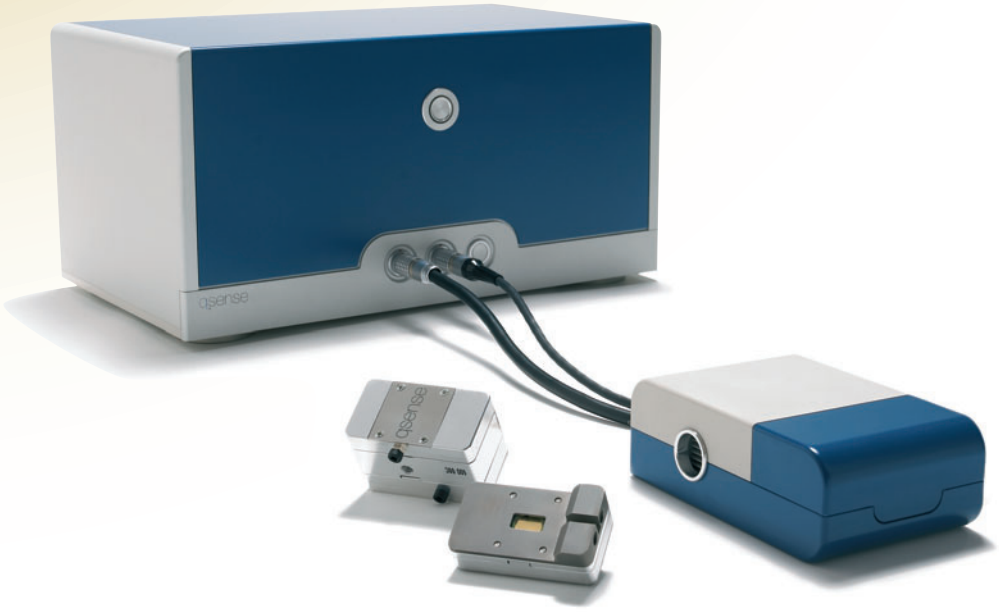
Product Information

TRACKING CHANGES AT THE SURFACE:

Q-Sense E1

interface analysis in real-time



Tracking changes at the surface

Measure mass changes, structural and viscoelastic properties with nanogram sensitivity. Distinguish between two similar binding events or observe a phase transition or reconfiguration in bound layers.

Real-time analysis

With up to 200 data points per second, the Q-Sense system allows you to follow the complete molecular interaction, step-by-step.

Flexible choice of surface

A wide range of sensors and coatings are available including metals, metal oxides, polymers, lipides and reactive surfaces.

Turnkey system

Q-sense provides ready to use turnkey systems. The E1 system include instrument, software, PC and installation. Q-sense also offers training and support.

1-Sensor system

Compact, easy-to-use, lable-free 1-sensor design enables reliable and stable QCM-D measurements. Excellent reproducibility.

Optional modules

Accessory modules, such as the electrochemistry and window modules, are available.

qsense®

Follow molecular events step-by-step as they occur in real-time.
Our QCM-D system is built on a proven technology with a steadily growing number of scientific references. The base is a quartz crystal which oscillates at a constant frequency when power is applied. As the mass on the crystal changes, so does the resonance frequency of the oscillation. In this way mass changes can be measured with nanogram sensitivity.

Uniquely Q-Sense instruments measure dissipation, which provides information about the structure and viscoelasticity of the film. This gives knowledge of e.g. molecular configuration, thickness and water content of adsorbed films as well as novel insights of surface substrates before, during, and after a reaction. Dissipation is measured from the time it takes the oscillating crystal to slow down when the power is disconnected.

Measurements can be carried out label-free on any surface that can be applied as a thin film, including polymers, metals and chemically modified surfaces. Analyses are made in real-time and the system provides up to 200 data points per second.

The Q-Sense system can analyse for example:

- degradation
- adsorption
- swelling, water content
- thickness
- mass changes
- structural changes
- interaction
- cross-linking

MEASUREMENT PROCEDURE

1. Mount a quartz crystal sensor in the temperature controlled chamber. The sensor is fixed in a removable flow module, with an inlet and an outlet. The quartz crystal sensor may be pre-coated with, for example, metals, polymers, or SAMs.

2. Insert a sample and conduct in-situ experiments. A typical experimental procedure could be: buffer followed by sample A, and sample B and then back to buffer.

3. Follow the results in real-time on the computer screen. Frequency changes reflect mass changes taking place on the sensor surface, whereas dissipation changes reflect changes in the adlayer's viscoelastic properties.

4. Analyze and present results using the Q-Tools software: extract mass, thickness, viscoelastic properties, kinetic constants and identify adsorption phases, etc.

Window module

The Q-Sense E1 system has an optional window module which provides simultaneous optical access to the sensor surface. The E1 system's compact design also enables microscopy studies of the reactions on the sensor.

