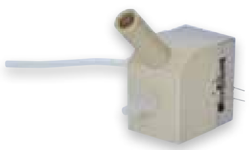
QCA922A

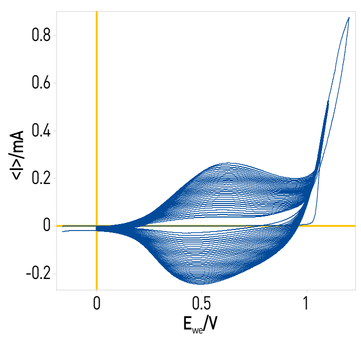
The instrument monitors both the resonant frequency and the resonant resistance which are also reflected on the two analog outputs.

It is possible to connect the QCM device to a Bio-Logic potentiostat using a DB9-8BNC cable (catalog n°: 092-22/1).

eQCM				Catalog n°
Quartz crystal microbalance 27 MHz kit				SE-QCA922A
Content				
EQCM 27 MHz main unit and cable				SE-QCA922A-00
Male BNC/BNC cable (2 pieces, length 1 m)				COR28100
Options				
Connector from QCA to potentiostat				092-22/1
Low flow peristaltic pump				EL-AV-008
Cells				
Holder is needed to get a full qcm or eqcm set-up			Static and flow qca cell	092-QCA-FC
			Dip cell	SE-CL3
			Well cell (ptfe)	SE-CL4
			Well cell (peek)	SE-CL4PK
			Transparent well cell	SE-CL5
			Flow cell (90 µl) (ptfe)	SE-CL6
			Flow cell (90 µl) transparent (ptfe)	SE-CL7
			Flow cell (90 µl) (peek)	SE-CL6PK
Resonators				
5 Mhz			Gold electrode (25 pieces)	SE-5AU
9 Mhz	Etching finish		Gold electrode (30 pieces)	SE-9AU-E/1
			Gold electrode (100 pieces)	SE-9AU-E/3
	Polish finish		Gold electrode (30 pieces)	SE-9AU-P/1
			Gold electrode (100 pieces)	SE-9AU-P/3
	Standard finish	Resonator and lead wire	Aluminum electrode (25 pieces)	SE-9AL
			Gold electrode (25 pieces)	SE-9AU
			Graphite electrode (25 pieces)	SE-9C
			Cupper electrode (25 pieces)	SE-9CU
			Molybdenum electrode (25 pieces)	SE-9MO
			Nickel electrode (25 pieces)	SE-9NI
			Platinum electrode (25 pieces)	SE-9PT
			Stainless steel (sus304) electrode (25 pieces)	SE-9SS
		Separated lead wire	Gold electrode (25 pieces)	SE-9AU-S
			Platinum electrode (25 pieces)	SE-9PT-S
	Mirror finish	Resonator and lead wire	Aluminum electrode (25 pieces)	SE-9AL-M
			Gold electrode (25 pieces)	SE-9AU-M
			Gold electrode (500 pieces)	SE-9AU-M2
			Graphite electrode (25 pieces)	SE-9C-M
			Copper electrode (25 pieces)	SE-9CU-M
			Ito electrode (25 pieces)	SE-9IT-M
			Nickel electrode (25 pieces)	SE-9NI-M
			Platinum electrode (25 pieces)	SE-9PT-M
			Silicon electrode (25 pieces)	SE-9SI-M
			Stainless steel (sus304) electrode (25 pieces)	SE-9SS-M
			Titanium electrode (25 pieces)	SE-9TI-M
		Separated lead wire	Gold electrode (25 pieces)	SE-9AU-MS
			Ito electrode (25 pieces)	SE-9IT-MS
			Platinum electrode (25 pieces)	SE-9PT-MS
Others				
Resonators lead wire no sputter (50 pieces)				SE-LEAD/2
Resonators 9 mhz, no sputter			No lead wire (50 pieces)	SE-9Q/2
			Mirror finish no lead wire (50 pieces)	SE-9Q-M/2
Control software for qcm922, qcm922a (no potentiostat control)				SE-WQCM


092-QCA-FC


SE-CL3



Gold electrode

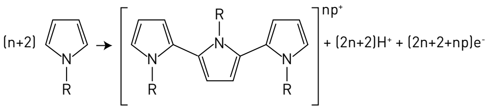
Platinum electrode

Stainless steel electrode

Measurement examples

Electropolymerization of pyrrol

The polypyrrol film was coated on an Au quartz (used as the working electrode) using cyclic voltammetry (20 cycles).



