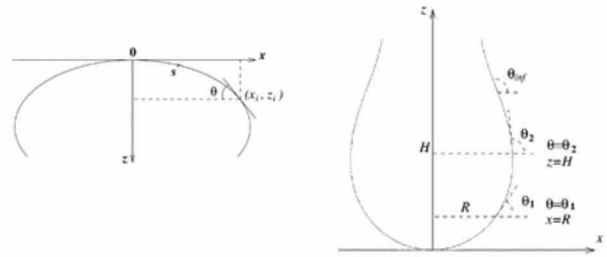


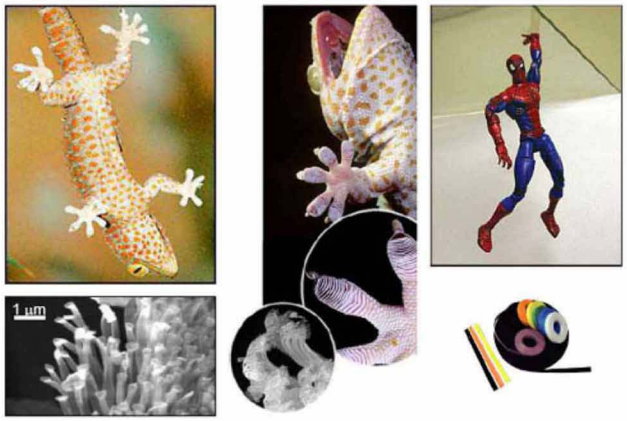
Drop Shape Analysis System CAST 3.0 – Young–Laplace Equation fitting and ADSA®

First, single or several dynamic images of drop/bubble are captured for us to analyze its key information like drop shape edge and geometric dimension via sub-pixel image recognition technology; By inputting some important parameters like density, gravitational acceleration, magnification and others, we compare and fit the real drop shape profile with theoretical curve generated by sophisticated mathematical analytical models (such as circle, ellipse, polynomial, spline curve and especially Young-Laplace equation fitting) using least square method; and finally surface tension of liquid-gas, interface tension of liquid-liquid, contact angle of solid-gas/liquid-liquid-solid are calculated.

Our great achievement is: initiating ADSA® based Young - Laplace equation fitting method and apply it into analysis of interfacial chemical properties after our 3 decades endeavor.

$$\gamma\left(\frac{1}{R_1}+\frac{1}{R_2}\right)=\Delta\rho g z+\frac{2\gamma}{b}$$





