

Press Release: Determination of dynamic surface tension

DataPhysics Instruments expands its portfolio with the MBP 200 Bubble Pressure Tensiometer

The measuring device manufacturer DataPhysics Instruments has expanded its product portfolio with the addition of the MBP 200 Bubble Pressure Tensiometer for measuring the dynamic surface tension of liquids. The MBP 200 is ideal for investigating processes in which liquid droplets are produced at a high speed, such as inkjet printing or spraying processes.

Filderstadt, 17 December 2024 – DataPhysics Instruments has launched the MBP 200 Bubble Pressure Tensiometer onto the market this year. The MBP 200 is a stationary laboratory instrument for the precise determination of the dynamic surface tension of liquids. Dr Sebastian Schaubach, Innovation Manager at DataPhysics Instruments, says: "With the MBP 200 Bubble Pressure Tensiometer, we have been able to add an important parameter to our analysis spectrum and thus provide users with another highly specialised and high-precision measuring device in our product portfolio".

Dynamic Surface Tension Explained

The surface tension describes the energy required to increase the surface area of a liquid against a gaseous phase, such as ambient air. The surface tension is an important parameter in assessing how easily a liquid separates into droplets or spreads on a solid surface. In practical applications, surface tension is often modified by adding surface-active substances, such as surfactants, to the liquid mixture.

When a new surface is created in a liquid solution, for example by the formation of gas bubbles, surface-active particles or molecules migrate to the newly created surface. This increases the number of surface-active particles per unit area and reduces the surface tension of the liquid. During this process, the surface tension is called the 'dynamic surface tension' because it changes as a function of the surface age, i.e., the time that has elapsed since the new surface was formed.

Subsequently, the system reaches equilibrium: the surface-active particles or molecules stop migrating, and their number on the surface and the surface tension remain stable. The surface tension measured after equilibrium is reached is called the 'static surface tension'.

The speed at which surface-active substances accumulate on the surface is a characteristic value for each mixture. This parameter is relevant for the investigation of many industrial processes, such as the wetting of surfaces at high speed during spray processes in inkjet printing, spray coating, or plant protection.

Measurements with the MBP 200 Bubble Pressure Tensiometer

The MBP 200 Bubble Pressure Tensiometer from DataPhysics Instruments uses the maximum bubble pressure method to determine the dynamic surface tension. In the experimental setup, the liquid to be analysed is placed in a vessel under a capillary. The opening of the capillary is being immersed in the liquid. Gas is then passed through the capillary at a controlled volume flow, forming gas bubbles at the opening of the capillary.

The fact that the pressure difference inside and outside the gas bubble is related to the dynamic surface tension of the liquid is now being utilised. To measure the pressure inside the gas bubbles, the MBP 200 has a sensitive pressure sensor. The MBP 200 can even measure very high differential pressures of over 3400 Pascal, making it possible to investigate highly viscous liquids such as certain oils.

From the moment a new bubble begins to form to the moment at which the bubble is hemispherical, and the pressure reaches a maximum, a certain amount of time has passed. This time is called the surface age. The MBP 200 is equipped with a pneumatic system that can generate different volume flows and thus different surface ages. In this way, the dynamic surface tension can be determined for different surface ages. Specifically, the MBP 200 can be used to determine dynamic surface tensions in the range between 10 mN/m and 100 mN/m for surface ages between 5 milliseconds and 200 seconds. This makes it ideal for studying liquids over a wide dynamic range.

With the optional LDU 25 Liquid Dosing Unit, it is also possible to generate automated concentration series. This allows the dynamic surface tension to be determined as a function of surfactant concentration for different surface ages in a fully automated measurement procedure.

As the surface tension is always dependent on external parameters, the measurement should be carried out at well-defined temperatures. Optional accessories allow the sample vessel in the MBP 200 to be set to temperatures between -15°C and 135°C.

Intelligent Software for Ease of Use

The MBP 200 software supports a variety of measurement methods. For example, dynamic surface tension can be determined for one or more surface ages in a single measurement. The surfactant concentration can also be adjusted to measure the dynamic surface tension at different surface ages for different concentrations. Finally, it is also possible to determine the adsorption and diffusion coefficients of a surfactant. Users can create templates for routine measurements and save calibration data to ensure high reproducibility. Real-time analysis and an intuitive user interface complete the package.

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About DataPhysics Instruments GmbH

DataPhysics Instruments GmbH is a German company from the Stuttgart region that has been manufacturing measuring instruments for the investigation of interfaces and surfaces for more than 25 years. The devices from DataPhysics Instruments can be used to determine important physical and chemical parameters such as surface tension and surface energy, adhesive force, static and dynamic contact angles, roughness profiles, zeta potential and destabilisation mechanisms.

In short, the devices from DataPhysics Instruments are used wherever a liquid meets another liquid or a solid surface. In addition to stationary and mobile contact angle measuring devices, the product portfolio also includes tensiometers, bubble pressure and spinning drop tensiometers, stability analysers, zeta potential analysis systems, surface profilometers and humidity generators. The company also offers contract measurements in all these areas.

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Figure 1: The MBP 200 Bubble Pressure Tensiometer enables the precise determination of the dynamic surface tension of liquids.

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Figure 2: When using the maximum bubble pressure method, gas bubbles are generated in the liquid to be examined via a capillary.

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