

CS350 potentiostat/galvanostat with built-in EIS is the most advanced and comprehensive model among single channel models. It contains a fast digital function generator, high-speed data acquisition circuitry, a potentiostat and a galvanostat. It has more than 40 electrochemical methods including built-in EIS (frequency range 10 μ Hz~1MHz). Max. current is \pm 2A, potential range is \pm 10V. It can be used for high current systems such as corrosion, the hot CO₂ reduction, and low current measurements as well. It supports 2-,3-,4-electrode system, and can run under floating or grounded mode.



Application

- Reaction mechanism of Electrosynthesis, electrodeposition, anodic oxidation, etc.
- Electrochemical analysis and sensor;
- New energy materials (Li-ion battery, solar cell, fuel cell, supercapacitors), advanced functional materials, photoelectronic materials;
- Corrosion study of metals in water, concrete and soil, etc;
- Fast evaluation of corrosion inhibitor, water stabilizer, coating and cathodic protection efficiency.

Specifications

Support 2-, 3- or 4-electrode system

Potential control range: \pm 10V

Current control range: \pm 2A

Potential control accuracy: 0.1% \times full range \pm 1mV

Current control accuracy: 0.1% \times full range

Potential resolution: 10 μ V (>100Hz), 3 μ V (<10Hz)

Current sensitivity: 1pA

Rise time: <1 μ S (<10mA), <10 μ S (<2A)

Current range: 2nA~2A, 10 ranges

Reference electrode input impedance: 10¹² Ω | | 20pF

Maximum current output: 2A

Compliance voltage: \pm 21V

Current increment during scan: 1mA@1A/ms

CV and LSV scan rate: 0.001mV~10,000V/s

Potential increment during scan: 0.076mV@1V/ms
CA and CC pulse width: 0.0001~65,000s
DPV and NPV pulse width: 0.0001~1000s
SWV frequency: 0.001~100 kHz
Minimum potential increment in CV: 0.075mV
AD data acquisition:16bit@1 MHz,20bit@1 kHz
Potential and current range: Automatic
DA Resolution:16bit, setup time:1 μ s
Low-pass filters: Covering 8-decade
Communication interface: USB
Operating System requirements: Windows 7/win8/win10
Dimensions/weight: 36*30*16cm, 6KG

Electrochemical Impedance Spectroscopy(EIS)

Signal generator

Frequency range:10 μ Hz~1MHz
AC amplitude:1mV~2500mV
Output impedance:50 Ω
DC Bias: -10~+10V
Waveform: sine wave, triangular wave and square wave
Wave distortion:<1%
Scanning mode: logarithmic/linear, increase/decrease

Signal analyzer

Integral time:minimum:10ms or the longest time of a cycle
Maximum:10⁶ cycles or 10⁵s
Measurement delay:0~10⁵s

DC offset compensation

Potential automatic compensation range:-10V~+10V
Current compensation range:-1A~+1A
Bandwidth: 8-decade frequency range, automatic and manual setting

Techniques /Software

Stable polarization

- Open Circuit Potential (OCP)
- Potentiostatic (I-T curve)
- Galvanostatic
- Potentiodynamic (Tafel plot)
- Galvanodynamic (DGP)

Transient Polarization

- Multi Potential Steps
- Multi Current Steps
- Potential Stair-Step (VSTEP)
- Galvanic Stair-Step (ISTEP)

Chrono Method

- Chronopotentiometry (CP)
- Chronoamperometry (CA)
- Chronocoulometry (CC)

Voltammetry

- Linear Sweep Voltammetry (LSV)
- Cyclic Voltammetry (CV)
- Staircase Voltammetry (SCV)
- Square Wave Voltammetry (SWV)
- Differential Pulse Voltammetry (DPV)
- Normal Pulse Voltammetry (NPV)#
- Differential Normal Pulse Voltammetry (DNPV)
- AC Voltammetry (ACV)
- 2nd harmonic AC Voltammetry (SHACV)
- Fourier Transform AC Voltammetry (FTACV)

Amperometric

- Differential Pulse Amperometry (DPA)
- Double Differential Pulse Amperometry (DDPA)
- Triple Pulse Amperometry (TPA)
- Integrated Pulse Amperometric Detection (IPAD)

Stripping Voltammetry

- Potentiostatic Stripping
- Linear Stripping
- Staircase Stripping
- Square Wave Stripping
- Differential Pulse Voltammetry Stripping
- Normal Pulse Voltammetry Stripping
- Differential Normal Pulse Voltammetry Stripping

