LABORATORY NOTEBOOK

CNWRA/SwRI

CNWRA
CONTROLLED
COPY 531

NOTEBOOK NO. _____

ISSUED TO PARRELL DUNN Parrell Dunn PD

ON _____

DEPARTMENT _____

RETURNED _____

20.01402.571

Brian K. Derby - B-K Derby - BKD

JONATHAN BOST - Jthm Bost - JB

—SCIENTIFIC NOTEBOOK CO.—
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INSTRUCTIONS

1. **The primary purpose of this notebook is to protect your and the Company's Patent-Rights by keeping records of all original work in a form acceptable as evidence if any legal conflict arises.**

2. • When starting a page, enter the title, project number, and book number.
   • Use ink for permanence -- avoid pencil.
   • Record your work as you progress, including any spur-of-the-moment ideas which may be developed later.
   • Avoid making notes on loose paper to be recopied.
   • Record your work in such a manner that a co-worker can continue from where you stop. You might be ill and to protect your priority it could be urgent that the work continue while you are absent.

3. • Give a complete account of your experiments and the results, both positive and negative, including your observations.
   • Record all diagrams, layouts, plans, procedures, new ideas, or anything pertinent to your work including the details of any discussions with suppliers, or other people outside the Company.
   • Do not try to erase any incorrect entries; draw lines deleting them, note the corrections, sign and date the changes. This extra care is worthwhile because of the necessity of original data to prove priority of new discoveries.

4. • After entering your data, sign and date the entries.
   • Explain your work to at least two witnesses who are not co-inventors, and have them sign and date the pages in the place provided.
   • Record the names of operators and witnesses present during any demonstration and have at least two witnesses sign the page. If no witnesses are present during an experiment of importance, repeat it in the presence of two witnesses.

5. Since computer programs can be patented these instructions apply to the development of computer software. In this case a description of the structure and operation of the program should be recorded in the notebook, together with a basic flow diagram which illustrates the essential features of the program. In the course of developing the code, the number of lines of code written each day should be recorded in the notebook, together with a statement of the portion of the flow diagram to which the section of code is directed.

6. This notebook and its contents are the exclusive property of the Company. It is confidential and the contents are not to be disclosed to anyone unless authorized by the Company. You must return it when completed, upon request, or upon termination of employment. It should be kept in a protected place. **If loss occurs, notify your supervisor immediately, and make a written report describing the circumstances of the loss.**

Form 590

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continued testing from Notebook #520 and 528

Copied from Notebook #528

Initial Scientific notebook entry for polarization resistance measurements

Title: Polarization Resistance Tests

Tests Preformed by: Darrell S. Dunn, Brian Derby, Div. 18, Jonathan Bost Division 20 Summer Student

Objectives: Determine uniform corrosion rate of passive alloys such as Alloy 22 using polarization resistance

Equipment: Keithley 614/617. Solartron 1287 Potentiostat and CorrWare and CorrView Software or equivalent, Electrochemical test cell.

Materials: Alloy C-22, heat 2277-8-3175. Other materials and heats to be added and identified prior to testing.

Specimen specifications: Specimens will be equivalent to 20.01402.571.006 unless otherwise specified.

Measurement Parameters: Temperature, Potential, and Current of specimen during test.

Required level of accuracy: Temperature ± 2 °C, Potentials ± 1mV, Current ± 0.01 microamp.

Uncertainty and Sources of Error: Anodic current assumed to be from anodic dissolution. Current form capacitive charging of the oxide film may interfere with corrosion rate measurement.

John Bost 7/15/02

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Project No._____
Book No._____ TITLE _____

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continued testing from Notebook 520 and 528

Copied from Notebook #528

Initial Scientific notebook entry for electrochemical impedance measurements

Title: Electrochemical Impedance Tests

Tests Preformed by: Darrell S. Dunn, Brian Derby, Div. 18, Jonathan Bost Division 20 Summer Student

Objectives: Determine uniform corrosion rate of passive alloys such as Alloy 22 using electrochemical impedance

Equipment: Keithley 614/617. Solartron 1287 Potentiostat, Solartron 1260 Impedance/Gain-Phase Analyzer, and ZPlot and ZView Software or equivalent, Electrochemical test cell.

Materials: Alloy C-22, heat 2277-8-3175. Other materials and heats to be added and identified prior to testing.

Specimen specifications: Specimens will be equivalent to 20.01402.571.006 unless otherwise specified.

Measurement Parameters: Temperature, Potential, and Current of specimen during test.

Required level of accuracy: Temperature ± 2 °C, Potentials ± 1mV, Current ± 0.01 microamp.

Uncertainty and Sources of Error: Models for oxide solution interface. Multiple models exist and may be applicable. Models used will be identified.

John Bost 7/15/02

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Project No._____
TITLE _____ Book No._____

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continued testing from Notebook #366, #485, #520, #528

Copied from Notebook #528

Initial Scientific notebook entry for repassivation potential measurements

Title: Alloy 22 Repassivation Tests

Tests Preformed by: Darrell S. Dunn, Letai Yang, Div 20; Brian Derby, Div. 18

Objectives: Determine the effect of thermal aging time and temperature on the localized corrosion susceptibility of Alloy 22.

Equipment: Laboratory oven for exposure of test specimens at 600 to 900 °C, Thermocouple and thermocouple meter. Keithley 614/617. Solartron 1287 Potentiostat and CorrView Software or equivalent, Electrochemical test cell.

Materials: Alloy C-22, heat 2277-8-3175. Other materials and heats to be added and identified prior to testing.

Specimen specifications: Specimens will be equivalent to 20.01402.571.006 unless otherwise specified.

Measurement Parameters: Temperature and time of exposure, Potential and Current of specimen during test.

Required level of accuracy: Temperature ± 2 °C, Time of exposure ± 1 minute, Potentials ± 1mV, Current ± 0.01 microamp.

Uncertainty and Sources of Error: Current measurement error can occur for localized corrosion processes because the actively corroding area is not the same as the surface area of the test specimen. John Bost 7/15/02

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Project No._____
Book No._____ TITLE Performance Verification of Solartron 1260 Impedance Analyzer

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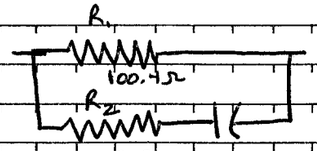
objective: evaluate performance of Solartron 1260 Impedance Analyzer

Test Performed by Jonathan Bost, Division 20 summer student
And Darrell S. Dunn

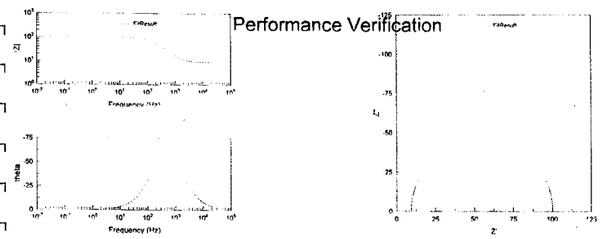
Materials and Equipment: Equipment (i.e. circuits) specified as used

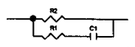
Test 1: Circuit used:



R_1 = 100.4Ω Fluke 87 III RMS Multimeter
R_2 = 10.2Ω S/N 73980453 cal: 12/21/01

Data:





Element	Freedom	Value	Error	Error %
R2	Free(+)	100.3	0.0038328	0.0038213
R1	Free(+)	10.05	0.00081811	0.0081323
C1	Free(+)	1.0085E-5	8.6011E-10	0.0085456

Chi-Squared:	2.6986E-6
Weighted Sum of Squares:	0.00034247
Data File:	D:\Corrosion Data\Performance Verification\15_July_02.z
Circuit Model File:	
Mode:	Run Fitting / Freq. Range (1E-5 - 20000)
Maximum Iterations:	100
Optimization Iterations:	0
Type of Fitting:	Complex
Type of Weighting:	Calc-Modulus

Jonathan Bost 7/15/02

Data Consistant with model used

continued on pg. 5

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Recorded by Jonathan Bost 7/15/02

Project No._____
TITLE Performance Verification of Solartron 1260 Impedance Analyzer Book No._____

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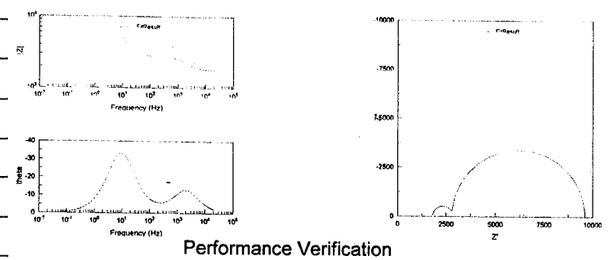
Test 2: Used circuit: Solartron 12861 ECI Test Module

Data



Element	Freedom	Value	Error	Error %
R1	Free(+)	1801	0.50612	0.028102
R2	Free(+)	6789	1.5097	0.022237
C1	Free(+)	4.7539E-6	2.3725E-9	0.049908
R3	Free(+)	1000	0.67788	0.067788
C2	Free(+)	1.0078E-7	1.6156E-10	0.16031

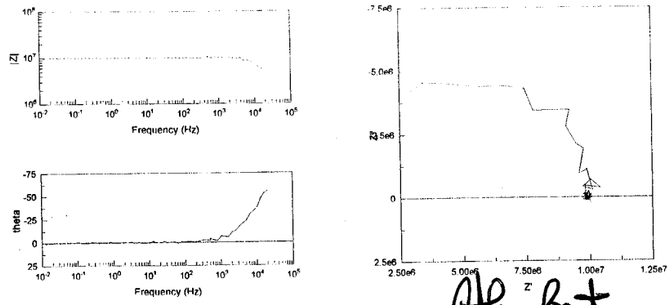
Chi-Squared:	8.338ME-6
Weighted Sum of Squares:	0.0010423
Data File:	D:\Corrosion Data\Performance Verification\9_July_02B.z
Circuit Model File:	
Mode:	Run Fitting / Freq. Range (1E-5 - 20000)
Maximum Iterations:	100
Optimization Iterations:	0
Type of Fitting:	Complex
Type of Weighting:	Calc-Modulus

Jonathan Bost 7/15/02

Data Consistant with values provided on the 12861 test Module

Test 3: Circuit used: ~~100~~ 10 M Ohm Resistor Jonathan Bost 7/15/02

Data



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Data consistant with the circuit.

