New

Sensor Instrument for
Surface Interaction Analysis
in Real Time

3T analytik

qCell / qCell T

Label-Free Observation of Molecular Interactions,
Surface Layer Systems and Fluid Properties.

Quartz Crystal Microbalance Sensor Platform

Explore Surface Interactions in a New Way of Operational Ease and Versatility

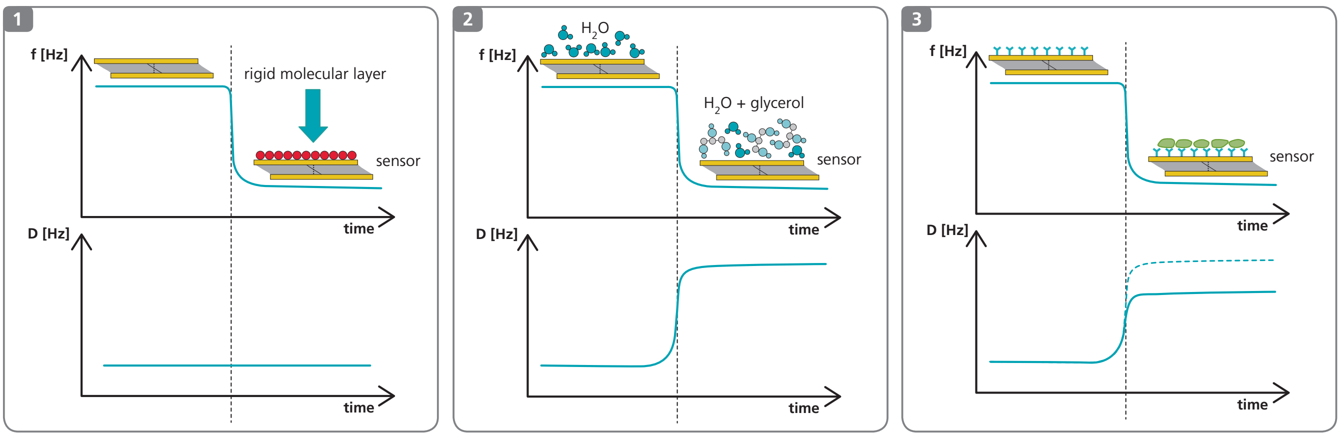
The qCell / qCell T is a quartz sensor instrument (QCM) for gaining real time insights into molecular interactions, biofilms, liquid properties and even the analysis of blood. The qCell / qCell T has been designed for unique operational ease and very short time to result.

qCell T comprises a small volume flow cell on a high precision and powerful Peltier driven temperature (T) control system for cooling and heating, a thermostated sample holder and an attached pump for liquid handling. qCell is an entry-level version with identical features but without T control and no integration of pump control. Sensor data acquisition, thermal control and fully automated pump operation are all carried out under the common user interface of qGraph software. For a convenient surface coating by standard lab operations and an easy insertion into the flow cell, the sensor quartz comes mounted on a sensor sheet. Through an optical window the quartz surface can be visually observed during all situations of measurement. All surfaces in contact with the sample solution are highly resistant to most chemicals.

QCM Principle and Measurement

Quartz sensors are highly sensitive to the mass and the material properties of deposited molecular layers as well as of the wetting liquids at their surface. Due to its sensitivity to mass, the technique is often referred to as Quartz Crystal Microbalance (QCM). The measuring principle of quartz sensor technique is based on the precise oscillation of the quartz sensors at their resonant frequency when an alternating voltage is applied. Depositions at the surface or wetting of the surface result in a frequency shift and – depending on the material properties – additionally in a damping of the oscillation. Both, the frequency shift and the damping (dissipation) of the oscillation are captured with the qCell / qCell T instrument with high resolution and in real time.

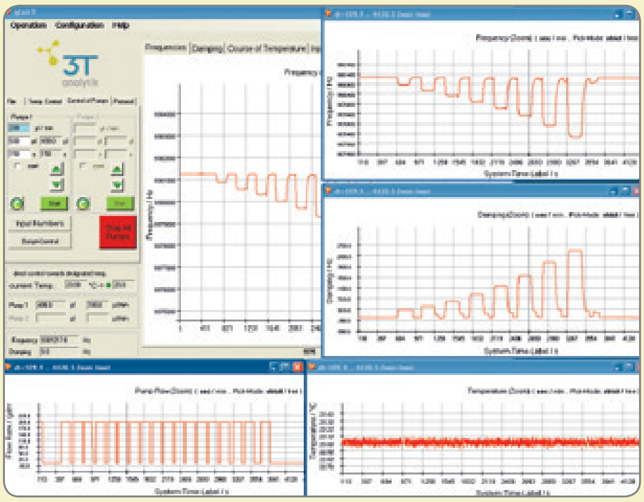
In the figures below the graphs of frequency and damping of three characteristic examples are shown, respectively. A thin, rigid layer (e.g. a thin protein layer or a thin metal layer) will cause a shift in frequency alone, without a change in damping (**1**). A change of viscosity of purely Newtonian liquids (e.g. water, treacle, milk or fruit juice) will cause a decrease in frequency and an increase in damping, to equal amounts (**2**). A viscoelastic layer (e.g. layers of polymers, biofilms, bacteria or cells) results likewise in a frequency and damping shift in opposite directions, but with different amplitudes (**3**). These examples reveal, that by analyzing these graphs it becomes possible to determine properties as viscosity (or shear module), mass or thickness of interfacial layers.