Electrochemical Impedance Spectroscopy (EIS)

- EIS vs Frequency (IMP)
- EIS vs Time (IMPT)
- EIS vs Potential (IMPE)(Mott-Schottky)

Corrosion Measurements

- Cyclic polarization curve (CPP)
- Linear polarization curve (LPR)
- Electrochemical Potentiokinetic Reactivation (EPR)
- Electrochemical Noise (EN)
- Zero resistance Ammeter (ZRA)

Battery test

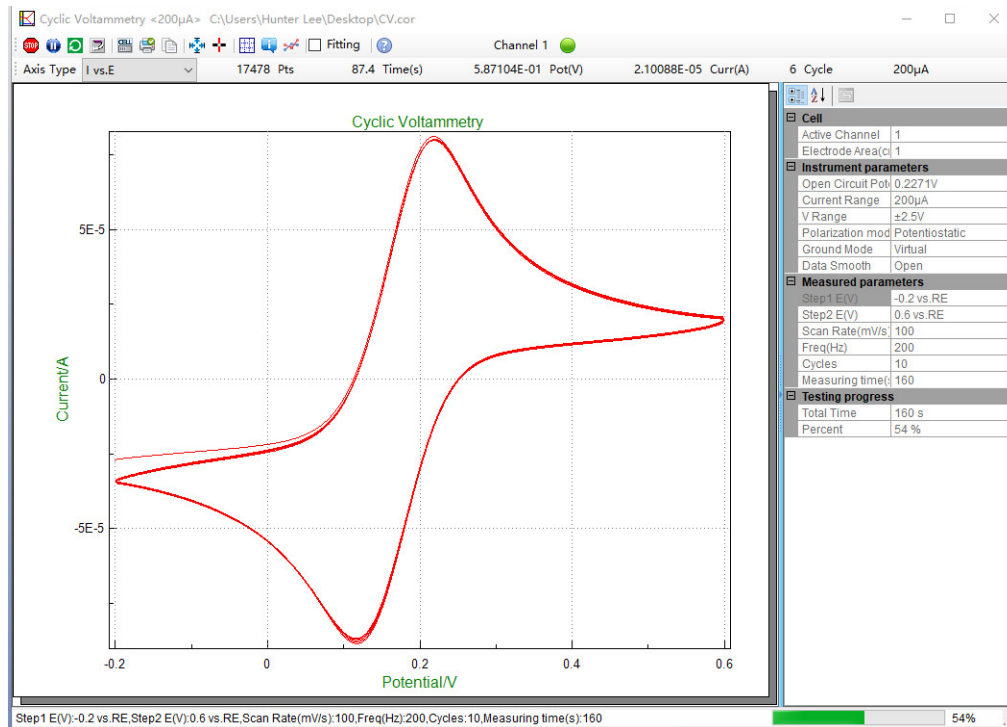
- Battery Charge and Discharge
- Galvanostatic Charge and Discharge (GCD)
- Potentiostatic Charging and Discharging(PCD)
- Potentiostatic Intermittent Titration Technique(PITT)
- Galvanostatic Intermittent Titration Technique(GITT)

Extensions

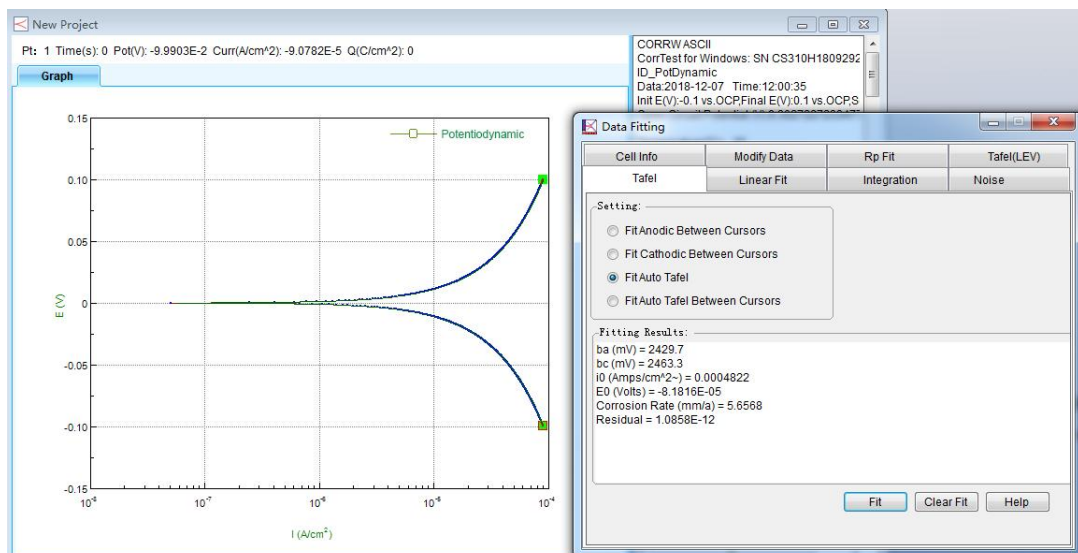
- Data Logger
- Electrochemical Stripping/ Deposition
- Bulk Electrolysis with Coulometry (BE)
- Rs measurement