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Project No._____
Book No._____ TITLE Polarization Resistance Test for Alloy C-22

From Page No.___

objective: Same as pg. 1

Specimen: C-22 heat: ~~2275~~ 2277-8-3175 polished to a 600 grit finish (J3 7/16/02)

start wt: 12.44580 g Santorius Genius S/N 12809099 cal 6/4/02
End wt: 12.44530 g
same test specimen as Notebook 520, pg. 8

Solution: 0.028M NaCl
3.296g NaCl Lot: 020814
+DI H_2O up to 2000ml

pH start: 5.654 Fisher Accumet 950 meter S/N 3340 cal 7/24/01
pH End: 7.023 pH probe # 13-620-296 S/N 1100208

Potentiostat: Solartron 1287

Counter Electrode: Pt flag

Reference: Fisher 13-620-52 S/N 005 2132

Temperature: 40°C Hg Thermometer S/N H98-162 cal: 4/22/02

E_{corr}: -136.22mV Keithley Model 614 S/N 704936 cal 5/26/02
E_{pt}: 80.8 mV

Solution aerated with "zero" air (79% N_2, 21% O_2, and 0% CO_2)

Specimen Examination: No staining or localized corrosion visible

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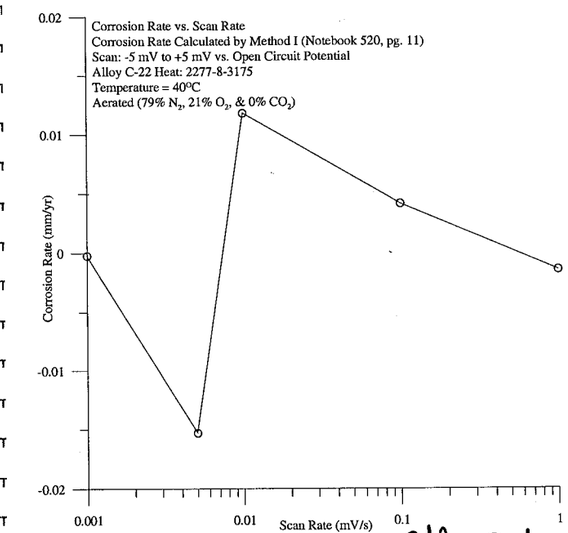
Project No._____
TITLE _____ Book No._____

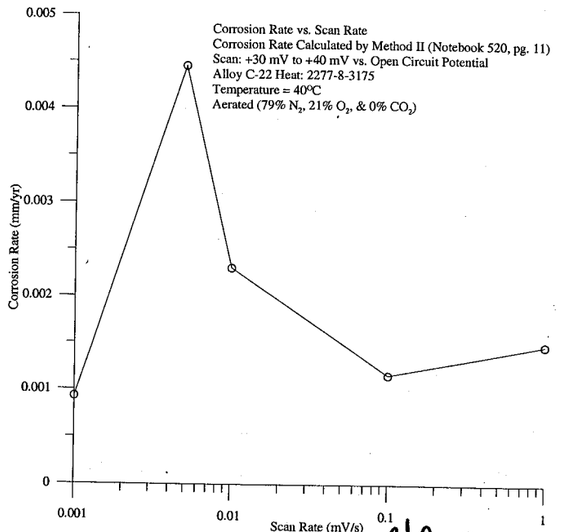
From Page No.___ Polarization Resistance Test for Alloy C-22 (continued from pg. 6)

Data: Method I

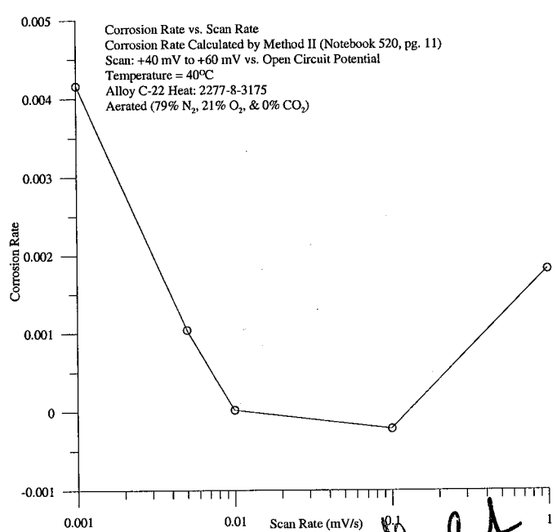


[signature] 7/17/02

Method II



[signature] 7/17/02



[signature] 7/17/02

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Project No._____
Book No._____ TITLE _____

From Page No.___ | Polarization Resistance Test for Alloy C-22 (continued from pg. 7)

Test: C22 lpr 66

Scan: −15mV to +60mV vs. open circuit potential

scan rate: 1mV/s

E_{corr} = 0.1140 V vs. SCE

Results: Method I (see formulas pg. 11, Notebook 520)

$(\partial E/\partial I)_{E_{corr}} = -2.90446 \times 10^{-6}$

$R_p = -3.4430 \times 10^{5}\ \Omega \cdot cm^2$

$i_{corr} = -1.5126 \times 10^{-7}\ A/cm^2$

C.R. = −0.00148 mm/yr

Method II (See formula in Notebook 520, pg. 11)

A. for Data: +30mV to +40mV vs. open circuit Potential
(0.1140 < E < 0.1540)

$b = -4.66213 \times 10^{-7}$

$m = 5.41144 \times 10^{-6}$

$i_{corr} = 1.50697 \times 10^{-7}\ A/cm^2$

C.R. = 1.48×10^{-3} mm/yr = 0.00148 mm/yr

B. Data: +40mV to +60mV vs. open circuit Potential
(E > 0.1540)

$b = -3.00492 \times 10^{-7}$

$m = 4.26444 \times 10^{-6}$

$i_{corr} = 1.85654 \times 10^{-7}\ A/cm^2$

C.R. = 0.00182 mm/yr

Data: C22 lpr 66 (Method I) pg. 9
C22 lpr 66 (Method II) pg. 9

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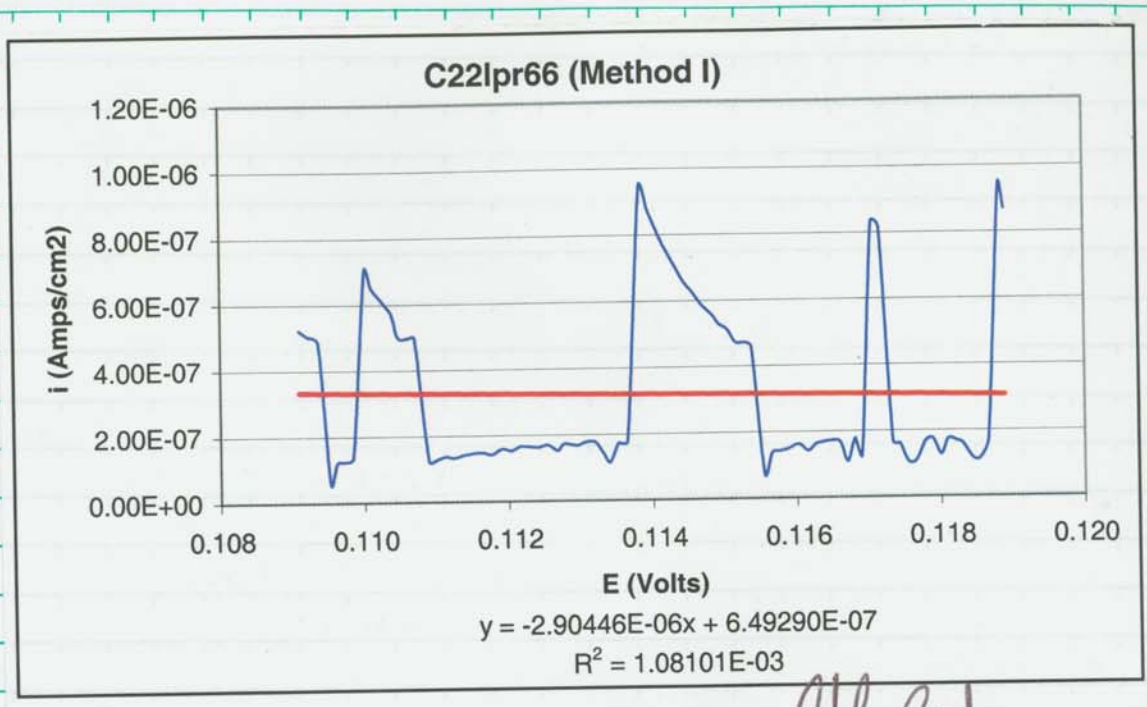
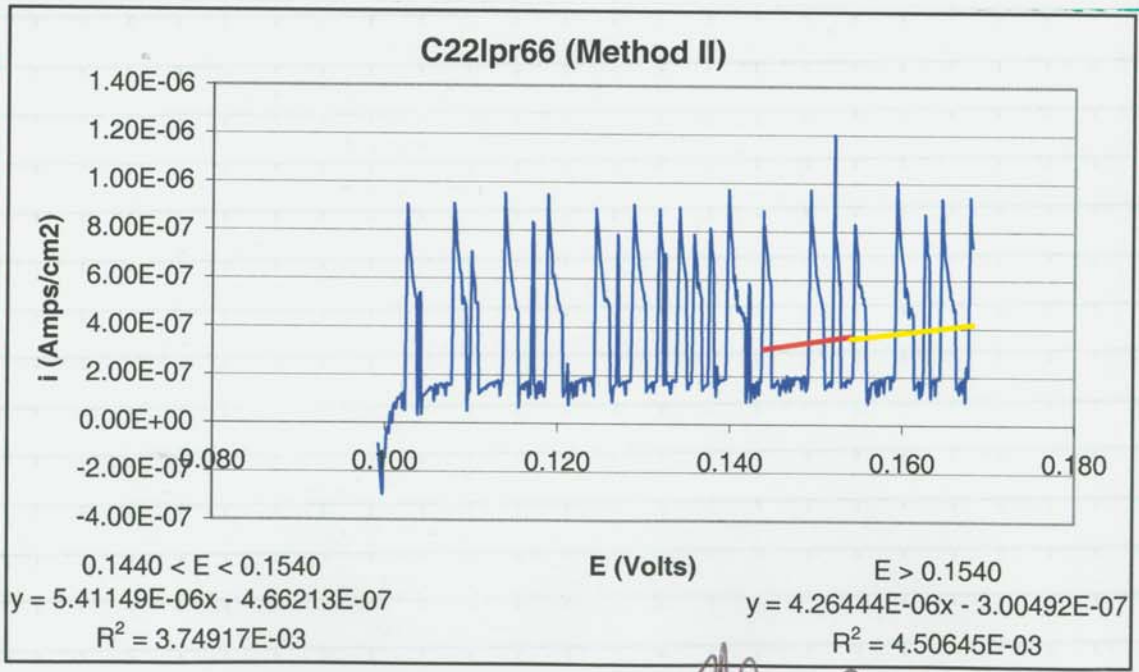
		Recorded by	7/18/02

