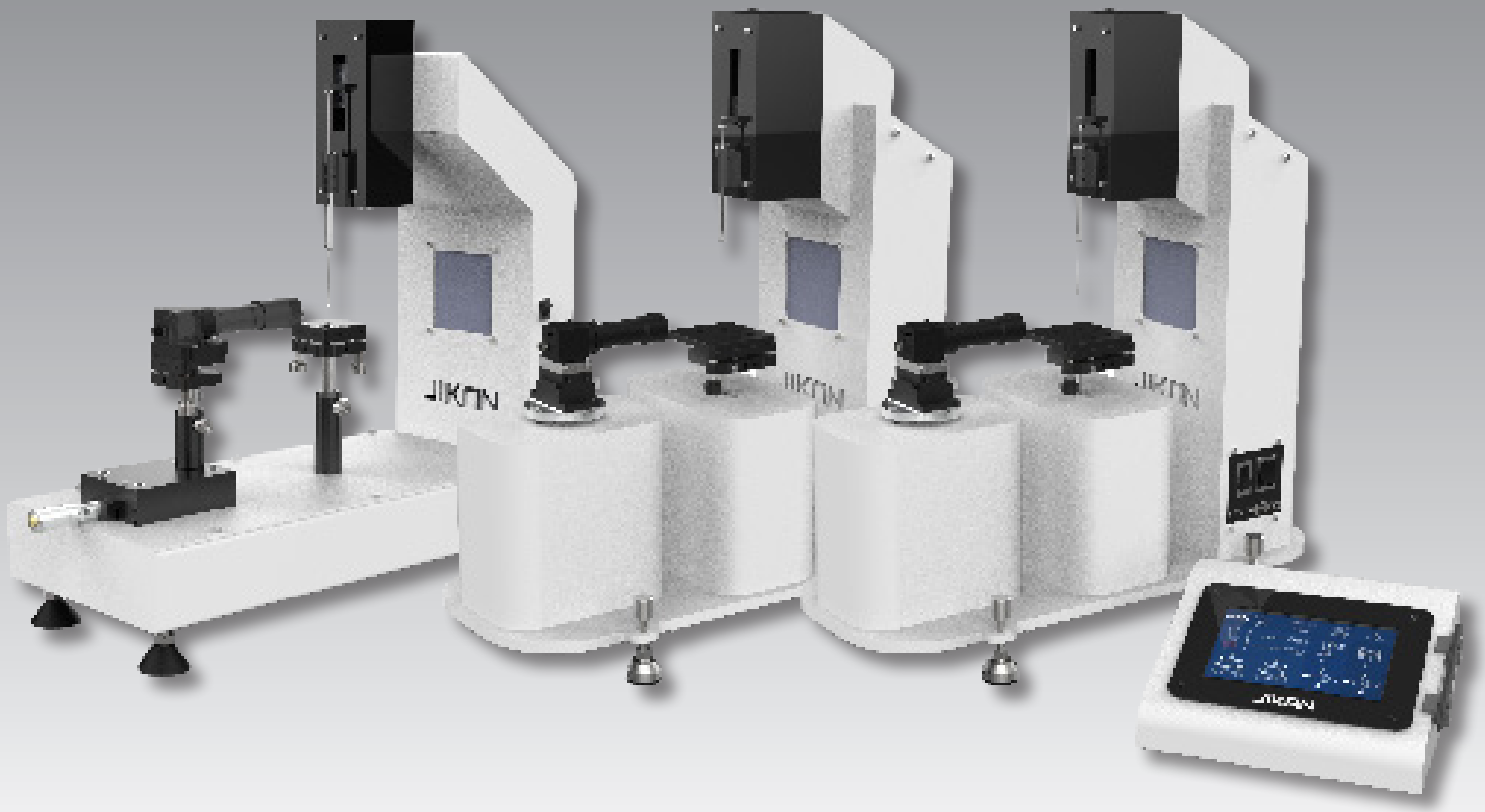
JIKAN

www.jikangroup.com

CAG Series

Contact Angle Goniometer



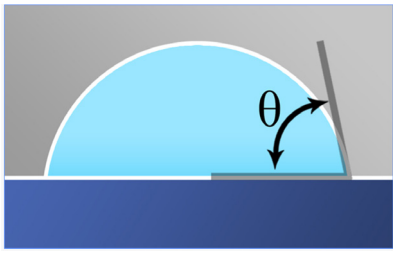
Static and dynamic contact angle measurement • Surface tension measurement • Software with 2 years of updates • Modular system with interchangeable syringe • High-speed camera with telecentric lens • Custom solutions tailored to customer needs

Jikan CAG Series

Jikan contact angle goniometer is a drop shape analyzer. By placing drops on test samples and taking images, the CAG device calculates the wettability and surface free energy of the solid surface.

What is contact angle?

Consider the system shown below consists of liquid, solid, and gas phases. The intersection of solid, liquid, and gas phases is called the contact line. The angle formed between the liquid-solid and liquid-gas interfaces is called the contact angle.



On an ideal surface (smooth and homogeneous), the static and dynamic contact angles are equal.
On a real surface, the contact angle varies from a maximum (advancing) to a minimum (receding). The difference between advancing and receding contact angles is called the contact angle hysteresis.