Software Features

CS studio software provides users a versatile smoothing/differential/ integration kit, which can complete the calculation of peak height, peak area and peak potential of CV curves.

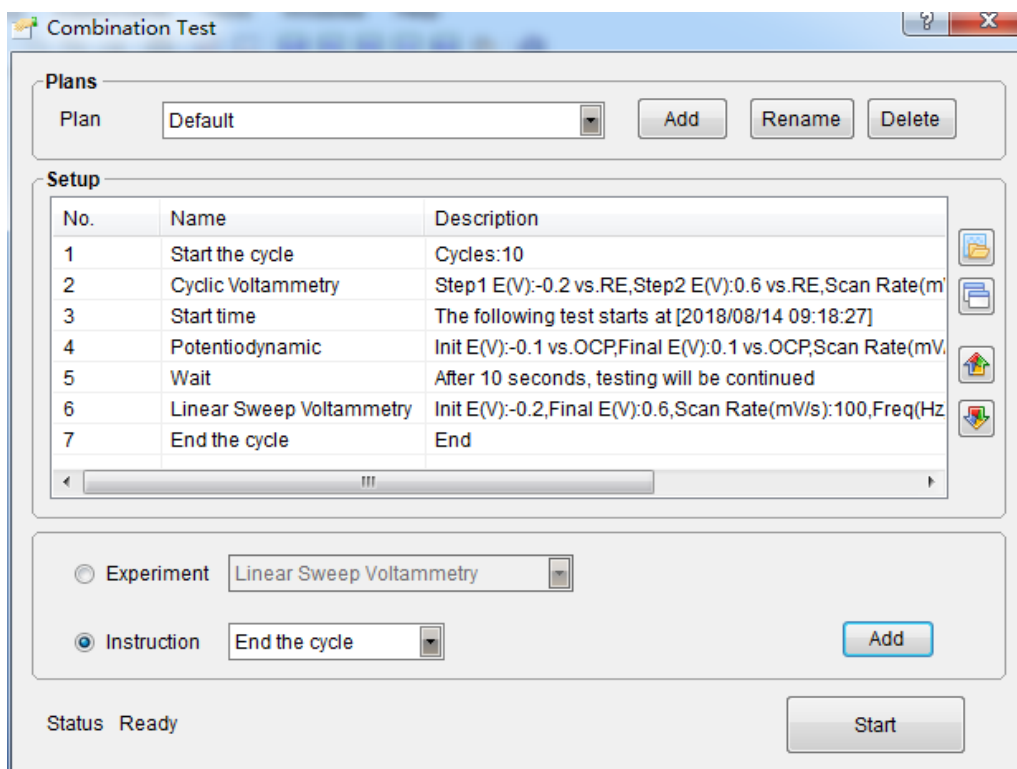


CS studio also provides powerful non-linear fitting on Butler-Volmer equation of polarization curve. It can calculate Tafel slope, corrosion current density, limitation current, polarization resistance, corrosion rate. It can also calculate the power spectrum density, noise resistance and noise spectrum resistance based on the electrochemical noise measurements.