From Page No. | Polarization Resistance Test for Alloy C-22 (continued from pg. 8)

Data:



Athan Boot 7/16/02



Athan Boot 7/16/02

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Project No._____
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From Page No.___ Polarization Resistance Test for Alloy C-22 (continued from pg. 9)

Test: C22lpr67

Scan: -15 mV to +60 mV vs. open circuit potential

Scan rate: 0.1 mV/second

E_{corr}: 0.1267 V vs. SCE

Results: Method I (see formulas in Notebook 520, pg. 11)

$(\partial E/\partial I)_{E_{corr}} = 8.04763 \times 10^{-6}$

$R_p = 1.2426 \times 10^5\ \Omega \cdot cm^2$

$i_{corr} = 4.1912 \times 10^{-7}\ A/cm^2$

C.R. = 0.00411 ~~cm²~~ mm/yr

537/16/02

Method II (see formulas in Notebook 520, pg. 11)

A. Data: +30 mV to +40 mV vs. open circuit Potential
($0.1567 < E < 0.1667$)

$b = -5.92628 \times 10^{-7}$

$m = 5.61063 \times 10^{-6}$

$i_{corr} = 1.18239 \times 10^{-7}\ A/cm^2$

C.R. = 0.00116 mm/yr

B. Data: +40 mV to +60 mV vs. open circuit Potential
($E > 0.1667$)

$b = -9.04723 \times 10^{-7}$

$m = $ ~~5.6~~ 537/16/02 $= 6.96671 \times 10^{-6}$

$i_{corr} = -2.20408 \times 10^{-8}\ A/cm^2$

C.R. = -0.000216 mm/yr

Data: C22lpr67 (Method I) pg. 11
C22lpr67 (Method II) pg. 11

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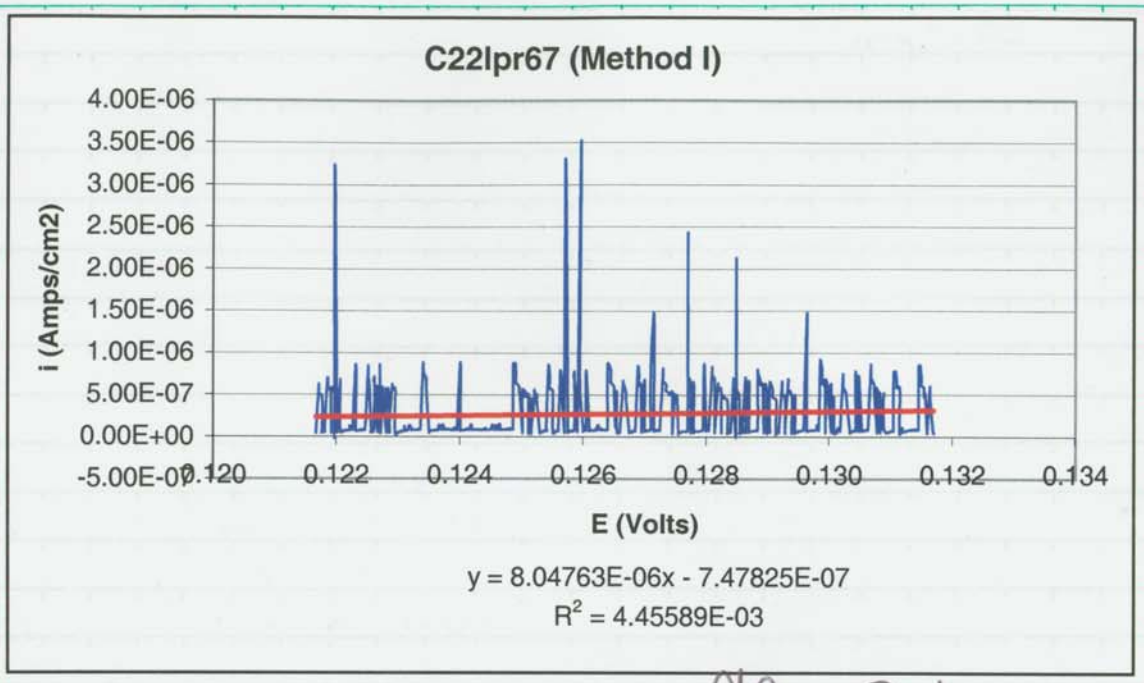
From Page No. Polarization Resistance Test for Alloy C-22 (continued from pg. 10)

Data:



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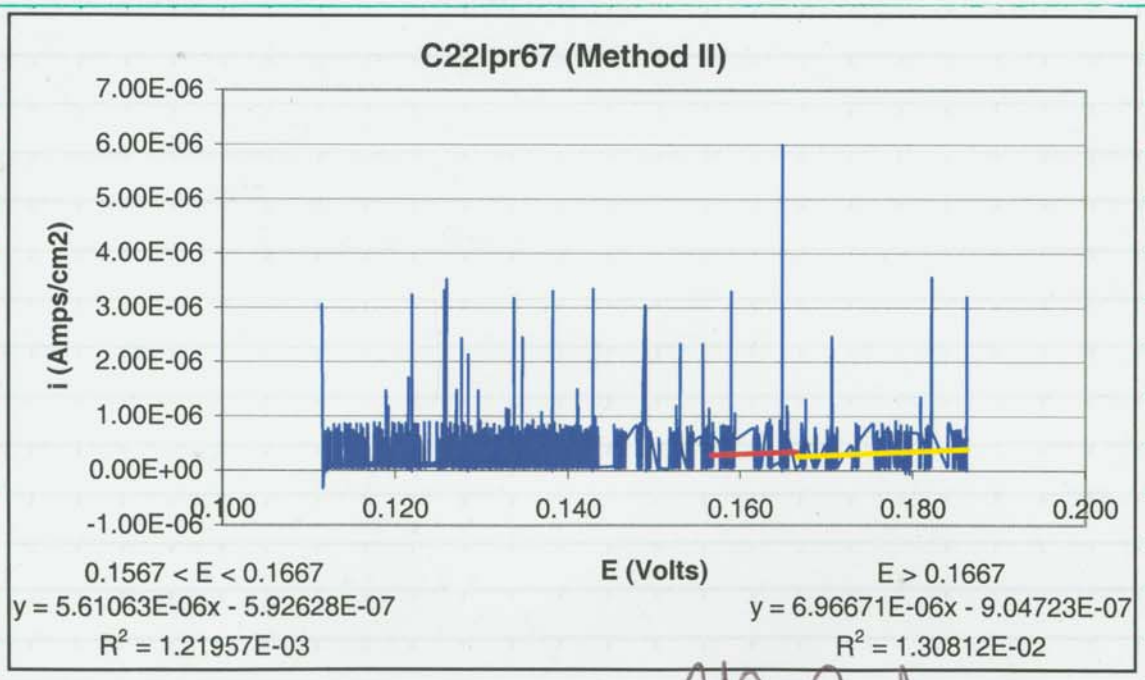

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Project No._____
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From Page No.___ Polarization Resistance Test for Alloy C-22 (continued from pg 11)