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

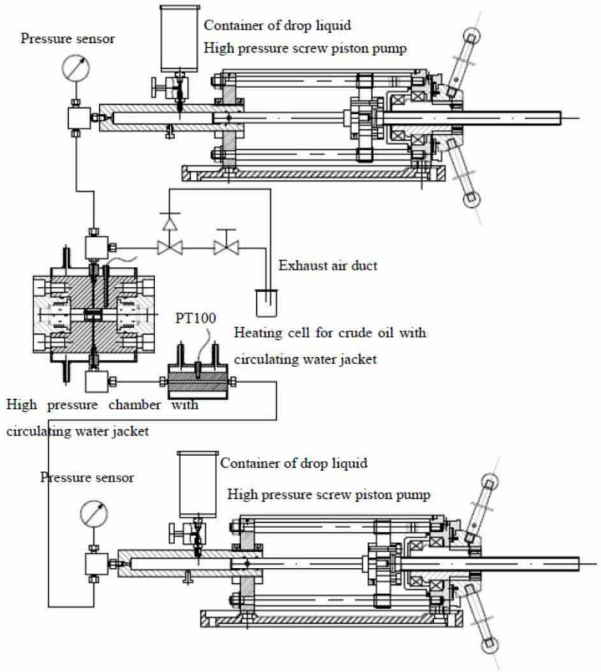
Typical fields of application

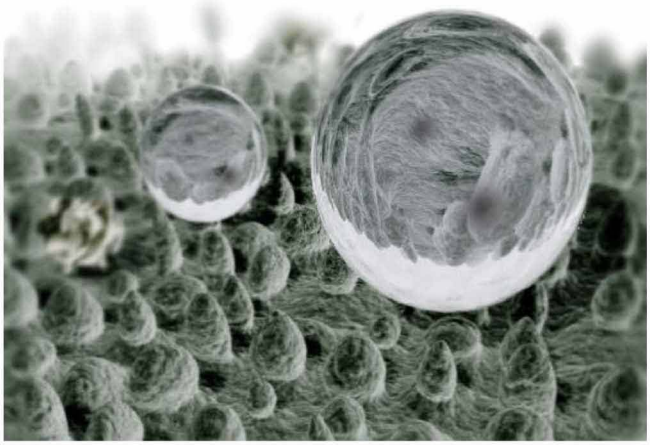
– Oil field especially for tertiary oil recovery such as develop ASP or SP flooding or CO_2

– Evaluating value of surface tension, interfacial tension or contact angle for surfactant or field of developing advanced material via pressure (–70Mpa) and temperature (–30–200℃)

– Detergent ~ surfactant's absorbing speed, property, discussion of proper concentration

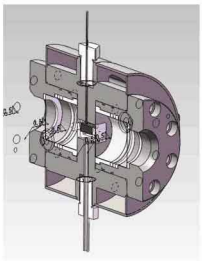
Schematic Draw of SL200HP





Performance Features

High-pressure and high temperature chamber - More professional and safety



→ chambers of different pressure (10M Pa, 30M Pa, 50M Pa, 70M Pa or more) are provided to meet special requirements under different ultra–high pressure;

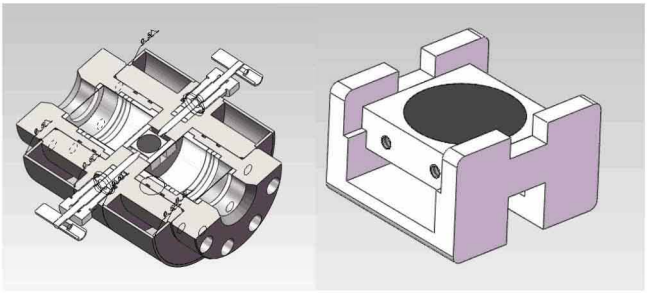
→ Temperature range can be –30–200℃ with circulating water jacket that connecting to a refrigerated–circulator or heating circulator to control temperature;

→ Easy to change the tube and needle and easy to clean the chamber to avoid cross contamination that may affect result

→ Exclusively provide a heating cell for crude oil to measure interfacial tension between ASP–crude oil;

→ Provide quick connector for Co_2.

6、Movable sample holder and changeable position of drop forming guarantees measurement of contact angle at different place.



Mechanics–professional and easy to operate

→ Mechanics of three-axis precision positioning stages for lens control provide you clearer imaging and more accurate imaging position;

→ Lens tilt control and level control of chamber facilitate determining baseline between melt and solid and easy to get a vertical needle.

→ Tilted unit for adjusting vision angle of parallel background light to promise a good drop shape.

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

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

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Clearer and higher speed vision system

→ Advanced drop shape profile lens and parallel background light ensures sharper imaging and clearer drop image edge;

→ Continuous zoom industrial lens with magnification of 0.35 – 4.5X enables larger VOA, suitable for samples of varies volumes;

→ Lens with long working distance (180mm) effectively protect vision system from high temperature;

→ World highest speed camera from Germany can reach 87FPS (WVGA)-340FPS (GIF)

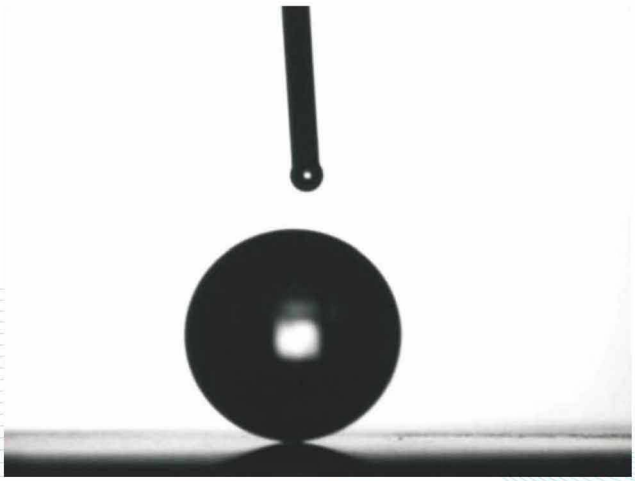
World Leading, More Powerful, Automatic and Ergonomic Analytical Software– CAST®3.0 – RealDrop® method based on ADSA®

(1) Wider fields of applications

It can be used to measure surface / interface tension and contact angle by sessile drop method and captive bubble method as well as surface / interface tension of liquid–gas / liquid–liquid by pendant drop method.