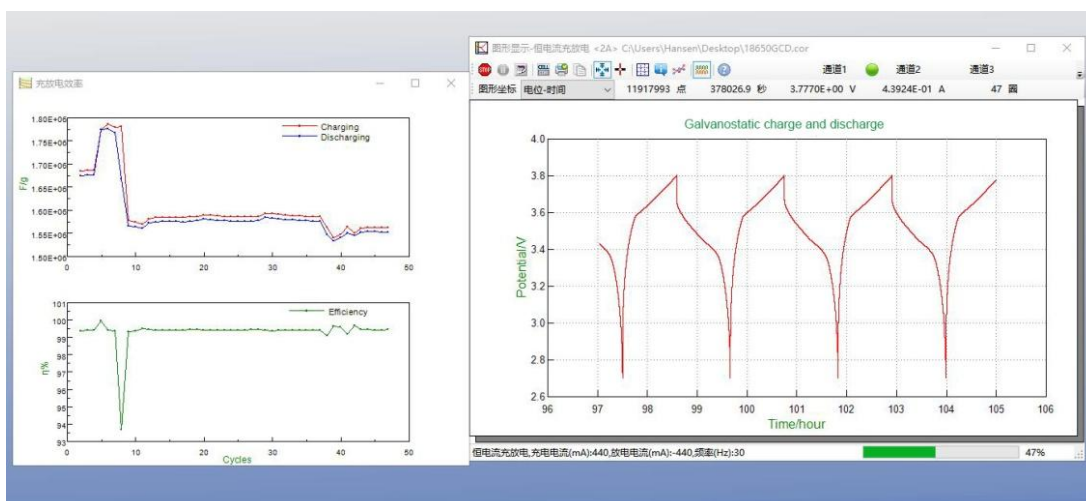


CS Studio software can achieve real time saving of the measuring data. The data can be automatically saved even in case of sudden power off.

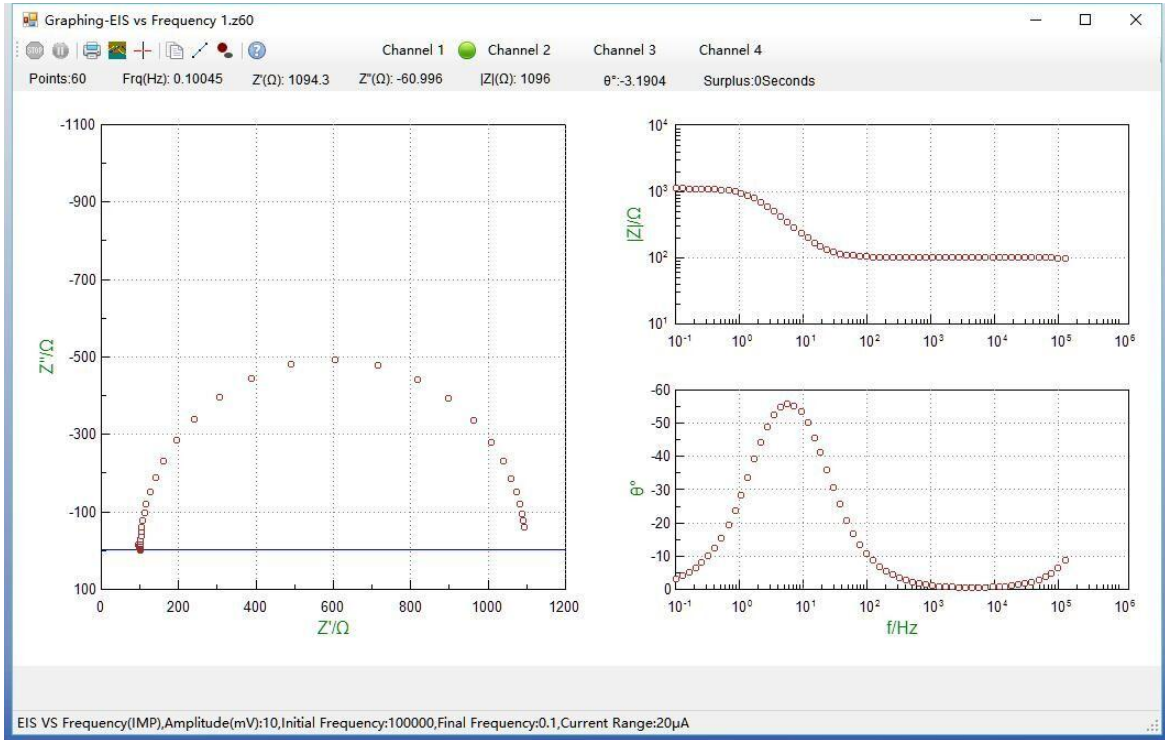
CS studio kit has a built-in versatile timing policy for combined measurements, which can facilitate the automation of experiments and save time. With the unique function of combination test, you can choose several techniques, and set the wait time, the start time, and the cycles. Choose the experiments you want to run, and click Add. Then you can make auto measurement of the set experiments as you want without having to wait in the lab. This function is especially useful if you have multi experiments to run and save your time greatly.



