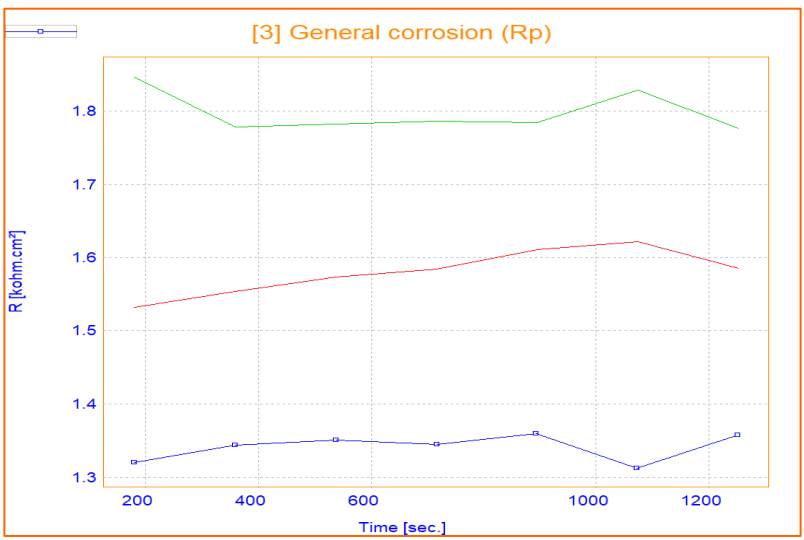
Application Note

General Electrochemistry
AP-C02

General Corrosion (Rp)



This Application Note describes how the General Corrosion (Rp) method works by giving an example with Iron nail.

Introduction

The General corrosion (Rp) tests from OrigaMaster 5 are useful to investigate the efficiency of inhibitors used to prevent general (or uniform) corrosion. Automatic calculation of the resistance of polarization (called Rp) is determined from cyclic or linear voltammetries performed around the rest potential.
The polarization resistance measures the instantaneous corrosion rate occurring at the electrochemical interface.

NOTE: The Rp can be used to evaluate the anti-corroding strength of an inhibitor.

Parameters

The Parameter of the Rp test is shown in figure 1.

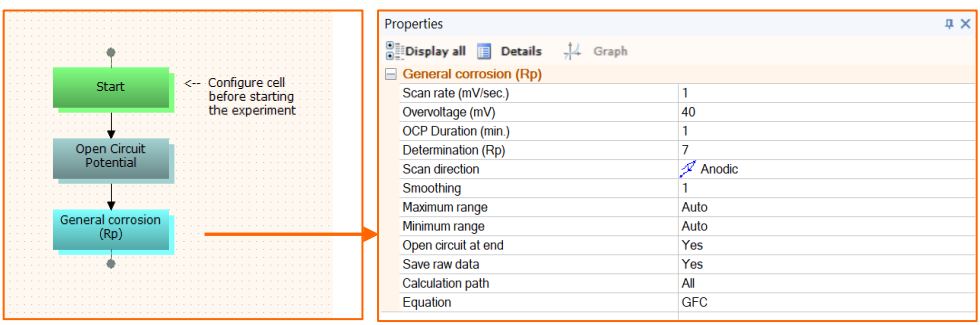


Figure 1: The parameters

With the above default settings, after 30 minutes of measuring OCP, individual voltammetries are recorded at 1mV/s.
The potential is scanned (in anodic direction, see page 2 to see all the available directions):
- from instantaneous OCP (Initial potential = free) to (OCP + 40 mV)
- and then back (in cathodic direction) to (OCP - 40 mV).

By default, 7 Rp determinations are recorded. Between two successive measurements, the circuit is opened, and the cell is at rest (OCP) for 1 minute.

The circuit is opened at the end. The voltammetries are saved (if save raw data = Yes) as the rest potential versus time. Calculated Rp results (and corrosion rates) are saved versus time.

Parameters: Scan direction

This parameter sets the Potential scan.
4 scan directions are available.

