

DropMaster



Microscopic Contact Angle Meter

Contact Angle & Surface Free Energy

MCA-4

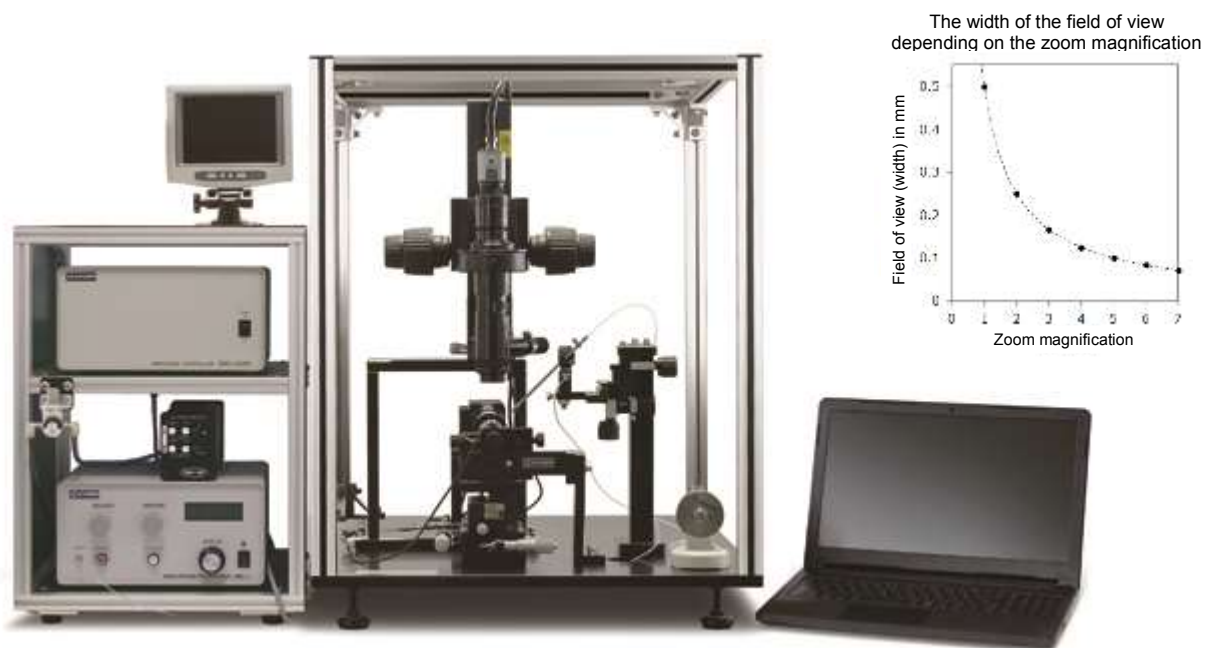
Wetting behaviour in nanotechnology

The patterns to be designed on silicon wafers and glass panels have become more and more miniaturized thanks to the technological development. The increasing demand for studying the wettability on miniaturized areas during the past few years, has led us to the development of our Microscopic Contact Angle Meter MCA.

With the development of a special capillary with an inner diameter of only 5 μm , it is possible to generate droplets with a volume as low as 10 pL, and the use of high-quality optical components assure the precise measurement of contact angles even at high magnifications.

The top-view camera monitors the surface of the solid substrate and tip of the capillary, which makes it easy to deposit tiny droplets with pin-point accuracy onto miniaturized areas such as on microelectronic components, micro-grooved surfaces or single fibers.

Using the sophisticated technology of our MCA-4 allows for reliable measurement of contact angles with high reproducibility, and for the evaluation of the wettability on micro-areas within the width of 100 μm .



Features

- Automatic recognition of drop deposition by FAMAS analysis software
- Top view camera allows for deposition of droplets with pinpoint accuracy and for observation of the spreading of micro-droplets
- The high magnification lens and a 12-fold zoom provide a field of view from approximately 75 x 56 μm to 910 x 680 μm
- Fine adjustable micro stage in x-, y- and z-axis for exact positioning
- Fast image capture system with max. 1,000 fps allows accurate measurements of even quick evaporating picoliter droplets
- Droplet calibration standard bearing three sets of one full circle for calibration and three droplet silhouettes of 5°, 60° and 108° for periodic inspection of measurement accuracy

Applications

- Miniaturized areas such as of silicon wafers, OLED panels, electronic components, printed circuit boards, etc.
- Very thin wire materials such as single fibers, hairs, filaments, etc.
- Defined locations on the surface of tiny samples
- Ink at very small droplet volume (emitted from an ink-jet head)
- Other or micro-structured areas where conventional methods and droplet volume are not applicable

Measurement



The MCA-4 utilizes a precise electric micro-injector system and a high-quality optical system for accurate contact angle measurements of micro droplets on small surface areas of only 100 x 100µm.

With special capillaries available with three different inner diameters, micro-droplets in the range from about 10pl to 1nL can be produced with high reproducibility.

This state of the art system is equipped with an additional top-view camera that enables the deposition of droplets with pinpoint accuracy and the observation of the three-phase line and the spreading of micro droplets on solid surfaces.