Battery analysis: charge & discharge efficiency, capacity, specific capacitance, charge & discharge energy.



EIS analysis: Bode, Nyquist, Mott-Schottky plot



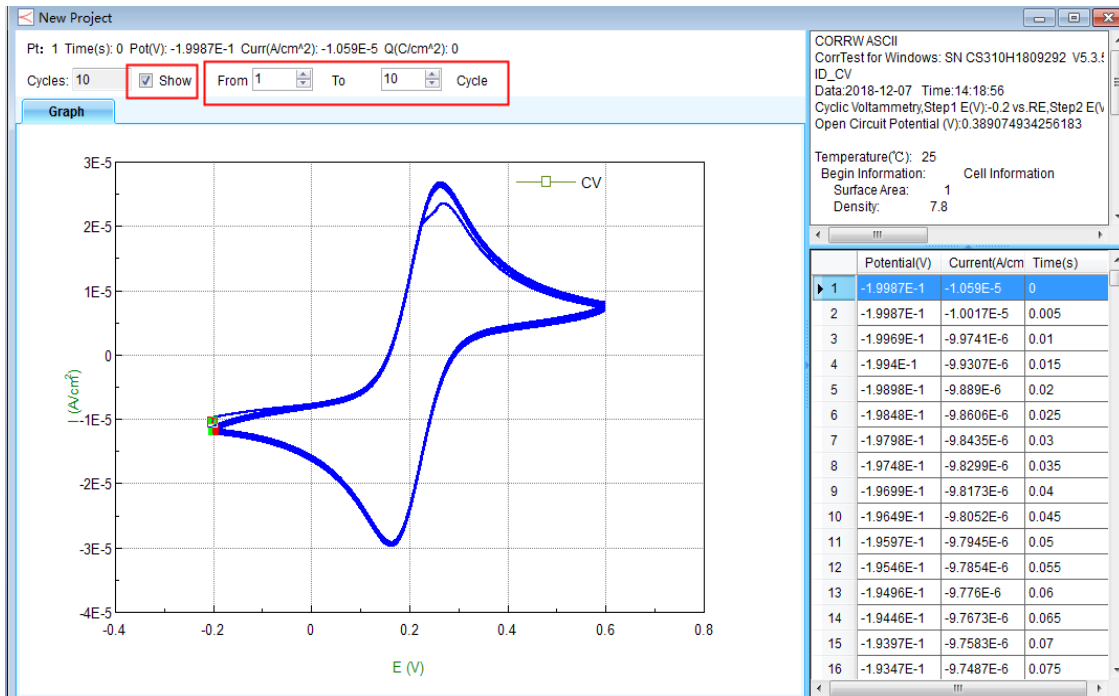
Timing measurements -- CS studio software can achieve timing measurements. After you set the experiment and time, click start, then the experiment will be run automatically when it is the time.

The 'Timing Measurement' dialog box is shown with the following fields and controls:

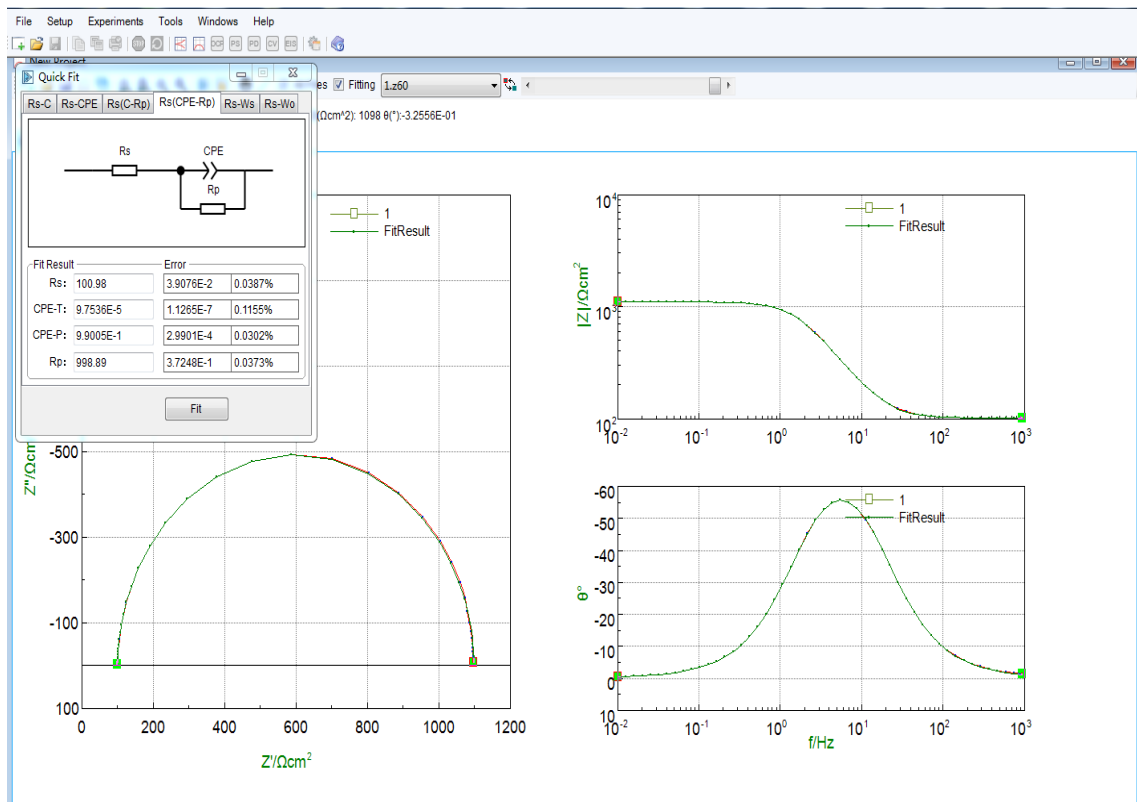
- New Data File:** File Name (text input), Comments (text input), and a Browse button.
- Experiment:** Open Circuit Potential (dropdown menu) and a Setup button.
- Cycle Schedule:** Run from (2020-06-01, 13 Hour 52 Min.), Run Once Every (30 min), Total Cycles (5), and Current Cycle (0).

 At the bottom, there are Start, Stop, Cancel, and Help buttons.

In CV technique and galvanostatic charge and discharge, during the data analysis, there is function of selecting exact cycle(s) to show. You can choose to see a cycle or some cycles as you want. You can also export data or vector graph of an exact cycle or several cycles.

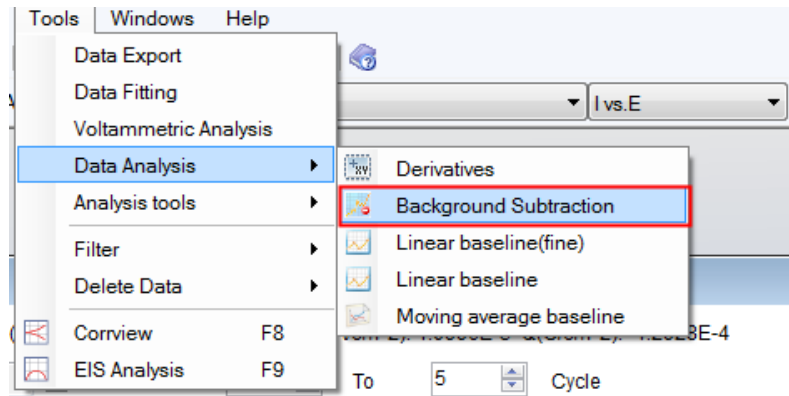


During EIS data analysis, there is built-in fitting function to draw the custom equivalent circuit. Firstly, draw the equivalent circuit, use the “Quick Fit” to obtain the parameters’ value, and then substitute the value into the equivalent circuit.



Background subtraction

This function can be used to reduce the background noise’s influence on the test.



You can open the ".cor"(all data files except EIS) and ".z60"(EIS) data files by txt(in notebook). They can also be opened in Origin by "Import single ASCII".

