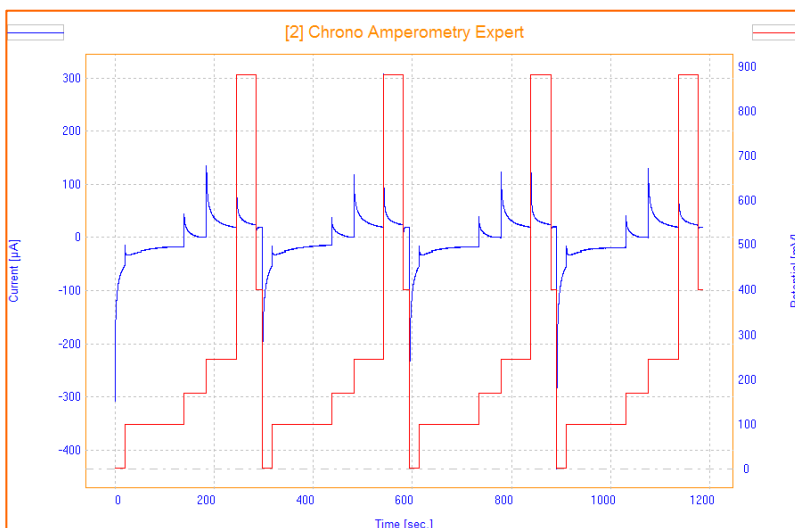


General Electrochemistry AP-GE06



Chrono Amperometry Expert



This Application Note describes how the Chrono Amperometry Expert method works by giving an example with Ferri/Ferrate solution.



Introduction

Chrono Amperometry Expert is an OrigaMaster 5 method. In single chrono Amperometry a potential step induces a current change. The current is recorded while the WORK potential is maintained at a preset value versus the REF or OCP potential. Information about the diffusion properties of the electrochemical species and the kinetics of the process can be obtained then.

In Chrono Amperometry Expert, there are more than one step (maximum 8 steps) which can be defined with different parameters (Figure 1). In each step, the potential can be imposed vs REF, OCP or LAST potential in different durations. All the defined steps can be repeated through definition of number of cycles.

Level	Value	Versus	Duration	Unit	Meas. Period
<input checked="" type="checkbox"/> Level 1	-200	REF	2	min.	0.1 Sec.
<input checked="" type="checkbox"/> Level 2	200	REF	20	sec.	0.1 Sec.
<input checked="" type="checkbox"/> Level 3	100	REF	1	hour	0.1 Sec.
<input checked="" type="checkbox"/> Level 4	-50	REF	15	min.	0.1 Sec.
<input checked="" type="checkbox"/> Level 5	20	LAST	45	msec.	0.001 Sec.
<input checked="" type="checkbox"/> Level 6	35	LAST	12	min.	0.1 Sec.
<input checked="" type="checkbox"/> Level 7	0	REF	10	hour	0.1 Sec.
<input checked="" type="checkbox"/> Level 8	-40	REF	100	msec.	0.001 Sec.

Figure 1: Chrono Amperometry Expert

Parameters

The Parameters of the Chrono Amperometry Expert is shown in figure 2.

Parameter	Value
Potential steps	2/-200/REF/2/min./0.1/1/200/REF/2/min./0.1/...
Cycle	1
Ohmic Drop Comp.	No
Maximum range	Auto
Minimum range	Auto
Analog Filter	Auto
Maximum current (mA)	5000
Minimum current (mA)	-5000
Open circuit at end	Yes
Auxiliary input	No

Figure 2: The parameters



By clicking on Potential Steps, the «potential steps» window will be opened, and different steps of potential can be defined in this window (figure 3). It can be performed as single chrono if only one step be chosen.

	Value	Versus	mV	Duration	Unit	Meas. Period	Sec.
<input checked="" type="checkbox"/> Level 1	1	REF	mV	5	min.	0.1	Sec.
<input checked="" type="checkbox"/> Level 2	100	REF	mV	2	min.	0.1	Sec.
<input checked="" type="checkbox"/> Level 3	170	REF	mV	20	sec.	0.1	Sec.
<input checked="" type="checkbox"/> Level 4	245	REF	mV	10	min.	0.1	Sec.
<input checked="" type="checkbox"/> Level 5	300	LAST	mV	40	sec.	0.1	Sec.
<input checked="" type="checkbox"/> Level 6	400	FREE	mV	1	hour	0.1	Sec.
<input type="checkbox"/> Level 7	0	REF	mV	1	min.	0.1	Sec.
<input type="checkbox"/> Level 8	0	REF	mV	1	min.	0.1	Sec.

