GalvanoPlot

GalvanoPlot Methods and Parameters

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1. Cyclic Voltammetry (CV)

CV applies a voltage sweep to an electrochemical cell and measures the resulting current. It is commonly used to study redox reactions and determine electrochemical properties like reaction rates and reversibility.

- **Current Range:** Specifies the range of current that can be measured during the experiment. A lower current range helps reduce background noise and improves the accuracy of measurements for low-current responses, while a higher range is suitable for measuring stronger signals.
- **Er1 (First Vertex Potential):** The first voltage value that the device will sweep towards. When the voltage is reached the direction of sweep will be revert.
- **Er2 (Second Vertex Potential):** The second voltage value that the device will sweep towards. When the voltage is reached, the direction of sweep will be revert.
- **Ei (Initial Potential Value):** The starting voltage value of experiment
- **Rate:** The amount of millivolts per second that will be scanned during the experiment.
- **Scan:** The number of cycles the experiment will perform.
- **Resolution:** Sweeping voltage step. Use small numbers to smooth sweeping or use large numbers to reduce number of data points of experiment.
- **Quiet Time:** The waiting period before the measurement begins. It improves measurement stability and helps prevent errors by avoiding initial noise. The default setting is 1 second unless modified.

2. Differential Pulse Voltammetry (DPV)

DPV applies voltage pulses while sweeping the potential. It is used for trace analysis and high-sensitivity measurements by minimizing background current.

- **Current Range:** Specifies the range of current that can be measured during the experiment. A lower current range helps reduce background noise and improves the accuracy of measurements for low-current responses, while a higher range is suitable for measuring stronger signals.
- **Ei (Initial Potential Value):** The initial voltage value set at the beginning of the experiment.
- **Ef (Final Potential Value):** The final voltage value reached by the end of the experiment.
- **Step:** Sweeping voltage step. Use small numbers to smooth sweeping or use large numbers to reduce number of data points of experiment.
- **Width:** The duration of each pulse applied during the experiment.
- **Period:** The time that is used to generate one measurement point. During a period, the device applies base potential, measures base current, applies (base + amplitude) potential and measures the current.
- **Amplitude:** The height of the pulse potential, indicating the difference between the baseline potential and the pulse peak.
- **Early Acquisition Time:** An advanced user parameter to adjust measurement time of pulse current. Generally used to adjust pulsive methods to match a reference device. Higher value means the device measures the peak current earlier, so the resulting current values should be higher. Default value is 0.
- **Quiet Time:** The waiting period before the measurement begins. It improves measurement stability and helps prevent errors by avoiding initial noise. The default setting is 1 second unless modified.

3. Square Wave Voltammetry (SWV)

SWV applies square wave pulses and measures the current. It is highly sensitive and often used for detecting low-concentration analytes.

- **Current Range:** Specifies the range of current that can be measured during the experiment. A lower current range helps reduce background noise and improves the accuracy of measurements for low-current responses, while a higher range is suitable for measuring stronger signals.
- **Ei (Initial Potential Value):** The initial voltage value set at the beginning of the experiment.
- **Ef (Final Potential Value):** The final voltage value reached by the end of the experiment.
- **Step:** Sweeping voltage step. Use small numbers to smooth sweeping or use large numbers to reduce number of data points of experiment.
- **Amplitude:** The height of the square wave pulses. Since SWV measures the current difference of positive pulse and negative pulse, this parameter roughly results two times higher current than at the same value of DPV amplitude measurement.
- **Early Acquisition Time:** An advanced user parameter to adjust measurement time of pulse current. Generally used to adjust pulsive methods to match a reference device. Higher value means the device measures the peak current earlier, so the resulting current values should be higher. Default value is 0.
- **Quiet Time:** The waiting period before the measurement begins. It improves measurement stability and helps prevent errors by avoiding initial noise. The default setting is 1 second unless modified.

4. Linear Sweep Voltammetry (LSV)

LSV applies a linear potential sweep and records the resulting current. It is like CV but without cycling back, often used to determine electrochemical reaction mechanisms.