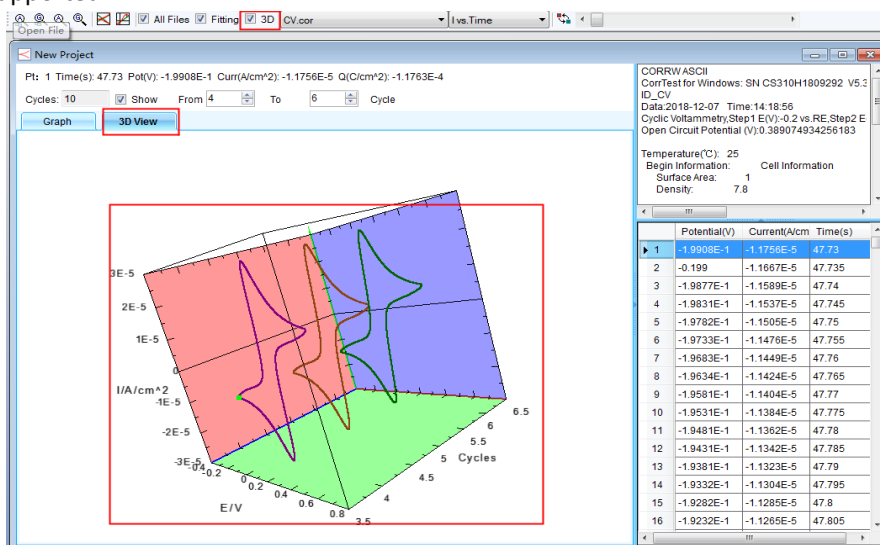
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CV - 记事本
文件(F)  编辑(E)  格式(O)  查看(V)  帮助(H)

CORRW ASCII
CorrTest for Windows: SN CS310H1809292 V5.3.521.9 2.5H6.11.07
ID_CV
Data:2018-12-07 Time:14:18:56
Cyclic Voltammetry, Step1 E(V):-0.2 vs.RE, Step2 E(V):0.6 vs.RE, Scan Rate(mV/s):100, Freq(Hz):200, Cycles:10, Measuring time(s):160
Open Circuit Potential (V):0.389074934256183