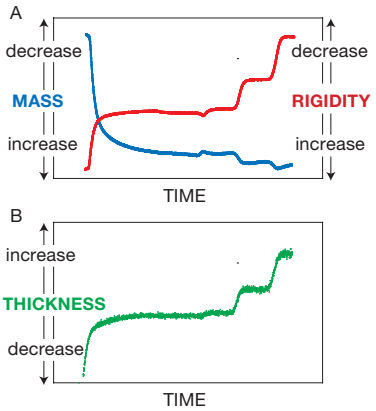
- Light-induced reactions, e.g. UV curing
- Simultaneous microscopy studies, e.g. cell adhesion
- Working distance 3.3 mm

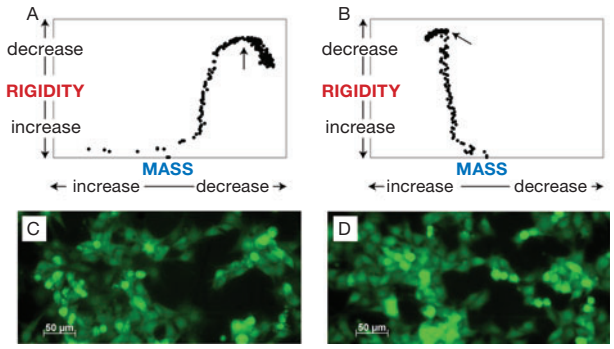
Monitoring conformational changes of thin films with QCM-D

Simultaneous monitoring of the mass and structure of thin films enables real-time assessment of molecular interactions and conformation. A descriptive example is the rearrangement of DNA as a function of bulk electrolyte concentration. DNA is composed of negatively charged subunits. It adsorbs irreversibly to a solid support in the presence of salt (mass increase in fig A). Lowered salt concentration, and thus reduced charge screening, forces the DNA molecules to adapt a less compact conformation, resulting in decreased film rigidity (fig A). The concept of DNA elongation is consistent with increased film thickness (fig B).

QCM-D data of DNA adsorption and subsequent stepwise lowering of bulk salt concentration: mass and rigidity (A), film thickness (B).

Reference: Nguyen and Elimelech Langmuir (23) 2007, 3273





QCM-D responses (A, B) and micrographs (C, D) of attachment and spreading of cells on two different surfaces.

Reference: Lord et al Biomaterials (27) 2006, 4529

Cell interactions: QCM-D with microscopy

QCM-D can be combined with light microscopy using the E1 window module. The visual access to the sensor enables correlation of real-time microscopy to QCM-D, response of changes in mass and viscoelastic properties. An excellent demonstration of such a combined set-up is the analysis of cell attachment and spreading. The QCM-D senses events associated with cell membrane rearrangements (fig A, B) not detectable with microscopy (fig C, D). Importantly, the visual observation of the cell behavior facilitates QCM-D data interpretation providing unique information on the cell-surface interactions.

Specifications subject to change without notice

Sensors and sample handling system				
Number of sensors	1			
Volume above each sensor	~ 40 µl			
Minimum sample volume	~ 300 µl			
Working temperature	15 to 65 °C, controlled via the software, stability ± 0.02 K			
Flow rates	0-1 ml/min			
Cleaning	All parts exposed to liquid can be removed and cleaned in e.g. ultrasound bath			
Sensor crystals*	5 MHz, 14 mm diameter, polished, AT-cut, gold electrodes			
Frequency and dissipation characteristics				
Frequency range	1-70 MHz (up to the 13th overtone, 65 MHz for a 5 MHz crystal)			
Maximum time resolution, 1 frequency	up to 200 data points per second			
Maximum mass sensitivity in liquid**	~ 0.5 ng/cm^2 (5 pg/mm^2)			
Normal mass sensitivity in liquid***	~ 1.8 ng/cm^2 (18 pg/mm^2)			
Maximum dissipation sensitivity in liquid**	~ 0.04 x 10^{-6}			
Normal dissipation sensitivity in liquid***	~ 0.1 x 10^{-6}			
Typical noise peak to peak (RMS) in liquid****	~ 0.16 Hz (0.04 Hz)			
Software				
PC requirements	USB 2.0, Windows XP			
Input data, analysis software	Multiple frequency and dissipation data			
Output data, analysis software	Modelled values of viscosity, elasticity, thickness and kinetic constants			
Import/Export	Excel, BMP, JPG, WMF etc.			
Dimensions	Height (cm)	Width (cm)	Depth (cm)	Weight (kg)
Electronics unit	18	36	21	9
Measurement chamber	5	10	15	1

** Several other sensor materials are available, for example, SiO2, Titanium, Stainless steel, Polystyrene to mention a few.*
*** Data from 1 sensor in single frequency mode. 1 data point is collected every 5 seconds. The Sauerbrey relation is assumed to be valid.*
**** Data from multiple frequency mode (7 harmonics) are collected within 1 second. The Sauerbrey relation is assumed to be valid.*
***** Data from 3 harmonics are collected in about a second. Peak to peak value from one minute data acquisition.*

Q-Sense is a product by Biolin Scientific, a premium instrument provider. Our products are high-tech precision instruments for research within surface, material and bio-science, drug discovery and diagnostic applications. We focus on service and application support for our customers, as well as on technology development and knowledge. Our products are based on advanced measurement techniques, and all of our technologies are unique, patented or have earned industry leadership through long term experience and development.

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