■ Hard drive read-write head

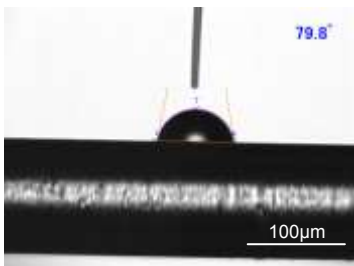


■ ROM circuit



■ Example of Measurement

Contact angel measurement of a water droplet on a human hair.



■ Example of Observation

Observation of the wetting condition inside cells of an OLED panel with respect to homogeneous three-phase lines of water droplets.

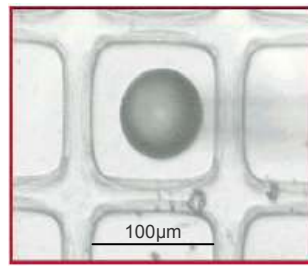
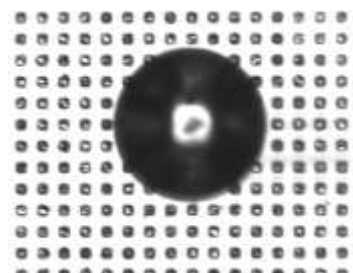
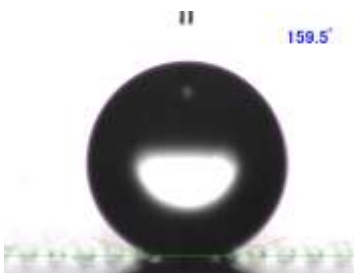


Image showing a homogeneous three-phase line



Image showing an inhomogeneous three-phase line

■ Contact angle measurement and top-view observation of an 1.7nL water droplet on superhydrophobic pillar surface



Analysis System FAMAS

■ Measurement of Contact Angles

The analysis software FAMAS enables highly reliable measurements of contact angles using different methods such as $\theta/2$ (height-width), tangent, ellipse & circle fitting.

The focusing aid with index graph and value displayed in the image screen helps operators to achieve perfect focus, and the black & white threshold level to determine the binary image can be adjusted before and after measurement to optimize droplet analysis.

Measured results are displayed in a spreadsheet-like table for easy reference and comparison, and a movie converter converts measurement data images to MPEG or AVI movie formats.





■ Analysis of Surface Free Energy of Solids

Solid surface free energies and their polar and dispersive components are analyzed from the results of contact angle measurements with different probe liquids.

The software provides theories from different authors such as Geometric mean, Harmonic mean, and acid-base, Interaction analysis (Work of Adhesion, Interfacial Free Energy), Young-Dupré, and Zisman plot.

An optional kit with 5 probe liquids and a set of needles is available to easily start measurements of surface free energies according to the desired theory.

Specifications

MCA-4	
Camera system	USB 3.0 CCD camera with: 400fps at 640x480 pixels 500fps at 640x400 pixels 1000fps at 640x200 pixels
Optical system	Primary magnification (PMAG): 5.3 to 64 times (manual focus with a 12-fold zoom lens) Field of view: 75 x 56 μm to 910 x 680 μm $\pm 5\%$
Measuring methods	Sessile drop
Analysis methods	Contact angle: $\theta/2$ (height-width), Tangent, Curve fitting (ellipse, circle) Surface free energy of solids: Owens-Wendt, Kaelble-Uy, Kitazaki-Hata, Wu, Acid-base, Zisman
Measuring range	0 to 180 ° (depending on sample and environmental conditions)
Display resolution	0.01 °
Sample stage size (WxD)	50 x 25mm
Stage travel range	X-axis: 25 mm by manual micrometer Y-axis: 25 mm by manual micrometer Z-axis: 15 mm by manual micrometer
Approximately droplet size	Diameter: above 40 μm Volume: 10 μl to 1 nL
Measuring temperature	Standard: Ambient Option: Jacket type temperature-controlled (+10 to +60 °C)
Dimensions (WxDxH)	Main instrument: 550 x 620 x 700 mm Controller rack: 420 x 320 x 323 mm Installation area: 1000 x 650 x 720 mm
Approximately weight	Main instrument: 50.0 kg Controller rack: 15.0 kg
Utilities	Clean dry and oil-free pressurized air or N ₂ gas at 0.4 to 0.7 MPa
Power supply	AC 100 to 240 V, 5.0 A, 50/60 Hz
Operating environment	Temperature: +10 to +35 °C, humidity: 30 to 80 %RH (non-condensing) Positioned away from sources of electrical noise and vibration

Standard Components

- Main instrument composed of horizontal & vertical camera assembly, LED light source, manual micro-positioning sample stage, micro-manipulator, micro-dispenser system and control box
- Analysis software FAMAS
- Standard accessories: 2 sets of capillaries (25 pcs. each)
1 droplet calibration standard for calibration and periodic inspections

For detailed information, please contact our sales partner or us directly at +81-48-483-2629 or at overseas-sales@face-kyowa.co.jp.

Specifications and designs are subject to change without notice.

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