Temperature(C): 25
Begin Information:          Cell Information
Surface Area:              1
Density:                   7.8
Weight:                    28
Polarity:                  0
PolarityI:                 0
Corrosion Unit Type:       1
Reference Type:            2
Reference Potential:        0.241
Reference User-Defined:    2
Stern-Geary:              18
End Information:          Cell Information
Begin Experiment:
Axes Type:                3
End Experiment:
E(V)          i(A/cm^2)      T(s)
End Comments
-1.99371E-01  -1.05902E-05  0.0000
-1.99371E-01  -1.00168E-05  0.0050
-1.99693E-01  -9.97412E-06  0.0100
-1.99404E-01  -9.93066E-06  0.0150
-1.98977E-01  -9.88998E-06  0.0200
-1.98478E-01  -9.86060E-06  0.0250
-1.97980E-01  -9.84351E-06  0.0300
-1.97483E-01  -9.82994E-06  0.0350
-1.96986E-01  -9.81728E-06  0.0400
-1.96489E-01  -9.80519E-06  0.0450
-1.95967E-01  -9.79454E-06  0.0500
-1.95461E-01  -9.78541E-06  0.0550
-1.94962E-01  -9.77601E-06  0.0600
  
```

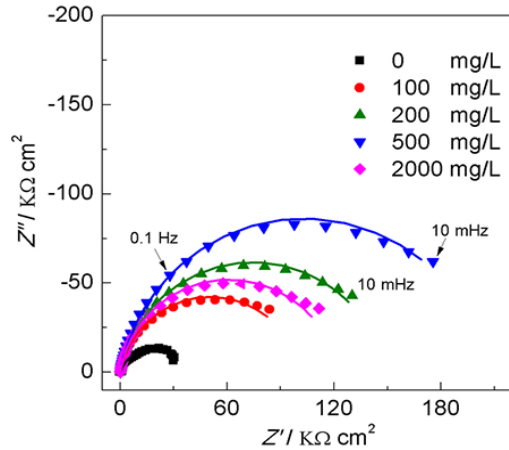
3D graph is supported.



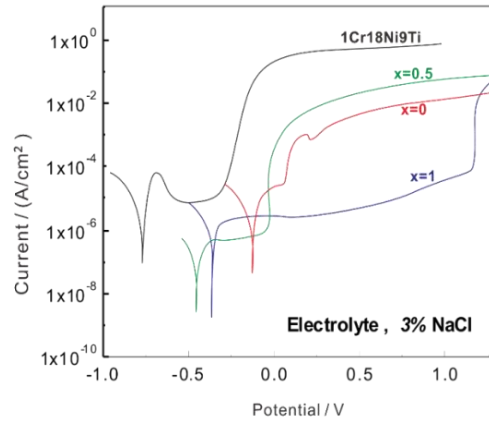
Technical advantages

1. Impedance (EIS)

CS350 potentiostat applies correlation integral algorithm and dual-channel over-sampling technique, and has strong anti-interference ability. It is suitable for EIS measurements of high-impedance system ($>10^9 \Omega$, such as coating, concrete etc.).



EIS of AA6063 Al alloy in Ce^{3+} containing 3% NaCl solution



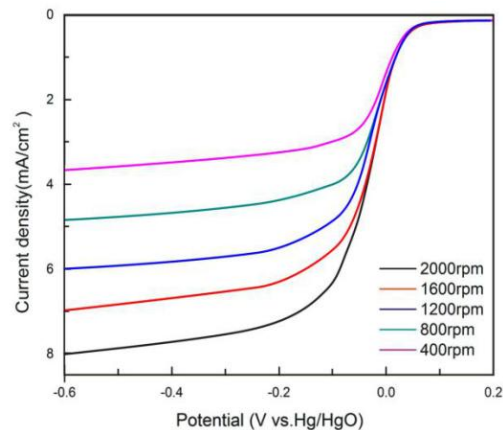
Polarization curve of Ti-based amorphous alloy & stainless steel in 3%NaCl solution

2. Polarization curve

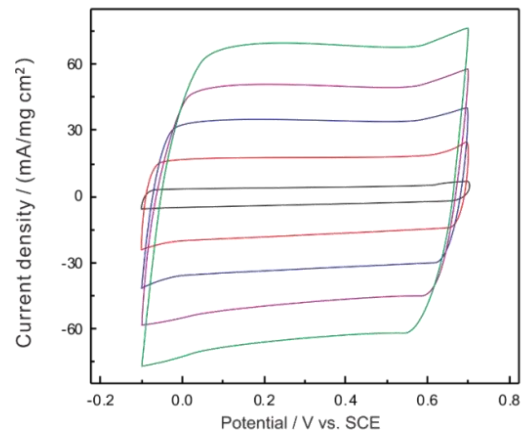
Tafel plot can be obtained. The user can set the anodic reversal current (passivation film breakdown current) of the cyclic polarization curve to obtain material's pitting potential and protection potential and evaluate its susceptibility to intergranular corrosion. The software uses non-linear fitting to analyze polarization curve, and can make fast evaluation of material's anti-corrosion ability and inhibitors.

3. Voltammetry

Linear Sweep Voltammetry (LSV), Cyclic Voltammetry (CV), SCV, SWV, DPV, NPV, ACV, Stripping voltammetry etc. It integrates calculation of peak area, peak current and standard curve analysis.



LSV: mesoporous carbon material in 0.1M KOH



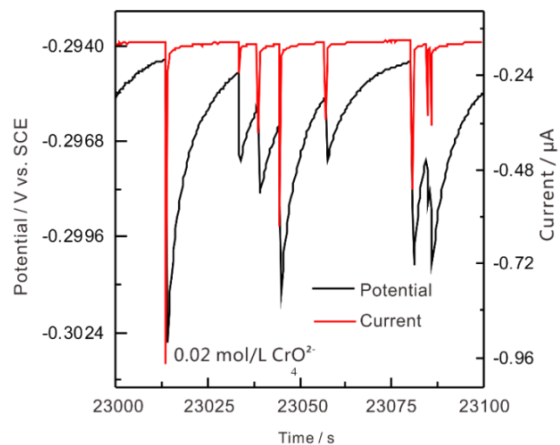
CV of PPy supercapacitor in 0.5 mol/L H_2SO_4

4. Electrochemical Noise

With high-resistance follower and zero-resistance ammeter, it measures the natural potential/current fluctuations in corrosion system. It can be used to study pitting corrosion, galvanic corrosion, crevice corrosion, and stress corrosion cracking etc. Based on calculation of noise resistance and pitting index, it can complete localized corrosion monitoring.

5. Full floating measurement

Full-floating mode be used for autoclave electrochemical measurements, on-line corrosion monitoring of metallic components under the ground (rebar in concrete, etc.)



Electrochemical noise of low-carbon steel in 0.05mol/L Cl⁻+0.1mol/L NaHCO₃

6. User-defined methods

We are able to provide API functions and development examples, which facilitates some users' requirements for secondary development and self-defined measurements.

Standard supply list for potentiostat Model CS350

Instrument host CS350*1

CS studio software(Testing & data analysis)*1

Power cable*1

USB cable *1

Electrode cable *2

Dummy cell*1

**If you need electrodes and cells, please kindly contact us for purchase.

Service

1. Warranty period: 5 years
2. Provide installation guidance and manual, software installation video.
3. Lifetime free software upgrading and technical service
4. Provide repair service for free