All levels : All levels :

OK Cancel

Figure 3: In « potential step » window, different steps of potential can be defined

By the following parameters, the 6 steps (levels) chrono amperometry is defined:

- In Level 1, the imposed potential is 1 mV **vs REF** electrode in **5 minutes**.
- In Level 2, the imposed potential is 100 mV **vs REF** electrode in **2 minutes**.
- In Level 3, the imposed potential is 170 mV **vs REF** electrode in **20 seconds**.
- In Level 4, the imposed potential is 245 **vs REF** electrode in **10 minutes**.
- In Level 5, the imposed potential is 300 mV **vs LAST** potential in **40 seconds**.
- In Level 6, the imposed potential is 400 mV **vs FREE** potential in **1 hour**.
- In Level 7, not enabled.
- In Level 8, not enabled.

NOTE: Duration of imposed potential can be defined as **millisecond** too, but it must be payed attention that the **Meas. Period** must be less than the duration for example 0,0005 second.



Figure 4 shows the result of the test. 6 steps Chrono Amperometry are achieved.

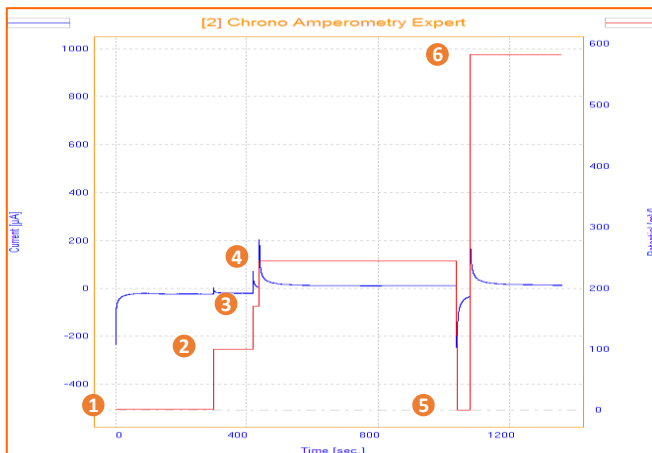


Figure 4: 6 steps of Chrono Amperometry

All the steps can also be repeated by defining the cycle number. Figure 5 shows another Chrono Amperometry Expert's curve which is repeated in 4 cycles.

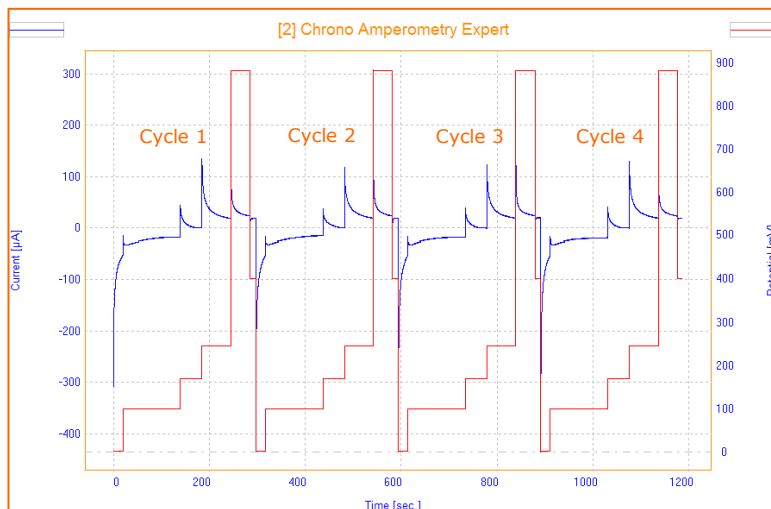


Figure 5: 4 cycles of Chrono Amperometry



Results

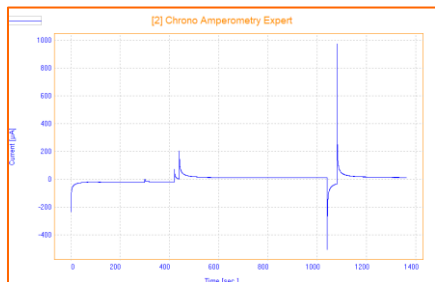


Figure 6: Final result

Compared to the standard **Chrono Amperometry**, the positive aspect of the **Chrono Amperometry Expert** is really its flexibility and possibility. From 1 to 8 levels of potentials.

Ideal method to study the kinetics of chemical reactions, diffusion processes and absorption.

Instrument and Electrodes



Figure 7: OrigaFlex OGF500



Figure 8: Electrochemical cell

Electrode setup

Reference Electrode (REF)	Calomel Type: OGR003
Counter Electrode (AUX)	Platinum wire Ø1mm Type: OGV005
Working Electrode (WRK)	Platinum Ø5mm Type: EMEDTPTD5
Electrolyte	Ferri/Ferrate solution 5 x 10 ⁻³ M in KCl
Instrument	OrigaFlex OGF500
Software	OrigaMaster

REF
Calomel



AUX
Platinum wire Ø1 mm



WRK
Platinum Ø5 mm



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