eQCM 10 M ™

Electrochemical Quartz Crystal Microbalance

GAMRY INSTRUMENTS

Electrochemical Quartz Crystal Microbalance

Gamry's *e*QCM 10M is a rapid, impedance-scanning quartz crystal microbalance (QCM) system. Any crystal in the frequency range of 1-10 MHz can be used. The *e*QCM 10M is designed to be used as a stand-alone instrument or in combination with a potentiostat.

Features

- Frequency Resolution of 0.02 Hz
- Impedance scanning gives full crystal spectrum
- No need to manually compensate for parasitic capacitance
- USB interface
- Integrated QCM and potentiostat acqusition
- Data analysis in Gamry's flexible and customizable Echem Analyst

Applications

- Polymer adsorption/desorption
- Electroactive polymers
- Li^+ intercalation
- Ion and solvent transport
- Corrosion studies
- Plating studies
- Underpotential deposition
- Antibody-antigen interactions
- Surfactant adsorption
- Self-assembled monolayers
- Nanoparticle adsorption
- Surface coatings

Fast Data Acquisition and Fitting

The very high data acquisition rates make the *e*QCM 10M an economical choice compared to more expensive network analyzers. The instrument does not rely upon a phase lock oscillator, so it does not require the manual cancellation of parasitic capacitance like some other QCMs.

The crystal's frequency spectrum is modeled using a linear fit of a rational function - a Padé approximant - providing the series resonance frequency and parallel resonance frequency, f_s and f_p, respectively. With these two parameters one gains information about the viscoelastic properties of the film in addition to mass changes – no more need to rely solely upon the Sauerbrey equation!
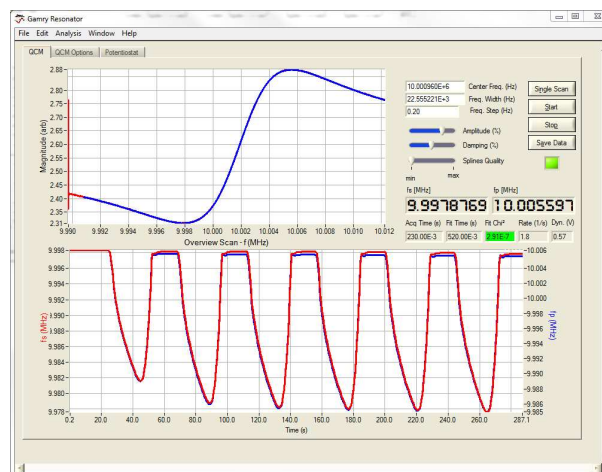

Data acquisition is controlled with one program. QCM control is on one tab while potentiostat control is on another tab.

Software

Gamry's Resonator™ software controls both the QCM and a Gamry Instruments potentiostat. Resonator comes with a full suite of physical electrochemistry techniques.

Electrochemical Techniques
- Cyclic Voltammetry
- Linear Sweep Voltammetry
- Chronoamperometry
- Chronopotentiometry
- Chronocoulometry
- Controlled Potential Coulometry
- Repeating Chronoamperometry
- Repeating Chronopotentiometry
- Multiple-step Chronoamperometry
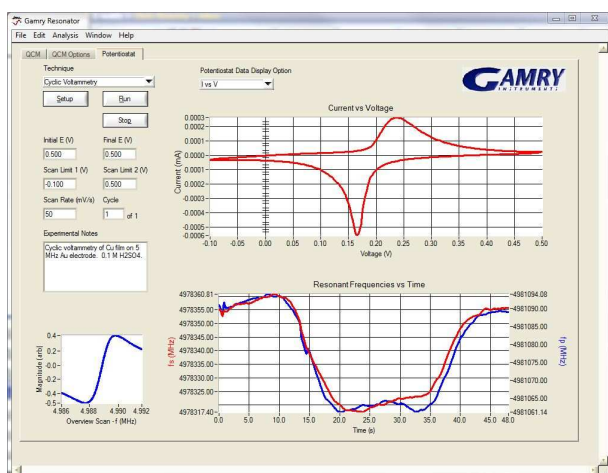
Frequency data are also displayed on the potentiostat tab during acquisition. Here are both the QCM and potentiostat responses during the cycling of a Cu film on an Au electrode.

