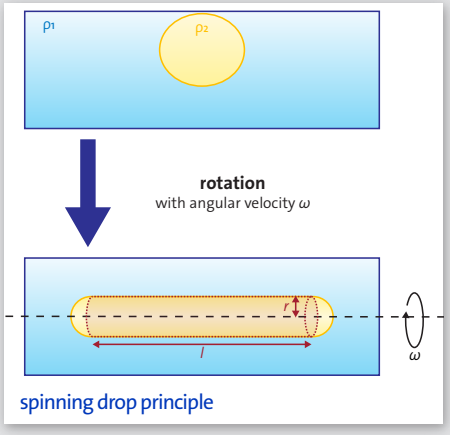
SVT 25

Spinning drop Video Tensiometer
for measuring low to ultra-low interfacial tensions

dataphysics

Spinning Drop Tensiometry

Spinning drop tensiometry is the technology of choice for measuring extremely low interfacial tensions. The method is based on the **optical contour analysis** of a drop. This drop, instead of hanging from a dosing needle and being exposed to gravitation, is located inside of a **rotating capillary**.



spinning drop principle

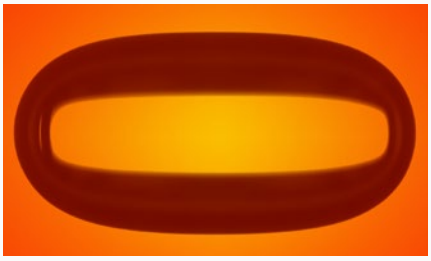
Inside of the capillary the centrifugal force pushes the denser liquid surrounding the drop outwards while the less dense drop gets pushed towards the rotational axis. Hence the drop is **deformed cylindrically** and its interfacial area increases. The interfacial tension counteracts this area increase and thus can be determined by analysing the equilibrium drop shape.

Enhanced oil recovery (EOR)

"Ultra-low" interfacial tensions occur particularly in **microemulsions** which are used, for example, in **enhanced oil recovery**. At suitable conditions microemulsions form spontaneously from water, oil and surfactant. The thermal stability of the microemulsion plays a crucial role as temperatures in the oil reservoir can reach well beyond the boiling point of water. Thus, measurements with **superheated aqueous solutions of up to 130 °C** are an important step in the research of appropriate surfactants and mixture compositions.

Interfacial rheology

With spinning drop tensiometry it is also possible to analyse how an interface reacts when its area is enlarged or reduced (interfacial rheology). For example, how fast can surfactants from the bulk adsorb at the interface in order to stabilise a newly formed interface? To investigate such questions the **rotational velocity is varied** in a spinning drop experiment, typically in an oscillating manner, which directly results in a change of size of the interfacial area.



The SVT 25

The Spinning drop video tensiometer SVT 25 is a compact optical measuring instrument for the determination of low to ultra-low interfacial tensions and rheological interface properties.

Highest precision and reproducibility of the measuring results is guaranteed by a well-established measuring technique and first grade mechanical and optical components. Due to state of the art electronic components the SVT 25 can be operated intuitively via the **TP 50 control panel**.

For an efficient measuring procedure the measuring cell, with the rotating capillary, is mounted on a **tilting table**, which allows the operator to easily move the drop of interest into the camera view. The fast **6.5-fold zoom lens** with fine focus enables an analysis of small and large drops alike.

Due to the **high-performance camera with USB 3 interface** the spinning drop can be analysed with exceptional

SVT 25 with temperature controlled measuring cell MC-TPC 25 and TP 50 control panel

holders for disposable glass capillaries as well as fast exchange capillary

resolution. Fast processes e.g. during oscillation experiments can be captured with **up to 3250 frames/s**. Once detected the drop is automatically tracked by the **movable camera**.

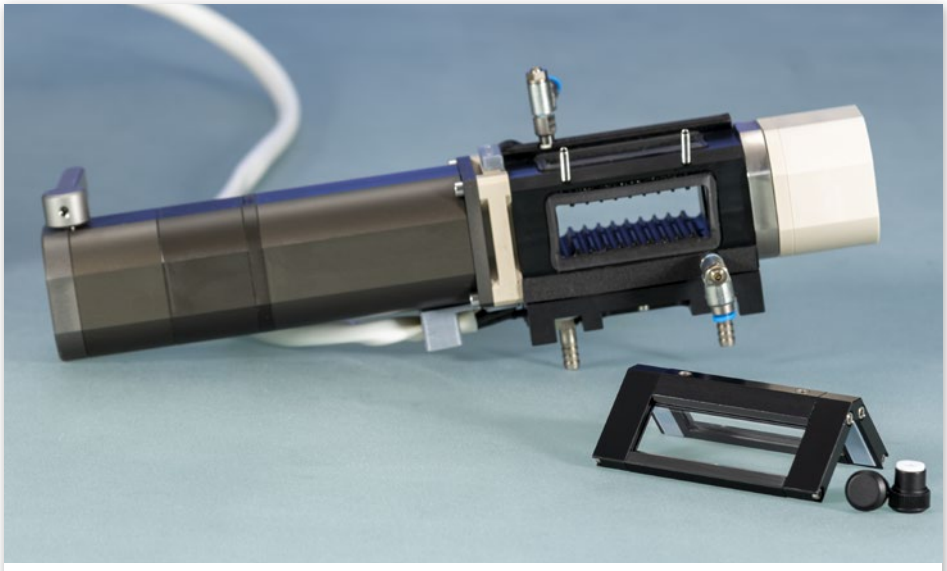
A highly dynamic measurement drive creates a uniform rotation even at **highest rotational velocities of up to 20 000 rev/min**. In addition it allows for sinusoidal changes in revolution speed for oscillation measurements and for rapid rotational velocity steps with a **max. acceleration of up to 500 rev/s²**.

