BP-D5

Automatic Dynamic Surface Tensiometer (Bubble Pressure Method)

Why is the dynamic surface tension required?

"The surface tension was properly low, but the wetting result was insufficient during the coating process." Have you ever faced this dilemma?
For instance, coating agents generally include surfactants to control their wettability to materials by lowering surface tension, and the surfactants can adsorb toward the solution surface gradually, changing the surface tension of the solution over time. Thus, surface tension has to be studied in the function of time if the target solutions include surfactants.
The widely-known Wilhelmy plate method and du Nouy ring method measure surface tension under conditions where the surfactant adsorbing has equilibrated, called Static Surface Tension. But coating solutions constantly change, with surfactants continually adsorbing to new surfaces and bulking up as micelle. In such conditions, the speed at which surface tension drops becomes essential via the time function Dynamic Surface Tension. The BP-D5 allows measuring Dynamic Surface Tension with its Bubble Pressure technique.

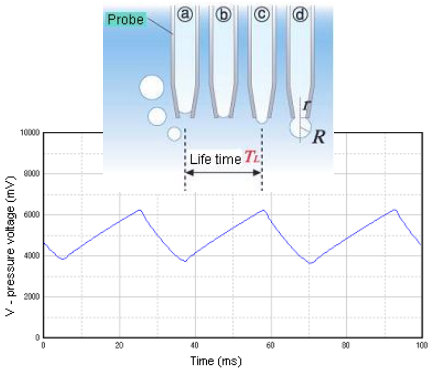
Functions

- Lifetime*1 can be changed automatically to draw variations over time in a single process.
- Real-time display of the bubble pressure waveform for monitoring the bubble generation.*2
- One-touch adjustment of the probe's immersion depth and start of the measurement.

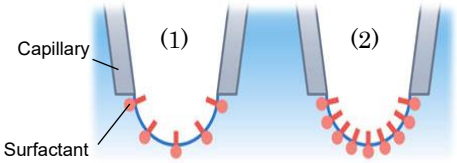
*1: Please refer to the lifetime explanation on the next page under the Measurement Principle.
*2: The stability of the bubble generation is essential for accurate measurement, which the waveform displays.

Measurement Principle

When pressurized air flows constantly through a capillary, the pressure inside the capillary changes in a regular cycle. → (a) to (d).
When the radius of the bubble curvature R equals the radius of the capillary outlet r, the pressure will reach its maximum. → (c)
The cycle from (a) to (c) is called lifetime or surface age.
Then, the bubble size increases quickly while the bubble pressure decreases until the bubble finally detaches from the capillary. → (d)
The cycle from (c) to (d) is called dead time.
A new bubble forms and a new formation cycle begins from (a) to (d).



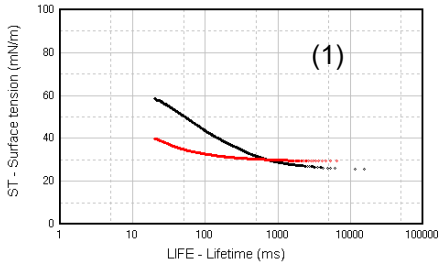
Using the Laplace equation, the bubble pressure method measures the maximum pressure and determines the surface tension.
The number of surfactants that adsorb on the bubble surface during the lifetime reduces the surface tension

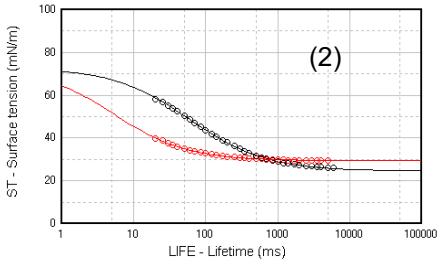


Surface tension: (1) > (2)

Software Performances

- Displays the row data of the measurement results in real time. → (1)
- Applies the fitting method according to Hua & Rosen to extrapolate the surface tension right after bubble generation and at equilibrium. → (2)
- Displays up to 11 data samples on a single sheet for comparison.
- Stores data in CSV file format for easy data export for handling and treatment in MS Excel.





Applications

- Surfactants: Study of fundamental properties
- Inks, coating agents: Instantaneous wettability
- Fountain solution in offset printing: Adsorbing speed of surfactants
- Aerosols, emulsions: Instantaneous generation of tiny droplets
- Detergents, extinguishants: Initial foaming

Specifications

	BP-D5
Measurement method	Maximum bubble pressure
Measurement range	Surface tension: 10 to 100 mN/m Surface age: 20 to 5000ms, Fixed surface age mode: 20 to 1000ms
Resolution	Surface tension: 0.01mN/m, Lifetime: 0.1ms
Repeatability	0.5mN/m (in terms of standard deviation based on manufacturer's standard)
Measurement temp	10 to 70 °C (a separate refrigerated/heating circulator is required)
Sample volume	About 80mL
Sample viscosity range	0.5 to 10mPa･s
Instrument dimensions (WxDxH)	320 x 315 x 475 mm
Instrument Weight	About 18.5 kg
Power supply	AC 100 to 240V, 50/60Hz, 50W, 80VA
Utilities	Clean, dry, and oil-free pressurized air at 0.4 to 0.7Mpa
Operating Environment	Temperature: +10 to 35 °C, humidity: 30 to 80 %RH (non-condensing) Positioned away from sources of electrical noise and vibration

* The specifications and designs are subject to change without notice. 2309

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