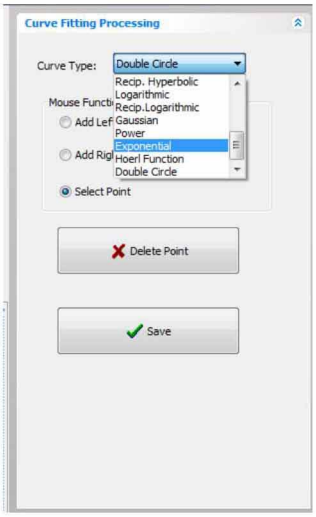
(2) Higher measurement accuracy

RealDrop® method is quite different from select plane based Young–Laplace equation fitting method, which adopts AFLI and 4th generation RealDrop® technology and achieves higher measurement accuracy without any experience calibration value.



(3) Unique interface tension measuring system of liquid–gas / liquid–liquid with Young–Laplace equation fitting method based on Bashford–Adams table, ADSA® (Runge–Kutta arithmetic and Realdrop® method) and capillary pressure method. It can be used for surface tension measurement of medium–high viscosity sample, dynamic surface / interface tension measurement of surfactant, and oscillating drop measurement.

(4) Powerful analytical functions



→Six drop shape states for analysis: sessile drop (liquid/gas, liquid/liquid/gas), pendant drop, captive drop, tilted plate and oscillated drop

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

–Exclusive methods of θ/2, circle fitting, ellipse fitting, RealDrop®, spline curve–fitting, Young–Laplace

equation fitting, curve ruler (tangent method);

–Dynamic / static contact angle measurement

–20 exclusive curve ruler methods, such as circle, spline, Gaussian and power.

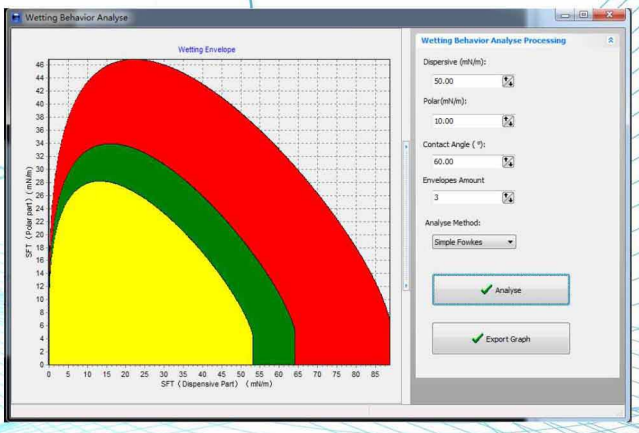
→ Twelve surface free energy calculating models, providing you more options to estimate surface free energy and its distributions.

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 free energy and its distribution (dispersive force, polar force and hydrogen bond value, and Lewis acid–base, etc.) of low / high energy solid surface.

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

A 2D map of wetting envelope can be constructed by analyzing components of surface free energy with 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 from perspective of force existing in the material and between the materials to understand.

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



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

(5) Automatic, human–oriented and high–precision function design

→ Standardized windows technology based video capture technology with better compatibility.

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

→ Real–time images analysis

It can be used to automatically analyse time–dependent interface tension/contact angle/volume/wetting line, and image is one–to–one correspondence with data for you to conveniently analyse measured value at any time.

→ Auto base line detection and curved surface base line correction

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

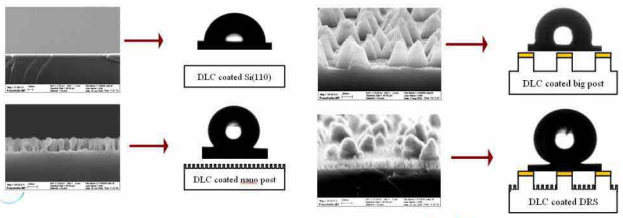
→ Dual–Software Triggering Technology for analysis of complicated dynamic/static contact angles.