Test: C22lpr68

Scan: -15mV to +60mV vs. open circuit potential

Scan Rate: 0.01 mV/second

E_{corr} = 0.1398 V vs. SCE

Results: Method I (see formulas in Notebook 520, pg. 11)

$(\partial E/\partial I)_{E_{corr}}$ = 2.3151 X 10^{-5}

R_p = 4.3194 X 10^{4} $\Omega \cdot cm^2$

i_{corr} = 1.2057 X 10^{-6} A/cm^2

C.R. = 0.0118 mm/yr

Method II (see formulas in Notebook 520, pg. 11)

A. Data: +30mV to +40mV vs. open circuit potential
(0.1698 < E < 0.1798)

b = -1.4465 X 10^{-7}

m = 2.71097 X 10^{-6}

i_{corr} = 2.34799 X 10^{-7} A/cm^2

C.R. = 0.00230 mm/yr

B. Data: +40mV to +60mV vs. open circuit potential
(E > 0.1798)

b = -4.97473 X 10^{-7}

m = 2.57371 X 10^{-6}

i_{corr} = 2.3166 X 10^{-7} A/cm^2

C.R. = 0.0000209 mm/yr

Data: C22lpr68 (Method I) pg. 13
C22lpr68 (Method II) pg. 13

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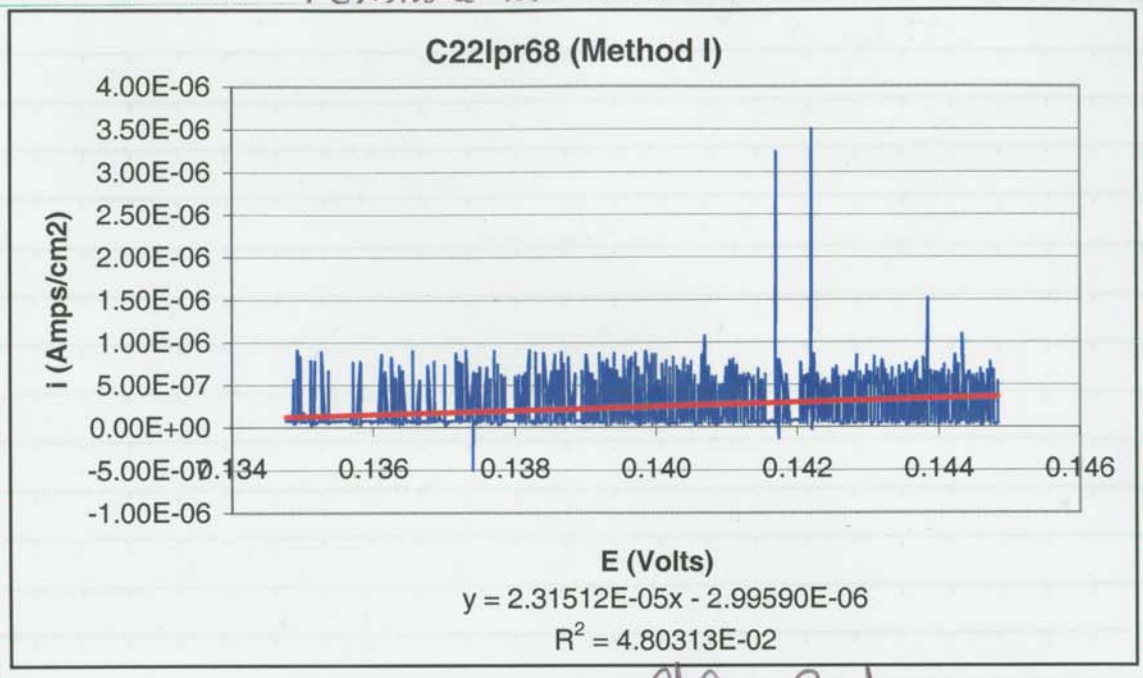
From Page No. ~~Resistance Test for Alloy~~ J3 7/16/02 (Continued From pg. 12)

Polarization ~~Resistance~~ Test for Alloy C-22

Data:



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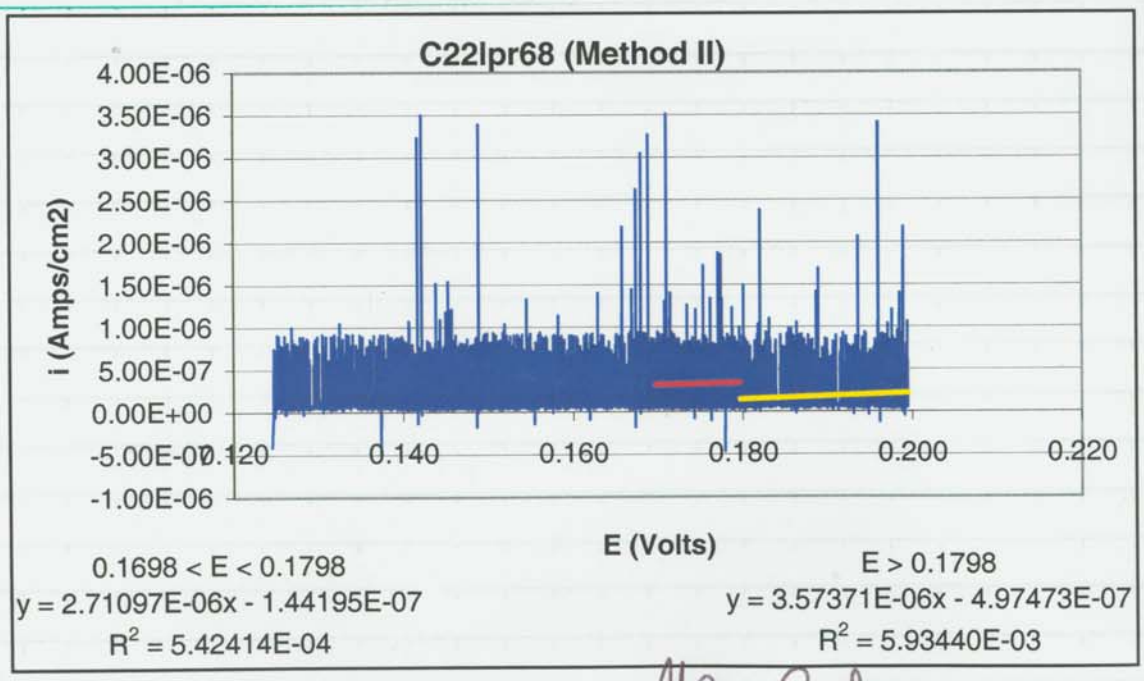

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Project No._____
Book No._____ TITLE_____

From Page No.___ | Polarization Resistance Test for Alloy C22 (continued from pg. 13)

Test: C22 lpr 69

Scan: -15 mV to +60 mV vs. open circuit potential

Scan rate: 0.005 mV/second

E_{corr}: 0.1555 V vs. SCE

Results: Method I (see formulas in Notebook 520, pg. 11)

$(\partial E/\partial I)_{E_{corr}} = -3.00242 \times 10^{-5}$

$R_p = -3.3306 \times 10^{4}\ \Omega \cdot cm^2$

$i_{corr} = -1.5637 \times 10^{-6}\ A/cm^2$

C.R. = 0.0153 mm/yr

Method II (see formulas in Notebook 520, pg. 11)

A. Data: +30 mV to +40 mV vs. open circuit potential
(0.1855 < E < 0.1955)

$b = 1.58265 \times 10^{-6}$

$m = -7.25739 \times 10^{-6}$

$i_{corr} = 4.54126 \times 10^{-7}\ A/cm^2$

C.R. = 0.00445 mm/yr

B. Data: +40 mV to +60 mV vs. open circuit potential
(E > 0.1955)

$b = -5.14373 \times 10^{-7}$

$m = 3.99228 \times 10^{-6}$

$i_{corr} = 1.06427 \times 10^{-7}\ A/cm^2$

C.R. = 0.00104 mm/yr

Data: C22 lpr 69 (Method I) pg. 15
C22 lpr 69 (Method II) pg. 15

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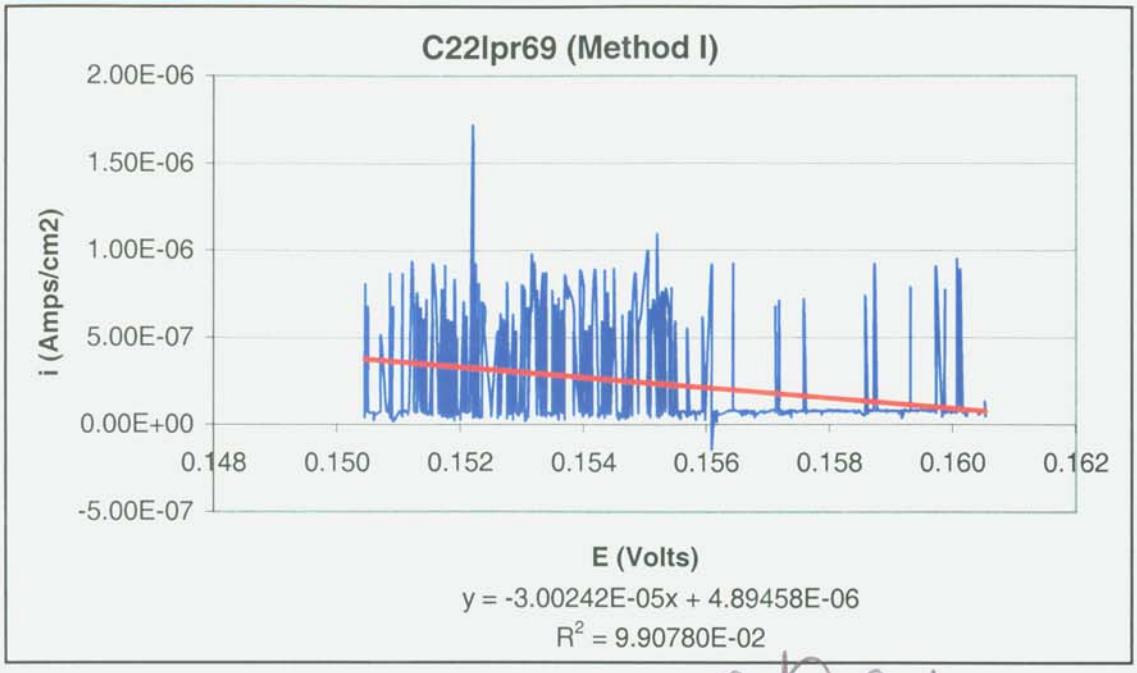
From Page No. Polarization Resistance Test for Alloy C-22 (continued from pg. 14)