Data Analysis with Gamry's Echem Analyst

When you combine the *e*QCM 10M with a Gamry Potentiostat such as a Reference 600, you get the combination of state-of-the-art instruments. Data are easily incorporated into Gamry's powerful Echem Analyst giving a intuitive feel to analysis and presentation. I/E curves overlaid with frequency data are standard while other plotting formats such as Δm versus Charge (Coulombs or moles) or the reduced quality factor, Q_r, versus time are available with the Curve Selector.

Plotting the reduced quality factor, Q_r, versus time, for example, shows the user a thin rigid film changing to a thick viscous film. Linear fitting of Δm versus Charge returns the molar mass of a mobile species into or out of a film.
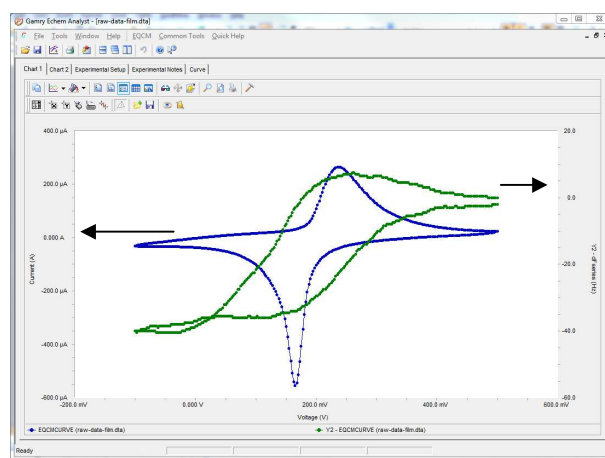
In Echem Analyst, I/E data are overlaid with frequency data as part of the standard data analysis. The chart selector gives the user flexibility to arrange charts in any number of ways.

Additionally, Echem Analyst scripts are written using Visual Basic for Applications, giving the user the ability to modify data handling to their liking. For example, if a user wanted to calculate solvent flux in a polymer film during redox cycling, they could simply write a custom script to calculate and display flux versus potential, time, or charge.

Resonator even has the ability to record the entire relative impedance spectrum, into a database, at each individual data point (or every n^{th} point). This exciting feature lets the user investigate phenomena in more detail after an experiment has concluded. Spectra can be opened in Echem Analyst or any other plotting or analysis program (e.g. Mathcad or Matlab) for modeling purposes.

Stand-Alone Use

The *e*QCM 10M system can also be used as a stand-alone instrument. Users interested in mass changes from processes such as formation of self-assembled monolayers, cell adsorption, or protein binding events will find the *e*QCM 10M a convenient choice. Corrosion engineers interested in mass changes will also find the instrument particularly useful since the frequency changes can be directly correlated to gain or loss of material. Data analysis can again be accomplished in our powerful and flexible Echem Analyst. A user could even customize the data analysis script to automatically calculate a corrosion rate based on mass loss versus time.

System Information

The *e*QCM 10M is shipped with the Gamry Resonator™ Software, Gamry Echem Analyst™ Software, a Quick Start Guide, a Hardware Operator's Manual (CD), a Software Operator's Manual (CD), one EQCM cell, one AC Power Adapter, one USB interface cable, one BNC cable, one potentiostat interface cable, and 5 Au-coated quartz crystals (5 MHz).

The *e*QCM 10M is protected by a two-year factory service warranty.

The *e*QCM 10M must be interfaced to a computer with a Gamry Potentiostat for incorporation and combination of QCM and potentiostat data into Echem Analyst. Users can also save QCM data separately. Microsoft® Windows® XP, Vista, or 7 is required.

Available Accessories

- EQCM cell
- 5 MHz 1.37 cm diameter AT-cut Au-coated Crystals
    - 0.813 cm^2 electroactive area
    - 0.316 cm^2 area of overlap
- 5 MHz 1.37 cm diameter AT-cut Carbon-coated crystals
    - 0.813 cm^2 electroactive area
    - 0.316 cm^2 area of overlap

Specifications

SYSTEM	
Frequency Range	1 - 10 MHz
Frequency Resolution	0.02 Hz
Interface	USB
Operating Temperature Range	0 to 45 ºC
Relative Humidity	Max 90% Non-condensing
Storage and Shipping Temperature	-25 to 75 ºC
WEIGHT	1 kg
DIMENSIONS	175 x 115 x 80 mm
AC Power Adapter	100-264 V AC, 47-63 Hz
Quartz Crystal Microbalance	12V DC, 25 W