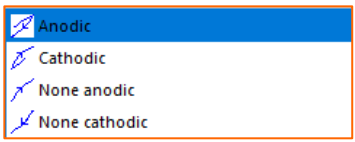


Figure 2: Available scans

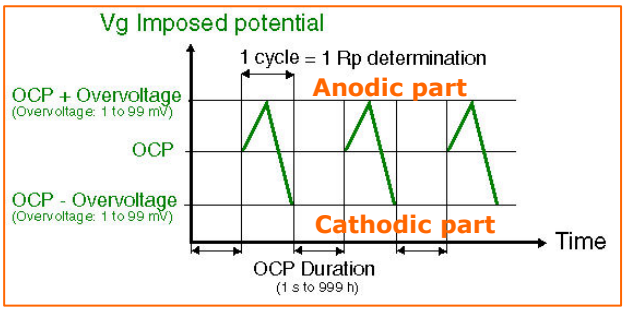


Figure 3: Scheme of Rp test for Anodic Scan

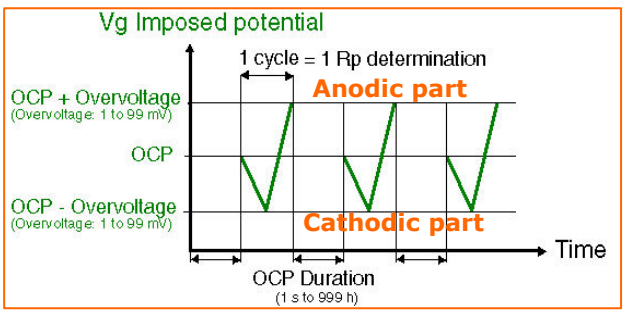


Figure 4: Scheme of Rp test for Cathodic Scan

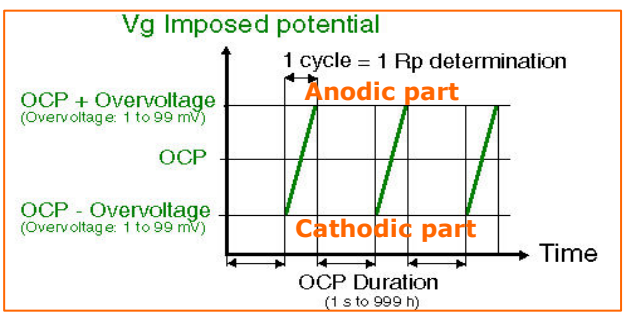


Figure 5: Scheme of Rp test for only Anodic direction

Anodic

The Potential is scanned to the Anodic part, then from there to the Cathodic part. So, by considering the parameters in the figure 1:

- First, from OCP to OCP + 40 mV
- Then, from OCP + 40 mV to OCP – 40 mV
- Once again OCP, and as cycles as Rp determinations.

Cathodic

The Potential is scanned to the Cathodic part, then from there to the Anodic part. So, by considering the parameters in the figure 1:

- First, from OCP to OCP - 40 mV
- Then, from OCP - 40 mV to OCP + 40 mV
- Once again OCP, and as cycles as Rp determinations.

None Anodic

The Potential is scanned from the Cathodic part to the Anodic part. So, by considering the parameters in the figure 1:

- Only, from OCP – 40 mV to OCP + 40 mV
- Once again OCP, and as cycles as Rp determinations.

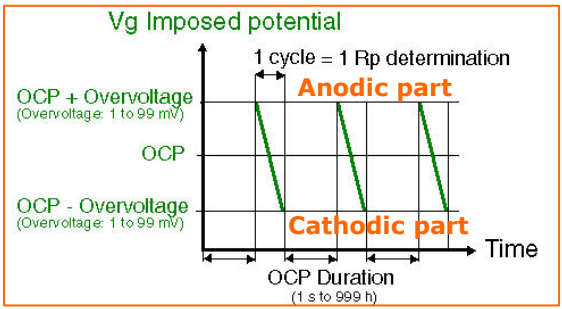


Figure 6: Scheme of Rp test for only Cathodic direction

None Cathodic

The Potential is scanned from the Anodic part to the Cathodic part. So, by considering the parameters in the figure 1:

- OCP + 40 mV to OCP - 40 mV
- Once again OCP, and as cycles as Rp determinations.

Results

Figure 7 shows the Rp values of 3 different tests, from different volume of Inhibitors.

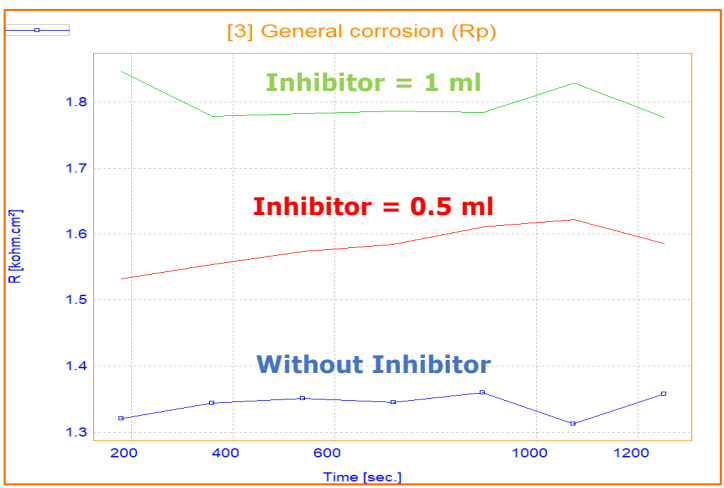


Figure 7: Overlay of Rp results from 3 different tests

The blue line = Rp measurements of Iron in NaCl 2 M - > without inhibitor.

The red line = Rp measurements of Iron in NaCl 2 M -> with 0.5 ml of inhibitor.

The green line = Rp measurements of Iron in NaCl 2 M -> with 1 ml of inhibitor.

Interpretation

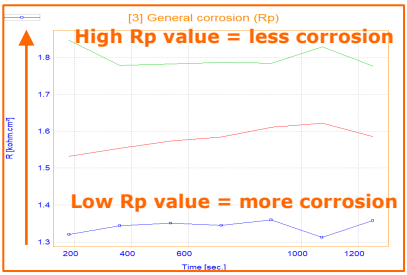


Figure 8: Overlay of 3 Rp results

By increasing the amount of inhibitors, we increase the Rp value too.
It means that the resistance of the metal increases. **More the Rp is, less the corrosion is.**

Using the **General Corrosion** method, we got the Rp value to study the quality of different kind of inhibitors.

Instrument and Electrodes

Figure 9: OrigaFlex OGF500

Electrode setup	
Reference Electrode (REF)	Calomel Type: OGR003
Counter Electrode (AUX)	Platinum wire Ø1mm Type: OGV005
Working Electrode (WRK)	Iron Nail Ø5 mm
Electrolyte	NaCl 2M
Instrument	OrigaFlex OGF500
Software	OrigaMaster

Figure 10: Electrochemical cell

REF
Calomel

AUX
Platinum wire Ø1 mm

WRK
Iron Nail Ø5 mm

OrigaLys ElectroChem SAS
Les Verchères 2
62A, avenue de l'Europe
69140 RILLIEUX-la-PAPE
FRANCE
☎ +33 (0)9 54 17 56 03
+33 (0)9 59 17 56 03
contact@origalys.com