Data:



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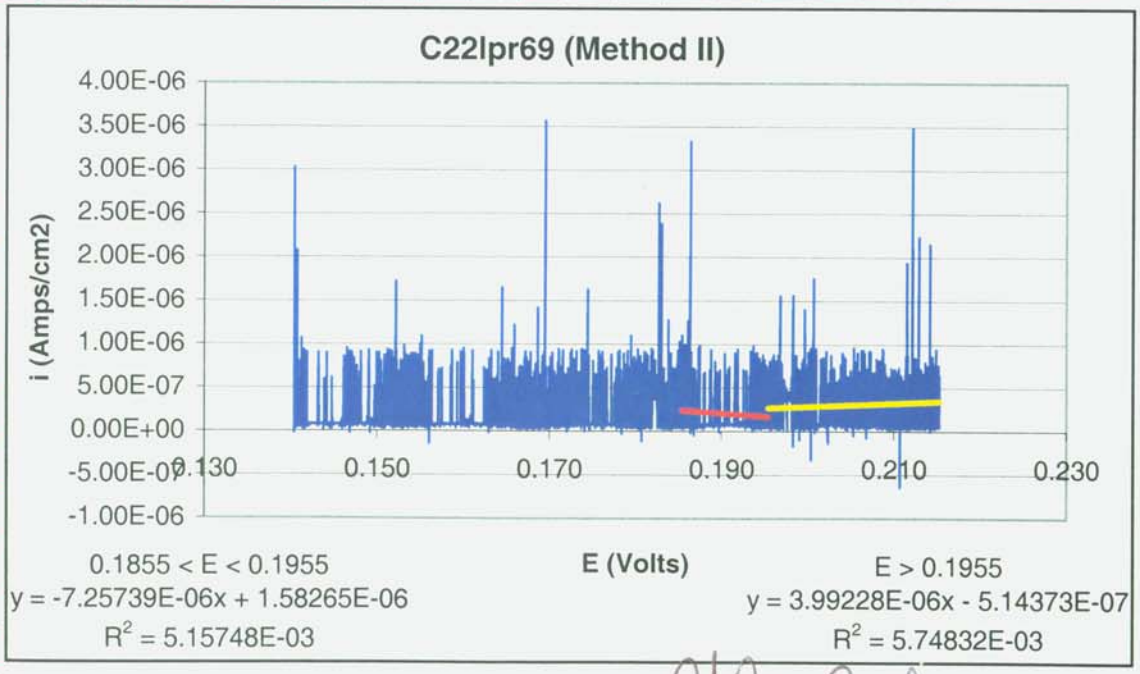

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Project No._____
Book No._____ TITLE Polarization Resistance Test for Alloy C-22

From Page No.___ | Polarization Resistance Test for Alloy C-22 (Continued from pg. 15)

Test: C22lpr70

Scan: -15mV to +60mV vs. open circuit potential

Scan Rate: 0.001 mV/second

E_{corr}: 0.1717 V vs. SCE

Results: Method I (see formulas in Notebook 520, pg. 11)

$(\Delta E/\Delta I)_{E_{corr}} = -4.4014 \times 10^{-7}$

$R_p = -2.2720 \times 10^{6}\ \Omega \cdot cm^2$

$i_{corr} = -2.2923 \times 10^{-8}\ A/cm^2$

C.R. = -0.000225 mm/yr

Method II (see formulas in Notebook 520, pg. 11)

A. Data: +30mV to +40mV vs. open circuit potential
($0.2017 < E < 0.2117$)

$b = -6.70550 \times 10^{-7}$

$m = 4.45657 \times 10^{-6}$

$i_{corr} = 9.4631 \times 10^{-8}\ A/cm^2$

C.R. = 0.000927 mm/yr

B. Data: +40mV to +60mV vs. open circuit Potential
($E > 0.2117$)

$b = 1.00144 \times 10^{-6}$

$m = -3.36108 \times 10^{-6}$

$i_{corr} = 4.24343 \times 10^{-7}\ A/cm^2$

C.R. = 0.00416 mm/yr

Data: C22lpr70 (Method I) pg. 17
C22lpr70 (Method II) pg. 17

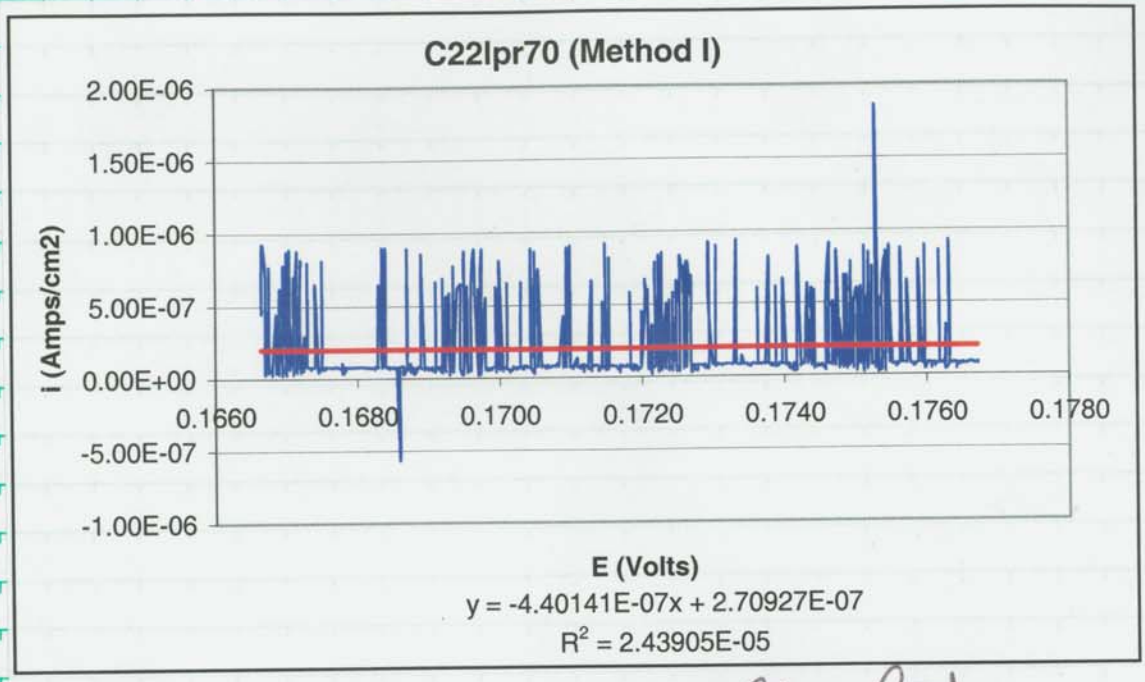
Continued on pg 17

To Page No._____

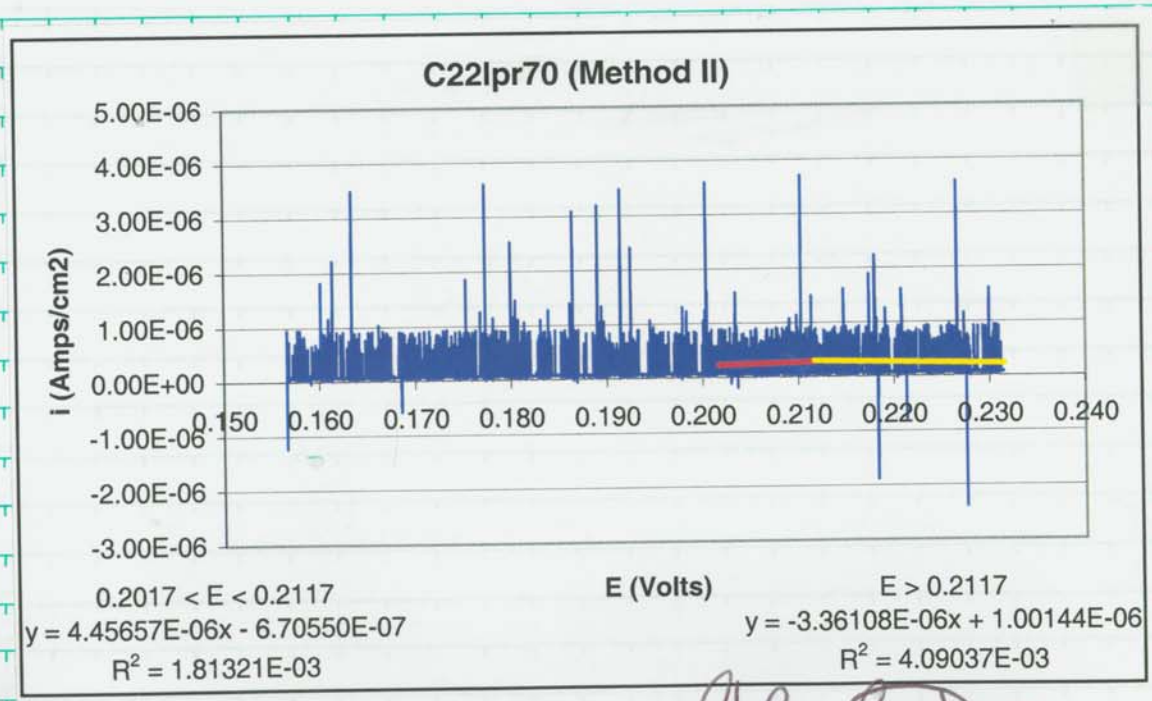
Witnessed & Understood by me,	Date	Invented by	Date
		Recorded by John Bost	7/16/02

From Page No. Polarization Resistance Test for Alloy C-22 (continued from pg 16)

Data:



Alan Bost 7/16/02



Alan Bost 7/16/02

To Page No.