- **Current Range:** Specifies the range of current that can be measured during the experiment. A lower current range helps reduce background noise and improves the accuracy of measurements for low-current responses, while a higher range is suitable for measuring stronger signals.
- **Ei (Initial Potential Value):** The initial voltage value set at the beginning of the experiment.
- **Ef (Final Potential Value):** The final voltage value reached by the end of the experiment.
- **Rate:** The amount of millivolts per second that will be scanned during the experiment.
- **Resolution:** Sweeping voltage step. Use small numbers to smooth sweeping or use large numbers to reduce number of data points of experiment.
- **Quiet Time:** The waiting period before the measurement begins. It improves measurement stability and helps prevent errors by avoiding initial noise. The default setting is 1 second unless modified.

5. Normal Pulse Voltammetry (NPV)

NPV applies a series of increasing voltage pulses and measures the current at the end of each pulse. It's useful for sensitive detection of analytes by reducing background noise.

- **Current Range:** Specifies the range of current that can be measured during the experiment. A lower current range helps reduce background noise and improves the accuracy of measurements for low-current responses, while a higher range is suitable for measuring stronger signals.
- **Ei (Initial Potential Value):** The initial voltage value set at the beginning of the experiment. This value is also the base voltage. After every pulse, the device returns to this potential.
- **Ef (Final Potential Value):** The final pulse voltage value reached by the end of the experiment.
- **Step:** The incremental change in pulse potential applied to the electrodes with each pulse during the experiment.
- **Width:** The duration of each pulse applied during the experiment.
- **Period:** The time that is used to generate one measurement point. During a period, the device applies base potential, measures base current, applies (base + amplitude) potential and measures the current. Base voltage is always Ei and the pulse voltage changes in every period.
- **Early Acquisition Time:** The period during which data is collected before the pulse reaches its peak, useful for minimizing noise in the measurement.
- **Quiet Time:** The waiting period before the measurement begins. It improves measurement stability and helps prevent errors by avoiding initial noise. The default setting is 1 second unless modified.

6. Multi Step Amperometry (MSA)

Multi Step Amperometry applies four different voltage and measures the resulting currents over time.

- **Current Range:** Specifies the range of current that can be measured during the experiment. A lower current range helps reduce background noise and improves the accuracy of measurements for low-current responses, while a higher range is suitable for measuring stronger signals.
- **Ei (Initial Potential Value):** The initial potential value set at the beginning of the experiment.
- **E1 (First Step Potential):** First step voltage to observe voltage step response. The observed current will be result of (E1 - Ei) voltage step response.
- **E2 (Second Step Potential):** Second step voltage to observe voltage step response. The observed current will be result of (E2 - E1) voltage step response.
- **Ef (Final Potential Value):** Final step voltage to observe voltage step response. The observed current will be result of (Ef - E2) voltage step response.
- **Rate:** The number current measurement per second. Higher values recommended to observe sharper step response peaks.
- **Ti (Initial Period):** The duration of Ei potential applied.
- **T1 (First Step Period):** The duration of E1 potential applied.
- **T2 (Second Step Period):** The duration of E2 potential applied.
- **Tf (Final Step Period):** The duration of Ef potential applied.

7. Amperometry

Amperometry applies a fixed potential and measures the resulting current over time, commonly used for continuous monitoring of analyte concentrations.

- **Current Range:** Specifies the range of current that can be measured during the experiment. A lower current range helps reduce background noise and improves the accuracy of measurements for low-current responses, while a higher range is suitable for measuring stronger signals.
- **E (Potential):** This represents the fixed potential applied to the working electrode during the experiment.
- **Rate:** Refers to the frequency at which the current is recorded during the experiment, with higher rates providing more detailed information about how the current changes over time. Smaller rates are suggested to enable automatic oversampling function of the device to reduce noise and reduce the data size while recording long measurements.
- **Run Time:** Defines the total duration of the experiment, i.e., how long the applied potential is maintained, and current is measured.
- **Quiet Time:** The waiting period before the measurement begins. It improves measurement stability and helps prevent errors by avoiding initial noise. The default setting is 1 second unless modified.