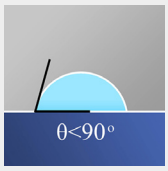
Contact angle hysteresis determines the required force to shed a drop from the surface. Therefore, lower contact angle hysteresis signifies easier drop detachment.

Surface Classification

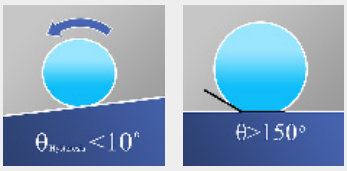
Water and oil represent two classes of liquids, i.e. polar and non-polar.

If the contact line moves during the measurement, the contact angle is referred to as dynamic contact angle. Otherwise, the angle is called static contact angle.

Water

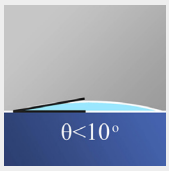


Hydrophobic



Superhydrophobic

Hydrophilic



Superhydrophilic

Oil

Oleophilic

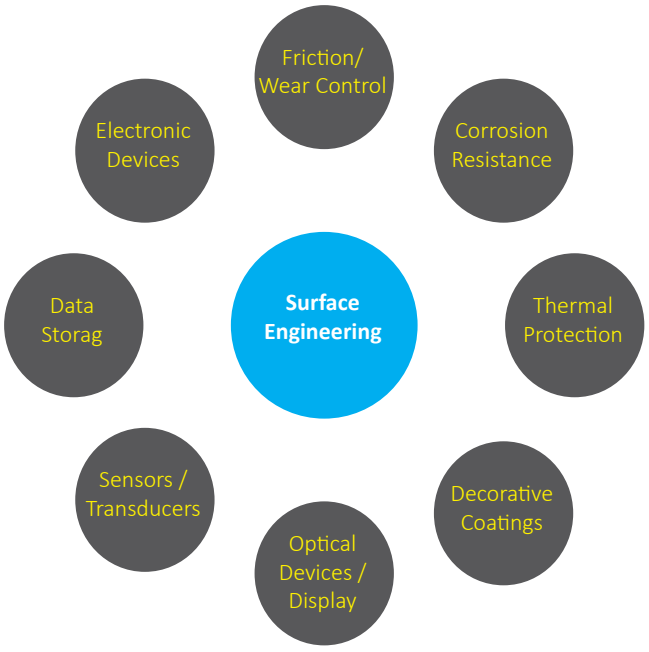
Oleophobic

Engineered Surfaces Application

Superhydrophobic surfaces are self-cleaning as water drops easily bead up and roll off on these surfaces. As drop rolls off, it collects dust and dirt, and carries them out. The superhydrophobic surfaces have various applications, e.g. drag reduction, corrosion inhibition, and heat transfer enhancement.