Witnessed & Understood by me,	Date	Invented by	Date
		Recorded by Alan Bost	7/16/02

Project No._____
Book No._____ TITLE _____

From Page No.___

Polarization Resistance Test for Alloy C-22

objective: Same as pg. 1

specimen: C-22 Heat: 2277-8-3175 Polished to a 600 grit finish

start wt: 12.44580 g Sartorius Genius S/N 12805099 cal 6/4/02
End wt: 12.44530 g
same test specimen as Notebook 520, pg. 8

Solution: 0.028 M NaCl
3.296 g NaCl Lt: 020814
+ DI H_2O up to 2000 ml

pH start: 5.654 Fisher Accumet 950 meter S/N 3340 cal 7/21/01
pH End: 7.023 pH probe #13-620-291 S/N 1100208

Potentiostat: Solartron 1287

Counter Electrode: Pt flag

Reference: Fisher 13-620-52 S/N 0052132

Temperature: 25°C H_2 Thermometer S/N HH8-162 cal 4/22/02

E_{corr} = -136.22 mV Keithley Model 614 S/N 704 936 cal 5/26/02
E_{Pt} = 80.8 mV

Solution Aerated with "zero" Air (79% N_2, 21% O_2, & 0% CO_2)

Specimen Examination: No staining or localized corrosion visible

continued on pg. 19

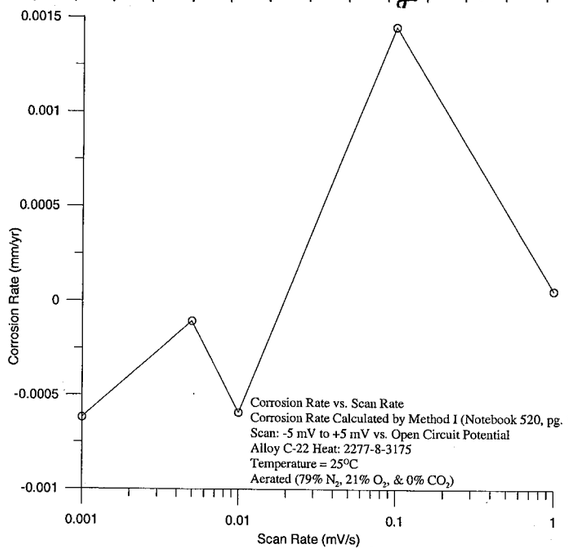
To Page No._____

Witnessed & Understood by me,	Date	Invented by	Date
		Recorded by John Bost	7/16/02

Project No._____
TITLE _____ Book No._____

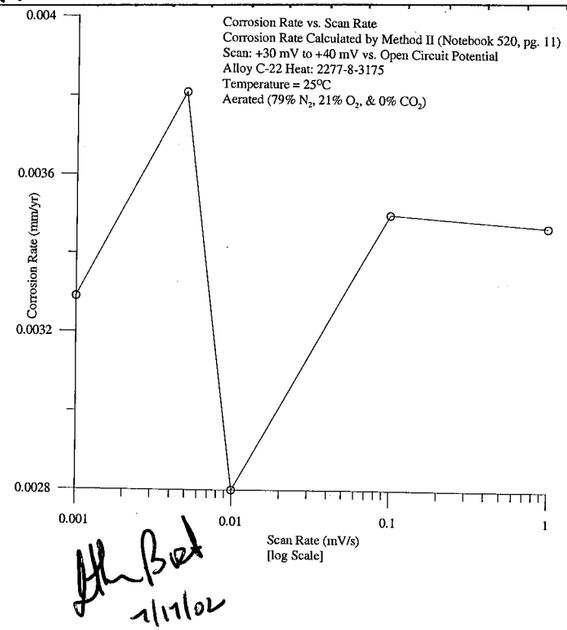
From Page No.___ Polarization Resistance Test for Alloy C-22 (continued from pg. 18)

Data: Method I



John Bost 7/17/02

Method II



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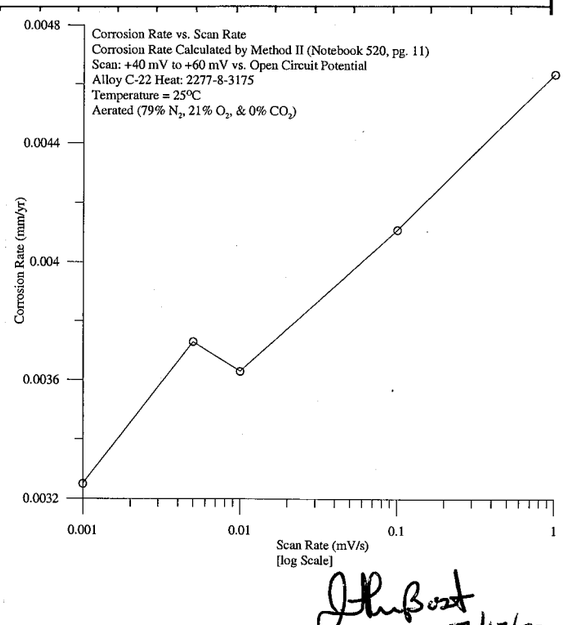

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continued on pg. 20

To Page No._____

Witnessed & Understood by me,	Date	Invented by	Date
		Recorded by John Bost	7/17/02

Project No._____
Book No._____ TITLE_____

From Page No.___ | Polarization Resistance Test for Alloy C-22 (Continued from pg 19)

Test: C22 lpr 71

Scan: -15 mV to +60 mV vs. open circuit potential

Scan Rate: 1 mV/second

E_{corr} = 0.0907 V vs. SCE

Results: Method I (see formulas in Notebook 520, pg. 11)

$(\Delta E/\Delta I)_{E_{corr}}$ = 1.07111×10^{-7}

R_p = 9.3361×10^{6} $\Omega \cdot cm^2$

i_{corr} = 5.5783×10^{-9} A/cm^2

C.R. = 0.0000547 mm/yr

Method II (see formulas in Notebook 520, pg. 11)

