# ZIVE LAB

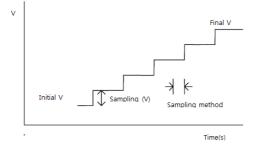
# SteadyState Cyclic voltammetry with IR measurement

### Purpose

This test is to demonstrate coin cell battery's steady state cyclic voltammetry. During cyclic voltammetry's potential scanning, it measures IR(internal resistance) with 1kHz impedance measurement method (Dynamic IR measurement).

Smart manager will apply sweep mode using constant DAC value increment or decrement with constant time duration. Smart Manager calculate DAC increment/decrement value nearby step height(or sampling interval) which user defined and time duration to meet nearby scan rate which user defined.

User can select averaging sampling condition.



This function is for high capacitive sample such as supercapacitor, corrosion, battery etc.

This demonstration's test condition is;

- ♦ Voltage range: 2.7V 4.2V
- Sweep rate: 1mV/sec
- Staircase height: 4mV
- Segment: 4 (Eoc to 4.2V, 4.2V to 2.7V, 2.7V to 4.2V, 4.2V to 2.7V)
- IR measurement condition
  - frequency: 1kHz
  - Amplitude: 10mV

### Preparation

- ZIVE SP/MP electrochemical workstation
- 4.2V Li ion Coin cell
- Coin Cell holder

## **Cell Connection**

+ electrode(Green lead & Blue lead)

- electrode(White lead & Red lead)



#### Procedure

- 1. Turn the Power switch on the ZIVE SP/MP electrochemical workstation
- 2. Open the SM software by clicking the SM icon. The following progress box will appear, and will show the progress of checking instrument configuration and communication between ZIVE SP/MP electrochemical workstation and PC.

SM ZIVE* Smart Manager™ 3, 1, 0, 0	1 device found.
ZIVE LAB	Ok

If the link is successfully connected, Click "OK" button on the box then the progress box will automatically disappear and SM software will appear. If the link failed, The following progress box will display then click the "Retry" button.

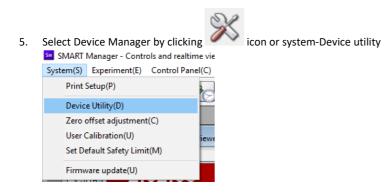


If the link failed again after clicking "Retry" button, you need to check USB cable connection.

3. Steady state CV test technique file: Click New technique function icon (or select Experiment-Techniques on Experiment menu) Then you can see the following menu

Multisine PEIS	^	Parameters   Informat	tion ]			-	Open
- Energy package(BAT)		ITEM	VALUE	Option	-	-	Save
CC/CV Test		Initial delay	Enable				Save as
/ Discharge test		-Duration(s)	1:40				Jave as
🖉 EVS Test		-Stability(V/s)	1.0000e-3				
🖉 Variable scan rate CV		Deposition	Enable				Apply to CH
Pstat IV Curve Gstat IV Curve		-Potential(V)	0.0000e+0	ERef	-		
SteadyState CV		-Duration(s)	0				Close
GITT Test		Quiet time(s)	2				
PITT Test Corrosion package(COR)		Initial potential(V)	0.0000e+0	Eoc	+		
/ Tafel		Middle potential(V)	4.2000e+0	ERef	-		
Polarization resistance		Final potential(V)	2.7000e+0	ERef	-		
/ Potentiodynamic		Step pontial(V)	4.0000e-3		_		
Galvanodynamic Cyclic polarization		Scan rate(V/s)	1.0000e-3				
Secor vs. time		Segment count	14	ŧ			
Galvanic corrosion		Step sampling	LAST 100% -	1			
RpEc trend Reactivation potential		IR Measure	I On				
Potentiostatic ECN		I Range(A)	100mA 👻	Auto			
Galvanostatic ECN ZRA mode ECN Echem Analysis package(EAS) STEP ChronoAmperometry ChronoPotentiometry ChronoCoulometry PLISE	ľ					-	

4. Click "Save" button to save the technique file which contains the above parameter and save it as "ssv.ssv" file name and click "Apply CH" button to assign this technique file on channel.



#### 6. Select Advance tab.

00		~.	
	I RangeCount	10	
	Max Current	1 A	
	Max Voltage	10 V	
	FRA Range I(A)	10.000e+0	
	FRA Range V(V)	10.000e+0	
-			Save channel info.
,	H 4 → H [1-1]Ger	eral / [1-1]AUX [1-1]Advance	Close

7. Input frequency (1k) and amplitude(10m) and click "save channel info" button

Subharmonic max. point(ns/cycle)	64.000e+0		
Averaging Freq.(Hz)	1.0000e+3		
Auto I Ranging Freg.(Hz)	1.0000e+3		
"IR EIS Frequency(Hz)	1.0000e+3		
"IR FIS Amplitude(A)"	1000.0e-9		
"IR EIS Amplitude(V)"	10.000e-3		
IR CI-On time(ms)	2.0000e+0		
IR CI-Sample time(ms)	2.0000e+0		Save channel info.
IR CI-Const value(A)	10.000e-3		
H	AUX / [1-1]Advance	1	Close

- 8. To start experiment, click Start button
- 9. After click start button, you can see the following box.