Superhydrophilic surfaces have applications in medical implants for biocompatibility improvement, anti-fog and anti-fouling applications and so on.

Oleophobicity has a wide application in self-cleaning paints, materials, glass and clothing.



Direct vs Indirect

In order to measure the contact angle there are two general methods:

- Indirect methods find the contact angle by measuring the force (e.g. the Wilhelmy Plate method). Direct methods find the contact angle from the image (e.g. the Sessile drop method).
- The direct methods are more common as they have higher precision and require less volume of liquid.
- The sessile drop method and the tilting plate method are the main two techniques to measure dynamic contact angles.
- In the sessile drop method, the droplet is firstly injected on a horizontal sample, the injection continues and contact angle is measured during the contact line motion (advancing contact angle). The reverse procedure is used to measure the receding contact angle. For a smooth and homogeneous surface, the surface free energy could be calculated by the equation of state, through the sessile drop method.
- In the tilting plate method, after the formation of the drop is formed on the surface, the stage (with the sample) starts to tilt. As soon as the drop starts to slide on the tilted surface, maximum (advancing) and minimum (receding) contact angles are recorded.

Measurment Methods

*Available with CAG-20
**Available with CAG-20 upon request

Jikan CAG Series

The Jikan Contact Angle Goniometer Series offers precise, innovative tools for surface and interfacial analysis, ensuring accurate and reliable results.

These goniometers measure contact angles and surface tensions with semi-automatic and automated features, making them ideal for labs and scientific research. Researchers can rely on them for consistent, meaningful data.

Our goniometer series incorporates advanced features such as automatic leveling, triple injection systems, and modular lighting and imaging, all designed to deliver exceptional quality and user flexibility.

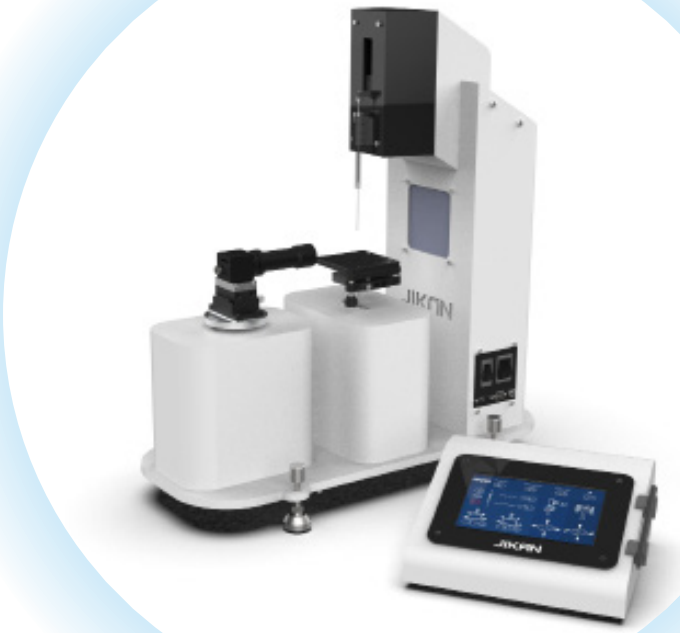
The streamlined assembly improves usability, making these instruments ideal for diverse research applications.

Discover precision and innovation with the Jikan Contact Angle Goniometer Series, where advanced technology ensures reliable performance for your research needs.

Adjustable camera and sample holder

Violet and adjustable intensity light

Vibration free, accurate and reliable injection system



Computer-controlled injection system

Changeable syringes

Levelable sample holder

High speed, noise-free imaging system

Changeable camera back to front angle

Image Processing Software

The Jikan Assistant is the exclusive software for the Jikan CAG series. With the Jikan Assistant, you can control all device hardware, read environmental data, capture images and record videos of experiments, and measure properties such as contact angles, surface, and interfacial tensions.