A. Data: +30 mV to +40 mV vs. open circuit potential
(0.1207 < E < 0.1307)

b = 8.38954×10^{-8}

m = 2.98429×10^{-6}

i_{corr} = 3.59571×10^{-7} A/cm^2

C.R. = 0.00347 mm/yr

B. Data: +40 mV to +60 mV vs. open circuit potential
(E > 0.1307)

b = -3.93933×10^{-7}

m = 5.09353×10^{-7}

i_{corr} = 4.73623×10^{-7} A/cm^2

C.R. = 0.00464 mm/yr

Data: C22 lpr 71 (Method I) pg. 21
C22 lpr 71 (Method II) pg. 21

Continued on pg. 21

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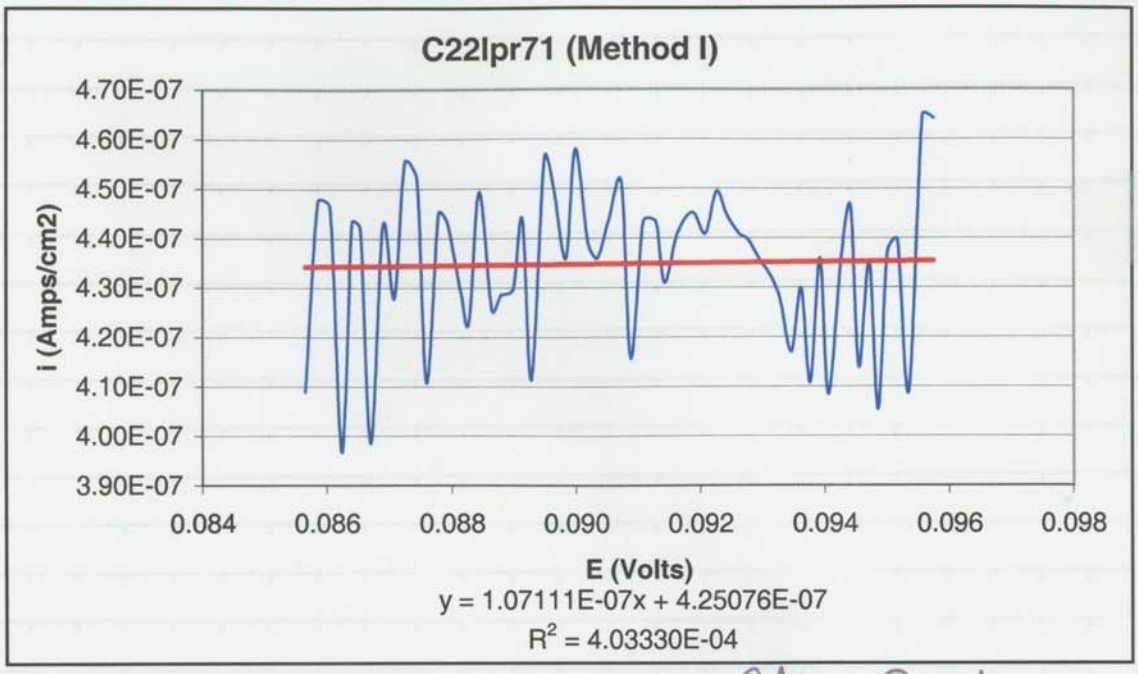
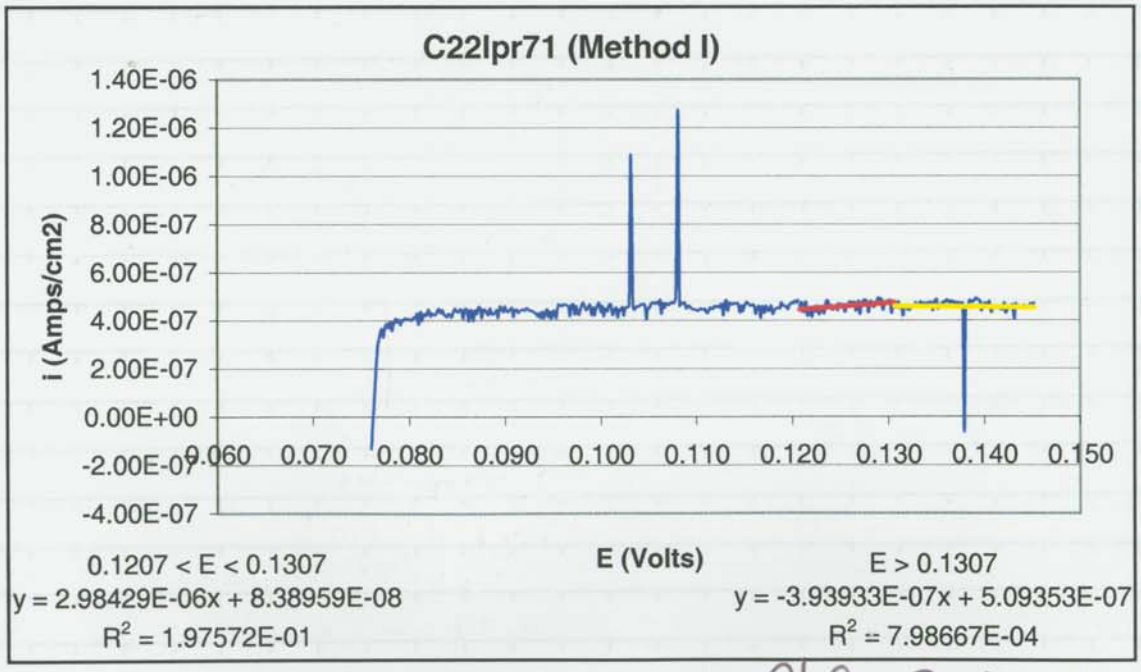
Recorded by John Bost 7/16/02

From Page No. | Polarization Resistance Test for Alloy C-22 (continued from pg. 20)

Data:



7/16/02



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To Page No.

Witnessed & Understood by me,	Date	Invented by	Date
		Recorded by	7/14/02

Project No._____
Book No._____ TITLE_____

From Page No.___ | Polarization Resistance Test for Alloy C22 (continued from pg 21)

Test: C22lpr72

Scan: -15mV to +60mV vs. open circuit Potential

Scan Rate: 0.1 mV/second

E_{corr} = 0.1165 V vs. SCE

Results: Method I (see formulas in Notebook 522, pg. 11)

$\Delta E/\Delta I)_{E_{corr}} = 2.84824 \times 10^{-6}$

$R_p = 3.5109 \times 10^{5}\ \Omega \cdot cm^2$

$i_{corr} = 1.9834 \times 10^{-7}\ A/cm^2$

C.R. = 0.00145 mm/yr

Method II (see formulas in Notebook 522, pg 11)

A. Data: +30mV to +40mV vs. open circuit potential
(0.1165 < E < 0.1565)

$b = 2.59670 \times 10^{-7}$

$m = 8.36665 \times 10^{-7}$

$i_{corr} = 3.57141 \times 10^{-7}\ A/cm^2$

C.R. = 0.00350 mm/yr

B. Data: +40mV to 60mV vs. open circuit potential
(E > 0.1565)

$b = 4.89031 \times 10^{-7}$ ~~4.89031×10^{-7}~~

$m = -5.93133 \times 10^{-7}$

$i_{corr} = 4.19931 \times 10^{-7}\ A/cm^2$

C.R. = 0.00411 mm/yr

Data: C22lpr72 (Method I) pg 23
C22lpr72 (Method II) pg 23

continued on pg. 23

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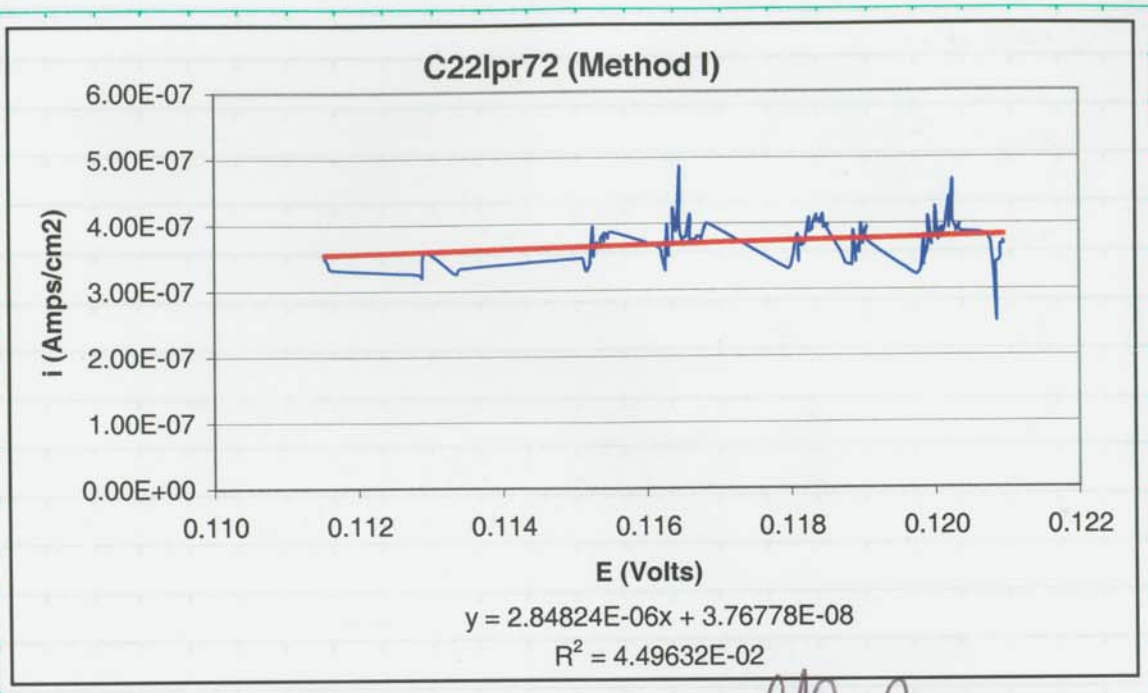
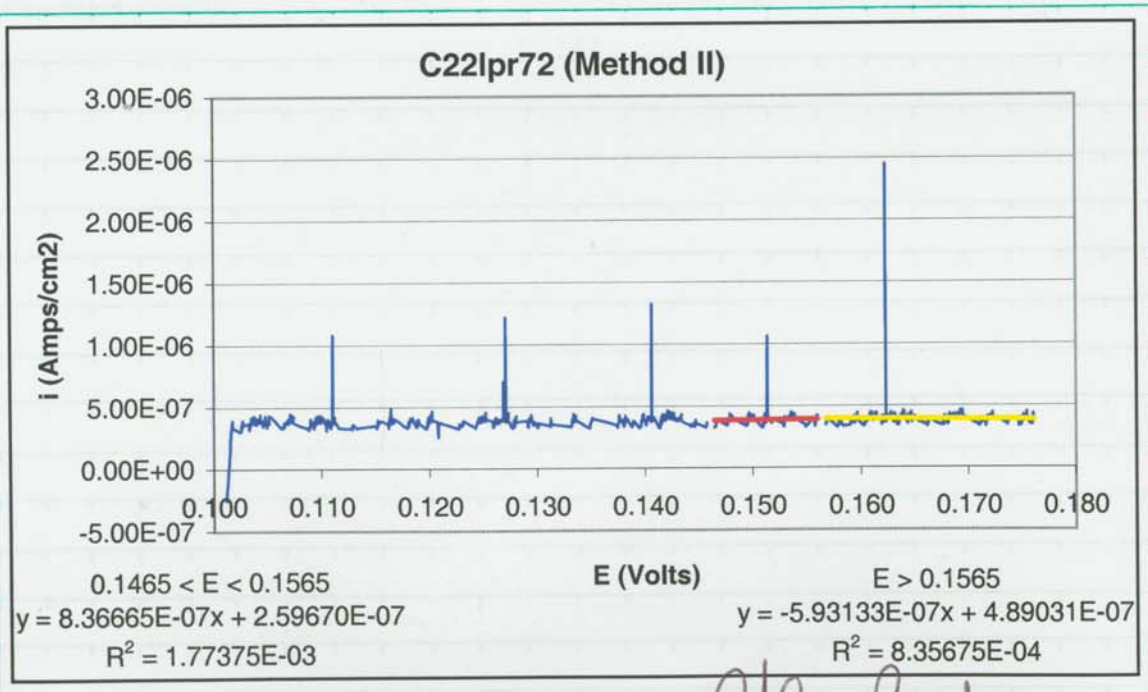
Witnessed & Understood by me,	Date	Invented by	Date
		Recorded by [signature]	7/16/02