Applications

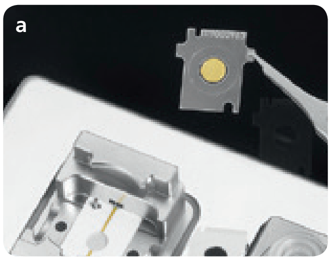
- Kinetic studies (dissociation- / binding constants)
- Protein interaction (affinity assays)
- Viscosity measurements in microliter volumes
- Cell adhesion / desorption
- Drug effects
- Receptor ligand interactions
- Molecular aggregation
- In situ formation of polymer films
- Enzymatic degradation studies
- Biofilm studies
- Studies of structural changes, proliferation and cell spreading
- Detection of coagulation status
- Real time studies of antigen-antibody interactions (e.g. immuno assay, specific coupling of cells and bacteria, blood typing)
- Investigation of the malaria cycle (e.g. release and reinvasion of parasites)

qGraph Software



The qCell T comes with a complete software suite for fully automated instrument control, signal acquisition, real time display, processing and data storage. Individual panels display frequency, damping (dissipation), temperature and pump flow profiles. Online protocol commenting, coordinate display by pick point function, scripts for programming flow rates, patterns and repetitive cycles can be added and edited by the operator. Data export to qGraph Viewer, Excel™, Origin™ and other processing software is supported.

Practical Aspects: Flow Cell and Sensor Handling



Sensor Chip
Each quartz sensor comes mounted on a thin polymer sensor sheet of precise dimensions. The sensor chip is labeled with a unique serial number and features an asymmetric shape with grooves (**a**) which precisely fits into a flat cavity at the bottom of the open-architecture flow cell (**b**). Different quartz coatings (e.g. Ti, Ag, Cu, Pt, polymers, proteins) are available upon request.

Positioning
The sensor chip is easily removed and replaced using a pair of tweezers without risk of damaging the sensors or spoiling their surface. It fits accurately, secured against rotation, into its support fixture on the qCell / qCell T and establishes a high quality electrical connection.

Closing
The stainless steel flow cell unit is now positioned over the sensor chip (**c**) and locked with a quarter turn in a bayonet style (**d**) to complete and seal the flow cell, which can then be filled with sample solution exposing it to the sensor surface. This design ensures along simple operation high repeatability and quality of the sensor signal.

Operation
The design of the flow cell guarantees bubble free filling together with uniform and reproducible flow dynamics. The filling process as well as all situations of measurement can be observed visually through the optical window above the sensor surface. After emptying, the flow cell can be removed without risk of contamination of the sensor support fixture.

Technical Data

Quartz Sensor	qCell	qCell T
Sensor characteristics	Diameter: 8.5 mm, area exposed to liquid 38 mm^2, active area 19.6 mm^2	
Sensor material	Quartz, by default coated with gold [1]; fixed on mylar sheet	
Frequency	f_0 = 10 MHz	
Max. sensitivity for covalent adsorption of sample	0.86 ng / Hz [2]	
Analyte Consumption		
Internal volume of flow cell	approx. 30 µl (above the sensor)	
Minimal sample volume	approx. 40 – 80 µl	
Fully automated Fluidic System		
Pump Type	Peristaltic pump [3] with 12 rollers; flow rates from 9 µl / min up to 5600 µl / min [4]	
Materials in contact with liquid	PTFE, PEEK, silicone (seal), polyolefin foil, upper quartz electrode	
Temperature Control		
Temperature control of		Peltier system with closed water loop
Temperature range		+ 4°C to + 80°C
Temperature accuracy		0.1°C (at + 25°C)
Max. speed of cooling		6°C / min
Max. speed of heating		10°C / min
Dimensions, Weight and Connectivity		
Dimensions (w x d x h)	100 x 100 x 70 mm^3	260 x 317 x 197 mm^3
Weight	0.42 kg	6 kg
Interfaces	RS 232 or USB	Ethernet, TTL I / O, Interface to control peristaltic pump

[1] Other electrode materials e.g. Ti upon request.
[2] Calculated under the assumption of a flow cell volume of 30 µl.
[3] Included in optional Starter Kit.
[4] Flow rate range depends on the diameter of tubes. Tubing set for pump (Tygon, inside diameter 1 x 0.38 mm and 1 x 1.02 mm) included in optional Starter Kit.

Instruments
smart solutions & service
IGZ Instruments AG
Furtbachstrasse 17
8107 Buchs ZH
Tel. +41 44 456 33 33
igz.ch igz@igz.ch

3T analytik

3T GmbH & Co.KG
Gartenstraße 100
D-78532 Tuttlingen
Tel.: +49 (0)7461-16503-0
Fax: +49 (0)7461-16503-29
E-Mail: info@3t-analytik.de
www.3t-analytik.com