8. Impedance Spectroscopy

Impedance spectroscopy measures the impedance of a system across a range of frequencies, providing detailed information on the system's electrochemical properties. It is used to investigate charge transfer, diffusion, and other electrochemical processes.

- **Current Range:** Specifies the range of current (in microamperes) that can be measured during the impedance spectroscopy experiment. A lower current range helps reduce background noise and improves accuracy for low-current responses, while a higher range is suitable for stronger signals. Since impedance vary in large amounts in frequencies, using auto current range is suggested.
- **Fi (Initial Frequency):** The starting frequency for the impedance measurement.
- **Ff (Final Frequency):** The last frequency in the frequency sweep.
- **Edc (Direct Current Potential):** The DC bias or potential applied during the impedance measurement. This maintains a constant potential on the working electrode while the AC signal is superimposed. Suggested to set open circuit potential for better results which is generally between (50 - 300) mV
- **Eac (Alternating Current Amplitude):** The amplitude of the AC signal applied during the impedance measurement. A small AC voltage is superimposed on the DC bias to measure impedance across different frequencies. Higher values are better on high impedances to overcome noise.
- **Accuracy:** Defines the precision of the measurement. Higher accuracy improves the resolution of impedance data but may result in slower measurements.
- **Nf (Number of Frequency Points):** Specifies the number of discrete frequencies at which the impedance will be measured between Fi and Ff.
- **Logarithmic:** Refers to how frequencies are distributed across the sweep. When set to logarithmic, the system spaces the frequencies logarithmically, providing better resolution at lower frequencies.

9. Impedimetry

Impedimetry measures the system's impedance at a specific frequency across time

- **Current Range:** Specifies the range of current (in microamperes) that can be measured during the impedimetry experiment. A lower current range helps reduce background noise and improves accuracy for low-current responses, while a higher range is suitable for stronger signals.
- **F (Frequency):** Refers to the frequency at which the impedance measurement is conducted.
- **Edc (Direct Current Potential):** The DC bias applied during the measurement. It maintains a steady potential on the working electrode while the AC signal is superimposed to measure impedance.
- **Eac (Alternating Current Amplitude):** Defines the amplitude of the AC potential applied during the impedance measurement.
- **Accuracy:** Defines the precision of the measurement. Higher accuracy provides more reliable data but may slow down the measurement process.
- **Run Time:** The total duration of the experiment, indicating how long the measurement will be conducted.

10. Open Circuit Potential (OCP)

OCP measures the potential difference between an electrode and a reference electrode when no external current is applied. It is used to assess the stability of an electrochemical system or the corrosion potential of materials.

- **Rate:** Rate typically refers to the sampling rate, which is how frequently the potential is recorded over time.
- **Run Time:** Defines the total duration for which the OCP measurement is conducted.
- **Quiet Time:** The waiting period before the OCP measurement begins. It allows the system to stabilize before recording starts, reducing the influence of initial transients or noise.

11. PSA Galvanostatic

PSA Galvanostatic applies a constant current to the system and monitors potential changes. It is often used for trace metal analysis or measuring the deposition and stripping of ions.

- **Elimit (Potential Limit):** Defines the maximum potential the system can reach during the experiment. Once this limit is reached, the system stops experiment to prevent overloading or damaging the electrodes.
- **Current:** In a galvanostatic method, this is the constant current applied to the system.
- **Run Time**: Defines the total duration for which the constant current is applied to the system.
- **Rate:** Rate typically refers to the sampling rate, which is how frequently the potential is recorded over time.
- **EStandby (Standby Potential):** The potential applied to the system after the experiment is completed.
- **Quiet Time**: The waiting period before the measurement begins. It improves measurement stability and helps prevent errors by avoiding initial noise. The default setting is 1 second unless modified.

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If you have any questions or recommendations
with the GalvanoPlot products, please contact us.

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