The quartz electrode was immersed in an acetonitrile solution (Bu_4NPF_6 0.2 mol/L) containing a solution of 1 methylpyrrol monomer (0.01 mol/L).

Polypyrrol film growth on the quartz working electrode

Fig. 1 presents polypyrrol film growth on the quartz electrode during successive cycles of cyclic voltammetry. The reversibility of the charge transfer in such a polymer film is often dependent on the deposition mode (quasi-reversible in this example). The growth is very regular but tends to slow down during the last cycles. This can be due to an interfacial depletion of the solution in methyl pyrrol species in the layer close to the electrode surface and to a saturation of the working electrode surface area.

(1): G. Sauerbrey, Phys. Verh., 1957, 8, 113-114.
(2): G. Sauerbrey, Z. Phys., 1959, 155, 206-222.
(3): Application note #13. Section “Apps & literature of EC-Lab division”.

QCM measurements during the film growth

Fig. 1 shows the resonant frequency decrease and the resonant resistance increase while the polymer film is growing. Moreover the variation is dependent on the potential sweep resulting in a pseudo oscillation of frequency and resistance related to successive cycles. This plot can also be made versus potential (see fig. 1).

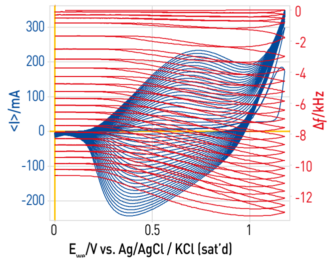


Fig. 1: overlaid frequency and current *vs.* E_{we} of the polymer film growth. Scanning at 100 mV/s between 0 and 1.018 V.

Here, it is interesting to note the frequency evolution versus potential on one cycle. The figure below shows the time evolution on one cycle.

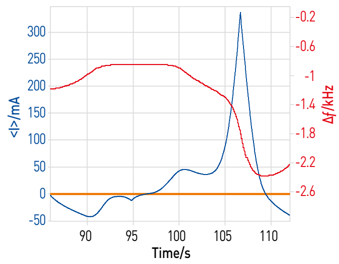
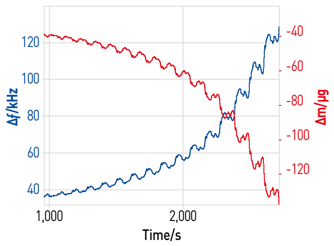


Fig. 2: graphic zoom on one cycle showing the resonant frequency and the current density versus elapsed time[3].

The mass calculation is done automatically in the EC-Lab® process data tool. More details can be found in the application note[3].



QCA922A specifications

Frequency range	5 MHz-30 MHz, resolution 0.01 Hz
Resonant resistance range	10-16 Ω, resolution 0.1 Ω
ΔF output	Full scale: ±10 V (14 bit) ±100 Hz / ±500 kHz
Mass range	0.1 ng / Hz // 3.5 ng / Hz
Resistance output	Full scale: 0-10 V (14 bit) 10 Ω to 10 kΩ
Gate time	Variable (10 ms / 20 ms / 100 ms / 1 s / 10 s)
Interface	USB

Surface finishing

	Roughness	Electrode materials deposition
Standard finish	0.6 µm	Sputtered
Etching finish	0.6 µm	Vacuum deposition
Mirror finish	0.06 µm	Sputtered
Polish finish	0.06 µm	Vacuum deposition

To help you choose the type of finish, bear in mind that the lower the roughness, the larger the surface area.