1

Image Processing

Users can choose from polynomial fit, circle fit, and ADSA to measure contact angles. Contact points can be found automatically, or users can select them manually. Live processing is available for rapid result evaluation, and comprehensive data analysis can be performed offline.

2

Hardware Control

Through hardware control, users can adjust the height of the sample stage and camera at different elevation rates. The injection rate can be set to recommended values for static and dynamic measurements, as well as surface tension analysis. Users can also monitor and record pressure, temperature, and relative humidity within the software.

3

Results Appearance & Data Analysis

The Jikan Assistant displays collective data in both table and graph forms, along with live analysis. Data, images, and videos can be saved separately, allowing for re-analysis at any time.

4

Imaging Adjustments

users can adjust frame rate, exposure time, image resolution, and illumination to obtain optimal results.

Mechanical Advantages

The robust design of the Jikan CAG-series, crafted with a durable material body, effectively reduces mechanical vibrations while significantly improving overall stability., ensuring precise measurements and reliable performance even in demanding environments.

Additionally, its robust construction guarantees longevity, making it an ideal choice for professionals who prioritize accuracy and durability in their equipment.

1 **Camera Back to Front Tilt**

This feature enables the user to see the reflection of drop and measure the contact angle accurately. The reflection is also needed to automatically detect the contact points. The tilt is engineered so that it does not produce any error in contact angle results.

2 **Stage Leve**

To test uneven samples, stage level enables the user to find a horizontal spot on the sample using this feature.

3 **Adjustable stage**

In order to achieve maximum flexibility, Jikan CAG-20 stage has the ability to be adjusted in vertical and horizontal directions. This enables the user to test samples with maximum size of 25×60×150 mm.

4 **Dispatchable Syringes**

The syringe could easily be dispatched from the system so the fill-in, discharge and probable washing process could be easily done. The user can fully replace the syringe and its holder with syringes of different sizes.

5 **Injecting System**

Our contact angle goniometer features an automatic, software-controlled injection system with interchangeable syringes, offering both precision and flexibility for various testing needs.

Imaging and lighting systems

To ensure precise angle measurement, the system's components are chosen from top-quality models and brands. The camera, with a 60 fps optical capability, utilizes a USB 3.0 connection for optimal data transfer speed. Its field of view fully encompasses the droplet area with exceptional accuracy. The Jikan CAG-20 imaging system employs advanced droplet imaging technology, effectively reducing perspective errors.

Imaging system 1

Imaging system plays a crucial role in the contact angle measurement, so the components of the system are selected with the highest quality models and brands. The camera features a 60 fps optical rate connects via USB 3.0 for optimal data transfer speed. The field of view completely covers the droplet area with a great accuracy. Jikan CAG-20 imaging system employs advanced imaging of the droplet which minimizes the perspective errors.

Minimizing Perspective Error 2

Perspective errors can result in inaccurate measurements. To mitigate this problem, we utilize a telecentric lens. This advanced optical solution effectively eliminates distortion, providing a reliable means for accurate measurement.

Lighting system 3

Proper lighting is a necessity to achieve an appropriate image of the droplet. Jikan CAG-20 uses a 450-nm lighting system to minimize the errors caused by ray diffraction. The intensity of the light is also easily adjustable by the user via the software.

Image processing software 4

Jikan CAG-20's Image processing software is completely automatic and needs no additional data for measurement. The software implements both Young-Laplace, and polynomial curve fittings.Surface energy algorithm is based on equation of state and contact angle values. The image processing software employs advanced and unique image processing algorithms with the sub-pixel resolution to find the actual contact point with minimum error.

