

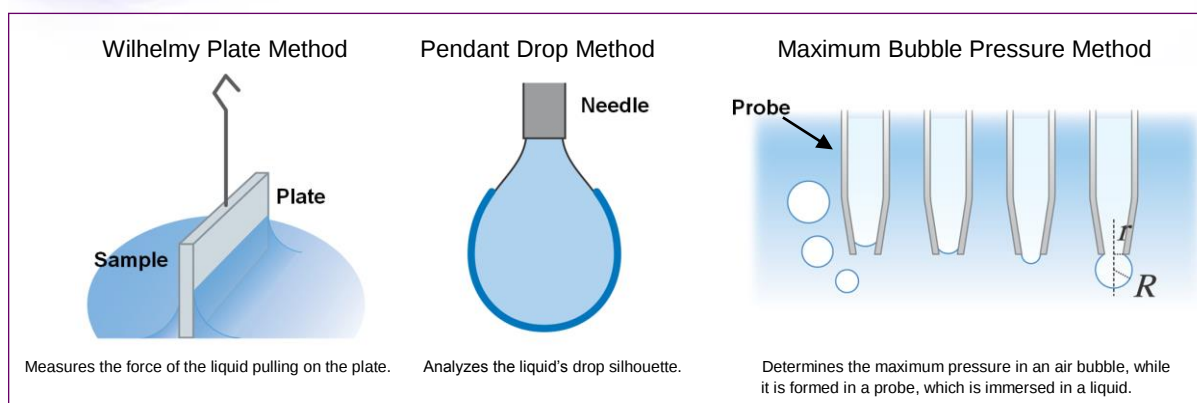
Applications of Surface Tension Measurements

Liquid surface tension is the characteristic of liquids to minimize their surface to the smallest possible area, which would result in a perfectly spherical shape.

Measuring surface tension allows characterizing different properties like wettability, permeability, foamability, solubility, emulsibility, dispersibility, etc.

These interface science phenomena are being studied in the process of Research & Development and production of products that we use in our daily lives.

Measurement Methods of Surface and Interfacial Tension



Wettability / Permeability (Measurement of Surface Tension)

- Detergents, Cosmetics, Fats and Oils, Chemicals, Pharmaceuticals**
Water is a typical liquid of higher surface tension. By adding detergents to the water, its surface tension can be controlled to reach the desired permeability to textile fibers. Among research of conditioners, milky lotions and topical creams, their surface tension has a significant effect on the receptivity to skins.
- Inks, Paper Manufacturing, Printing**
Wettability of paper by inks is characterized by controlling the surface tension of ink.
- Photo Films, Magnetic Tapes and Disks, Latex**
On the one hand, coating agents with a high surface tension will not wet solid surfaces well. On the other hand, if the surface tension is too low, surface irregularity on coating quality may occur. Thus, proper control of the surface tension is key to successful coating.
- Automobiles and Parts, Precision Machineries, Business Machines, Printing Machines**
Lubricating oils used in these machinery have to spread into small joint gaps. In order to achieve this goal, the surface tension of the lubricants is controlled by adding additives.

Emulsibility (Measurement of Interfacial Tension)

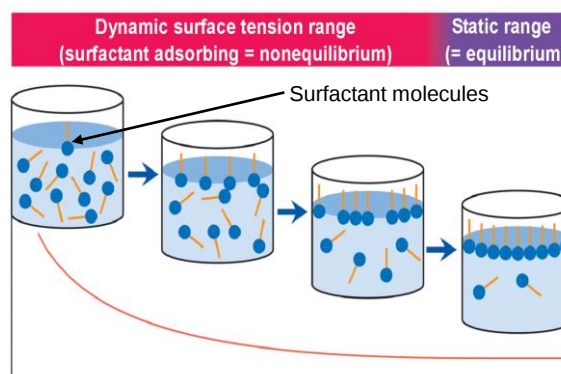
- Food Products, Beverages, Dairy Products, Cosmetics, Chemicals, Pharmaceuticals**
Separation and dispersion of phases in liquid/liquid systems, like oil in dressings or mayonnaise, are subjects of many research studies. The lower the surface tension of water, the easier oil can be dispersed in water and emulsified. Chocolate, butter, cosmetics, liquid medicine, for example, also belong to the group of emulsified products.

Surfactants and Surfactant Solutions

- Detergents, Inks, Paints, Cosmetics, Plating Solutions, Fats and Oils, Coating Agents**
In order to set up practicable conditions, characterizations of surfactants can be drawn from the relationship between surfactant concentration and surface tension. Understanding the time and temperature dependent properties of surfactants is the key to their effective use.

Dynamic Surface Tension

Surfactants have the ability to lower surface or interfacial tensions over time with the molecules being absorbed to the newly created surface or interface. During the time span from a newly created surface until an equilibrium value of surface tension is reached, the Dynamic Surface Tension can be measured. While at equilibrium state of the liquid the Static Surface Tension can be measured. Detergents and solutions for coating purposes are being used in processes where new surfaces or interfaces are constantly being created, thus determination of the Dynamic Surface Tension is of high importance.



1. Inks, Paper Production, Printing

The permeability of paper by the ink is influenced by the dynamic surface tension of the ink.

In spray painting, the particle size of spray droplets is influenced by the dynamic surface tension of the ink.

2. Thin Films, Coating, Wafers, Printing, Semiconductors

In processes like spin coating wafers with photoresists or dip- or roll-coating thin films on substrates, the absorption rate of surfactants has a significant effect on the finishes.

In high-speed coating processes like the offset printing process, the wettability of the aluminum surface by the fountain solution depends on the dynamic surface tension of the fountain solution.

3. Detergents, Cleaning Solutions, Surfactants

To increase the permeability of textile fibers by detergents in the washing process where new surfaces and interfaces are constantly being created, a rapid absorption rate of surfactants is necessary.

Other Applications

1. Fire Extinguishing Fluids, Chemicals

Fire extinguishing fluids have to be spread over the origin of fire to extinguish it. The factor of spreading, or the "Spreading coefficient", is obtained by evaluating their interfacial tensions.

2. Space Engineering, Heavy Machineries, Construction

Fluidic behavior in zero gravity is dominated by the surface tension and wetting behavior of the liquid. Without adding any forces, a continuous flow of liquids in narrow spaces, such as in small pipes, is possible only due to capillary action.

It is the same phenomenon plants use to move water and nutrients from their roots through very tiny pipes up to their leaves.

3. Food Products, Beverages, Paints, Detergents, Firefighting

The foamability of liquids, for example, beer or surfactant solutions, is closely related to the value of the surface tension. Whereas the lower the surface tension of the liquid, the better the foamability, the foam stability, however, depends on a number of parameters.

4. Product Quality Control

The need for quality control of consumable solutions, such as detergents, plating solutions, developing agents, is critical to maintain their properties during their application process.

Typically, the value of the surface tension of the liquid gives information about its qualitative condition.