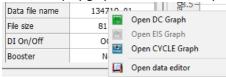
Start test configuration	
SM C:WZIVE DATAWSMW	
File name	
Start file File-1 V Start step Step-1 V	Current polarity
Active area(cm^2) 1.000000 Capacity(mAHr) 1.000000	Weight(g) 1.000000
Tester	( Next line : CTRL+ENTER )
Memo	
□ Not save file	OK Cancel

You can see real time plot as the following.

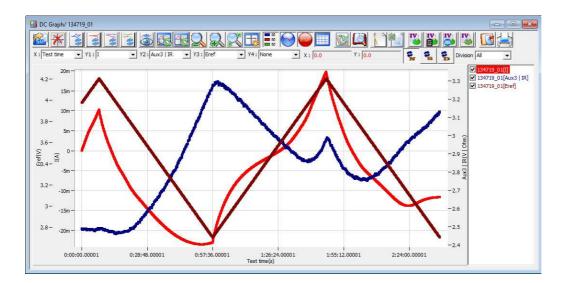




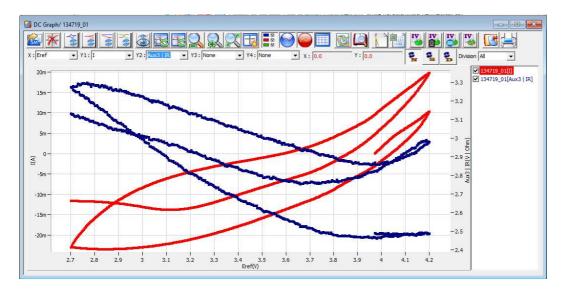
10. You can display graphic or data editor by clicking right mouse on data file name



11. You can see voltage, current, IR vs test time when you selected those parameter on DC graph

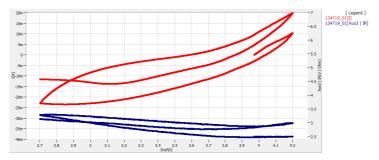


12. You can see current, IR vs voltage when you selected those parameter on DC graph



13. You may re-scaling the graph by clicking

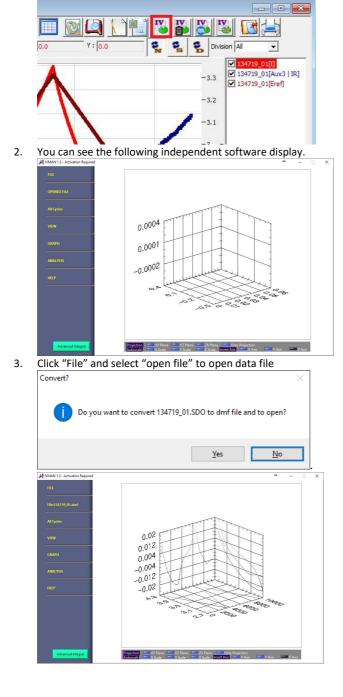




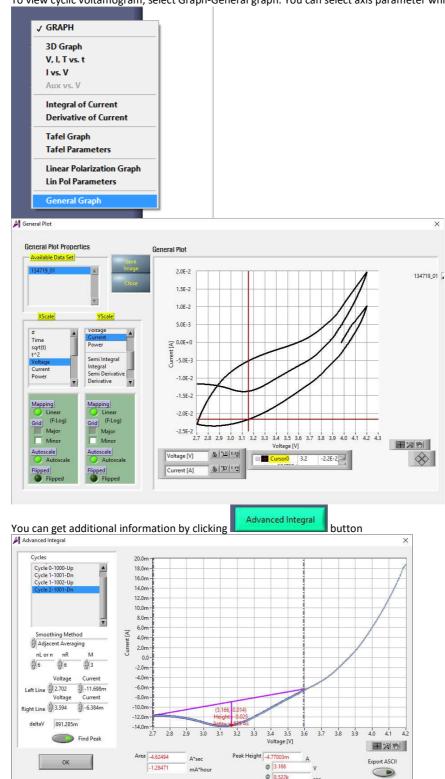
### Data Analysis

IV

1. Open "IVMAN" by clicking IVMAN main icon To use this analysis software, you must install IVMAN software package. This software package is on setup CD.



To view cyclic voltamogram, select Graph-General graph. You can select axis parameter which you want. 4.



@ 8.522k

sec

5.



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