Samples can be easily placed inside the SVT 25, within seconds, due to **fast-exchange capillaries** with perfect fitting accuracy. Hence the highest throughput rates can be assured. In order to avoid extensive cleaning procedures **disposable glass tubes** with corresponding holders can also be used for the measurement.

The observation windows of the measuring cells for the SVT 25 can be easily removed by opening just two knurled screws and are **easy to clean** in case they came into contact with sample material.

Temperatures within the range of **-30 °C to 180 °C** can be reached inside the measuring chambers. This facilitates the recreation of many different environmental conditions.

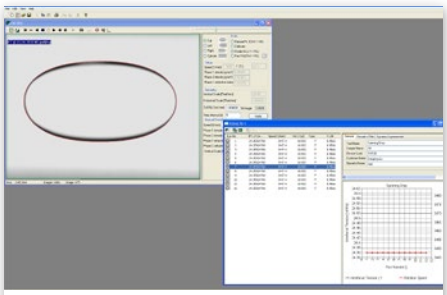
Due to a specially designed capillary and a resulting higher pressure tolerance the SVT 25 can even be used with **water-based solutions at up to 130 °C**.



measuring cell with removable observation windows for easy cleaning

Software for an efficient workflow

The **SVTS**oftware supports you in the use of the SVT 25 by easily specifying measurement procedures and in collecting and evaluating data. The software is designed as a modular program for the use under Microsoft Windows®.



interfacial tension measurement using SVTS 20

SVTS 20 — interfacial tension

- video based measurement and presentation of the time and temperature dependent interfacial tension based on spinning drop contours according to various models
- control of the rotational speed, the inclination of the measuring cell and the camera position including the automatic calibration of the magnification of the drop and an automatic “drop hold” function
- automatic compensation of density and refractive index as well as of temperature dependent changes
- statistics and measurement error analysis
- liquids database

SVTS 21 — oscillation

- relaxation analysis with predefined speed increments and sinusoidal speed variations
- analysis of fast relaxational oscillations and elongations of drops
- determination of dilatational interfacial elasticity of viscoelastic and viscoplastic materials

SVTS 22 — membrane covered drops

- determination of deformation and elasticity parameters of membrane covered or encapsulated spinning drops with contours deviating from corresponding Young-Laplace shapes
- calculation of the effective deformation in relation to spherical or ellipsoidal rest or reference contours
- calculation of centrifugal stresses as a measure of the membrane or capsule loads
- calculation of membrane capsule elasticity parameters from the effective deformation and the centrifugal stress

Technical data

Interfacial tension	according to models by Vonnegut, Cayias-Schechter-Wade or Young-Laplace
measuring range	$1 \cdot 10^{-6}$ ... $2 \cdot 10^{3}$ mN/m
measuring resolution	$1 \cdot 10^{-6}$ mN/m
Rotational drive	high dynamic measurement drive
rotational speed range	0 ... 20 000 rev/min
rotational speed resolution	± 0.001 rev/min
rotational speed stability in long term experiments	± 0.5 rev/min
rotational speed changes	oscillation period: 0.5 s ... ∞; max. acceleration: 500 rev/s²
Sample table	motorised tilting table
tilting range	± 15°
tilting resolution	± 0.0023°
Optics	high-performance zoom lens with integrated continuous fine focus
zoom range	6.5-fold zoom (0.7 ... 4.5-fold magnification)
focus range	± 6 mm
lateral traversing range for following moving drops	± 25 mm
Camera system	USB 3 camera, 2/3" sensor
max. resolution	2048 x 1088 pixel with 180 frames/s
max. frame rate	3250 frames/s with 2048 x 60 pixel
Illumination	LED-lighting with strobe function and adjustable slit diaphragm
Temperature control	measuring cell with temperature control system
via liquid circulator (MC-TFC 25)	-10 ... 130 °C
via Peltier element (MC-TPC 25)	-30 ... 180 °C
via electric heating (MC-TEC 25)	RT ... 140 °C
temperature measurement	Pt100 sensor for -60 ... +450 °C ± 0.01 K; precision 1/3 DIN IEC 751 (±0.03%), class B
Device control	via TP 50 control panel and software
Dimensions (L [mm] x W [mm] x H [mm])	420 x 290 x 370
Weight	25 kg
Power supply	100 ... 240 VAC; 50 ... 60 Hz; max. 200 W
Temperature controller TCU	required for temperature control systems with Peltier element or electric heating
dimensions (L [mm] x W [mm] x H [mm])	220 x 180 x 100
weight	3 kg
power input	90 ... 264 VAC; 47 ... 63 Hz; max. 650 W

For more information please contact us.
We will find a tailor-made solution to your surface chemistry requirements and will be pleased to provide a quotation, obligation-free, for your instrument system.

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