Technical Specifications

Specification	CAG-10	CAG-20 SE	CAG-20 PE
Measuring Range | Inaccuracy	0°-180° | ±0.1°	0°-180° | ±0.1°	0°-180° | ±0.1°
Camera System	Pixel Depth: 10 bit Progressive CMOS Sensor |Global Shutter 60fps Optical Frame Rate 1280×1024 Pixels | Pixel Size: 5.3 µm×5.3 µm USB 3.0 | Video Sequences	Pixel Depth: 10 bit Progressive CMOS Sensor |Global Shutter 60fps Optical Frame Rate 1280×1024 Pixels | Pixel Size: 5.3 µm×5.3 µm USB 3.0 | Video Sequences	Pixel Depth: 10 bit Progressive CMOS Sensor |Global Shutter 60fps Optical Frame Rate 1280×1024 Pixels | Pixel Size: 5.3 µm×5.3 µm USB 3.0 | Video Sequences
Optics	±1mm Working Distance Tolerance	±1mm Working Distance Tolerance	±1mm Working Distance Tolerance
Camera Back To Front Tilt	Manual	±10°	±10°
Lighting System	450nm Wavelength | No Heat LED	450nm Wavelength | No Heat LED	450nm Wavelength | No Heat LED
Camera | Sample Holder Positioning	Manual X & Z Direction Move Manual Z Direction Move	Motorized X & Z Direction Move | Motorized Y & Z Direction Move	Motorized X & Z Direction Move | Motorized Y & Z Direction Move
Position Adjustment Stroke | Accuracy	Manual	2.5 cm | ±100 µm	2.5 cm | ±100 µm
Input | Power Supply	USB 3.0 | 110/220 V, 50 W, AC	USB 3.0 | 110/220 V, 50 W, AC	USB 3.0 | 110/220 V, 50 W, AC
Jikan Assistant Software	Contact Angle & Surface Tension Measurement Module Included (Optional Surface Free Energy Measurement)	Contact Angle, Surface Tension & Surface Free Energy Measurement Module Included	Contact Angle, Surface Tension & Surface Free Energy Measurement Module Included
Computer Requirements	OS: Windows 8, 8.1, 10 (32-bit & 64-bit) CPU: Intel Core-2 Duo @ 1.3 GHz or Higher RAM: 1GB or Higher Disk Space: 2 Gb	OS: Windows 8, 8.1, 10 (32-bit & 64-bit) CPU: Intel Core-2 Duo @ 1.3 GHz or Higher RAM: 1GB or Higher Disk Space: 2 Gb	OS: Windows 8, 8.1, 10 (32-bit & 64-bit) CPU: Intel Core-2 Duo @ 1.3 GHz or Higher RAM: 1GB or Higher Disk Space: 2 Gb
Dispenser	Automatic Dispenser Nanoliter Resolution	Automatic Dispenser Nanoliter Resolution	Automatic Dispenser Nanoliter Resolution
Hardware Control	PC via Jikan Assistanst	PC via Jikan Assistanst (Optional 7" Touch Control Pad)	PC via Jikan Assistanst | 7" Touch Control Pad
Weight	12 kg	13 kg	15 kg
Size	60 cm×25 cm×55 cm	55 cm × 30 cm × 50 cm	55 cm × 30 cm × 50 cm

Accessories

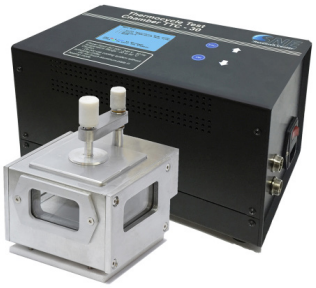
Our contact angle goniometer device can be equippedwith three key accessories, each designed to boost its precision and versatility, enabling users to perform a wide range of experiments with greater accuracy and control, whether in controlled environments, varying conditions, or intricate surface interactions.

1 Captive Bubble Chamber

This module is designed to measure the Young, advancing and receding contact angle of bubbles, rather than of drops.

2 Environmental Chamber

This chamber allows the user to adjust the temperature and humidity from -30°C to +90°C, and 0% to 100%, respectively. The chamber is able to do the standard thermocycle tests to evaluate the durability of superhydrophobic, icephobic or any other coatings.



3 Touch Control Pad

The Touch Control Pad helps with easy control over the device's functionalities, allowing users to seamlessly navigate menus, adjust settings, and interact with applications with just a swipe or tap, enhancing the overall user experience with intuitive and responsive feedback.

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