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.

→ More comfortable software user interface:

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

– Unicode based software interface. Its English user interface can easily be changed between different languages (such as Simplified–Chinese), which makes it more convenient to operate.



→ Full automatic analysis of contact angle, adhesive work and surface free energy:

– Fully automatic. Just press “Measure”, images capture, contact angles calculation, data storage and real–time measured value display will be done without manual operation.

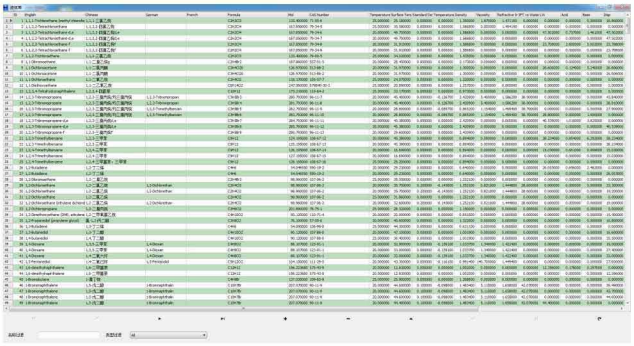
– Manual modification function. Double–click ” Modify”, you can modify measured value by captured image, and software saves the record of operation trace conveniently to avoid errors of automatic measured values.

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

(6) Powerful database management

→ Most comprehensive liquid database

We provide 300 kinds of liquid with 800 data values of liquid surface tension and its contributions as reference data or for faster analysis of surface free energy of solid.



→ Powerful database management for convenient storage, query, and export of 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

– Import and backup of historical data

– Database compression

– 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.

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Technical Specifications

Specification will be changed while changing of design, please chech out the last version of specification from us

			SL200HP
Hardware	High Pressure Chamber		10MPa, 30MPa, 50MPa, 70MPa for you choosing
		Max Pressure	–70MPa (Depends on the system you choose, Higher pressure system for option)
		Temperature control method	Provide a jacket to thermostat by external bath
		Max temperature	200℃
		Temperature Range	–30–200℃ (Depended on refrigerated–circulator that selected)
		Windows material	Sapphire (above 50MPa) or explosion–proof glass Sn6 ((below 30MPa)
		Windows ID	≈45mm
		Material of Chamber	Stainless steel (Hastelloy C276 for option)
		Internal volume	About 39*25*40mm 40mL
		Pressure Reading	A digital pressure meter and pressure sensor. Resolution: 0.01MPa, Accuracy: 0.25, Max pressure: 80M Pa, Interface: RS485
		Movable Holder	2 thimbles for moving solid sample to measure contact angle at different positions
	Heating Cell (For crude oil)	Main Function	Standard provide to heat sample with viscosity such as crude oil
		Temperature control method	Provide a jacket to thermostat by external bath
		Max temperature	200℃
		Temperature Range	–30–200℃ (Depended on refrigerated–circulator that selected)
		Temperature sensor	Pt100 with resolution 0.1℃
	High pressure screw piston pump	Main Function	To form a drop in air (one pump) or form a drop in fluid (two pump)
		Control method	Manual (Automatically pump for option)
		Max pressure	80MPa
		Drain port	Provided with a drain port at the bottom of the chamber
		Max volume of container	100mL
		Value and tube	Made of stainless steel for high pressure system
	Control of vision system	3 axis positioning stage	Positioning stage of XY axis with travel range 60mm and accuracy about 0.01mm, positioning stage of Z axis with travel range 13mm and accuracy 0.01mm.
		Multi–axis positioning stage	For levelness adjustment of vision system with micrometer
		Tilted positioning stage	For adjusting tilted angle of parallel background light
	Dimension and weight	Dimension of Main body	90(L)*35(W)*90 (H) cm
		Weight of Main body	65kg
		Dimension of piston pump	18(L)*90(W)*60 (H) cm / per unit
		Weight of piston pump	34kg / per unit

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

State of the art interface chemical analytical instruments from USA KINO provide you professional solutions. For more information, please visit
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