From Page No. | Polarization Resistance Test for Alloy C-22 (continued from pg. 22)

Data:



7/16/02



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continued on pg. 24

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Witnessed & Understood by me,	Date	Invented by	Date
		Recorded by	7/16/02

Project No._____
Book No._____ TITLE _____

From Page No.___ | Polarization Resistance Test for Alloy C-22 (continued from pg. 23)

Test: C22-lpr-73

Scan: -15mV to +60mV vs. open circuit potential

Scan Rate: 0.01 mV/second

E_{corr} = 0.1462V vs. SCE

Results: Method I (see formula in Notebook 520, pg. 11)

$(\Delta E/\Delta I)_{E_{corr}} = -1.16143 \times 10^{-6}$

$R_p = -8.6101 \times 10^{5}\ \Omega \cdot cm^2$

$i_{corr} = -6.0487 \times 10^{-8}\ A/cm^2$

$C.R. = -0.000593$ mm/yr

Method II (see formula in Notebook 520, pg. 11)

A. Data: +30mV to +40mV vs. open circuit potential
(0.1712 < E < 0.1812)

$b = -7.81632 \times 10^{-8}$

$m = 2.48633 \times 10^{-6}$

$i_{corr} = 2.85738 \times 10^{-7}\ A/cm^2$

C.R. = 0.00280 mm/yr

B. Data: +40mV to +60mV vs. open circuit potential
~~(E?)~~ 3 6/17/02 (E > 0.1812)

$b = 3.8755 \times 10^{-7}$

$m = -1.18533 \times 10^{-7}$

$i_{corr} = 3.7022 \times 10^{-7}\ A/cm^2$

C.R. = 0.00363 mm/yr

Data: C22lpr73 (Method I) pg. 25
C22lpm73 (Method II) pg. 25

Continued on pg. 25

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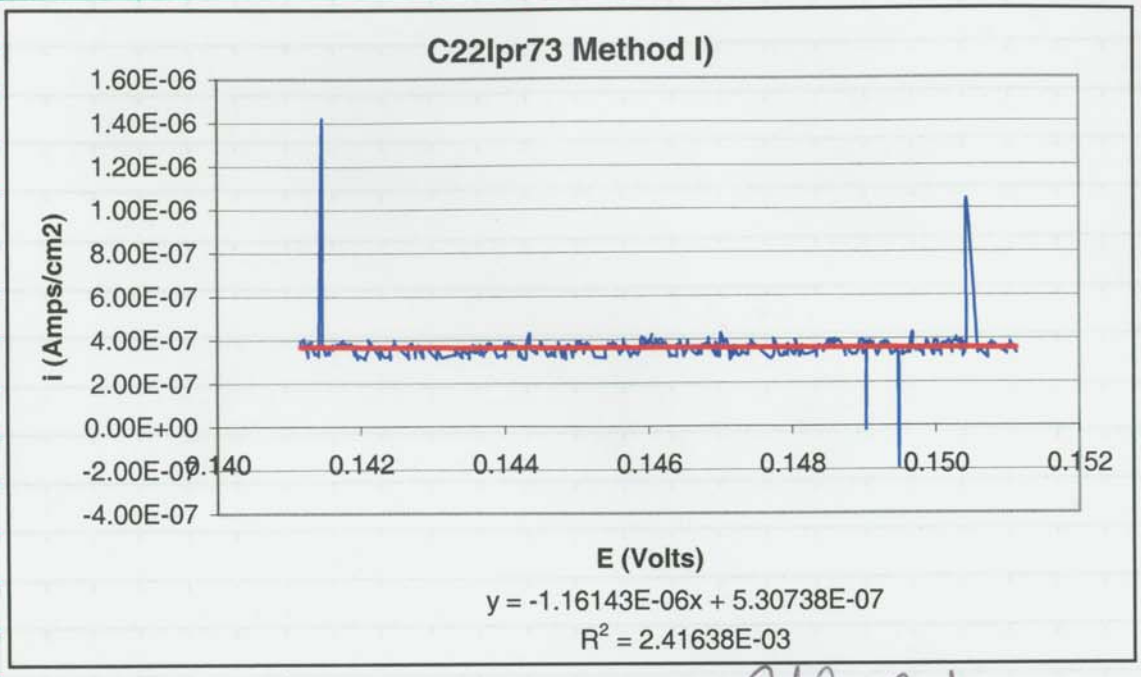
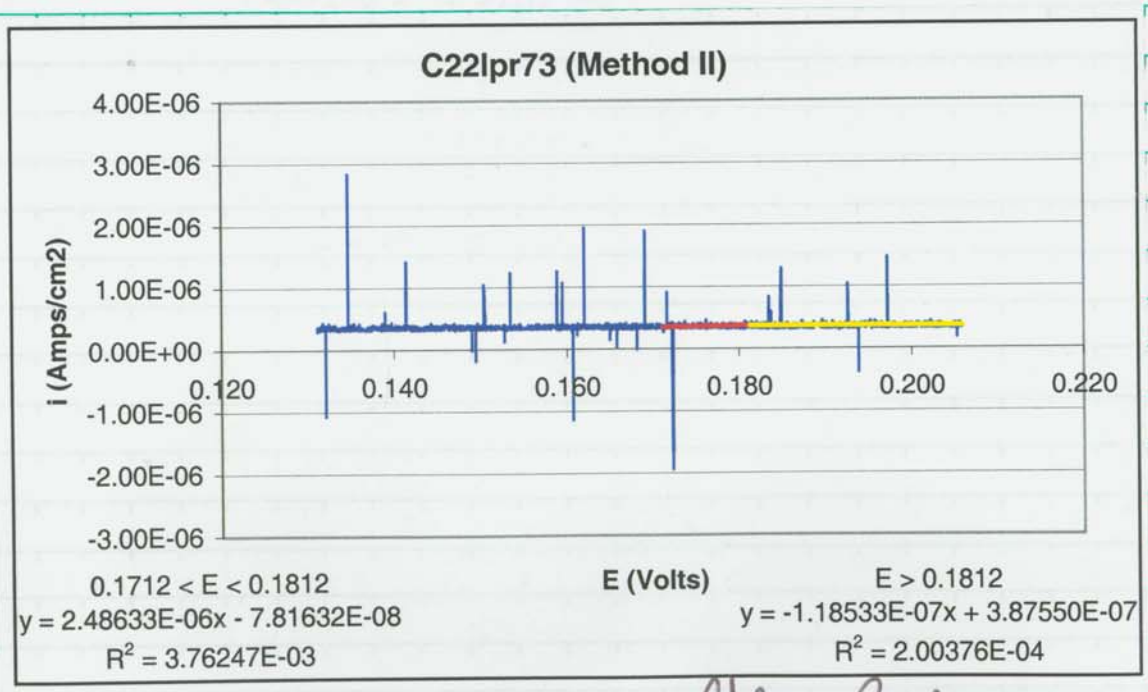
Witnessed & Understood by me,	Date	Invented by	Date
		Recorded by [signature]	7/16/02

From Page No. Polarization Resistance Test for Alloy C-22 (continued from pg. 24)

Data:



John Bart 7/16/02



John Bart

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Recorded by John Bart 7/16/02

From Page No. | Polarization Resistance Test for Alloy C-22 (continued from pg. 25)

Test: C22 lpr-74

Scan: -15mV to +60mV Vs. open circuit potential

Scan rate: 0.005 mV/second

E_{corr}: 0.1826 V vs. SCE

Results: Method I (see formulas in Notebook 520, pg. 11)

$(\partial E/\partial I)_{E_{corr}} = +2.05652 \times 10^{-7}$

$R_p = -4.8626 \times 10^{+6}\ \Omega \cdot cm^2$

$i_{corr} = -1.0710 \times 10^{-8}\ A/cm^2$

C.R. = -0.000105 mm/yr

Method II (see formulas in Notebook 520, pg. 11)

A. Data: +30 mV to +40mV vs. open circuit potential

(0.2121 < E < 0.2226)

$b = 4.70945 \times 10^{-7}$

$m = -4.51962 \times 10^{-7}$

$i_{corr} = 3.88467 \times 10^{-7}\ A/cm^2$

C.R. = 0.00381 mm/yr

B. Data: +40mV to +60mV vs. open circuit potential

(E > 0.2226)

$b = 4.35085 \times 10^{-7}$

$m = -2.98498 \times 10^{-7}$

$i_{corr} = +3.80579 \times 10^{-7}\ A/cm^2$

C.R = 0.00373 mm/yr

Data: C22lpr 74 (Method I) pg. 27

C22lpr 74 (Method II) pg. 27

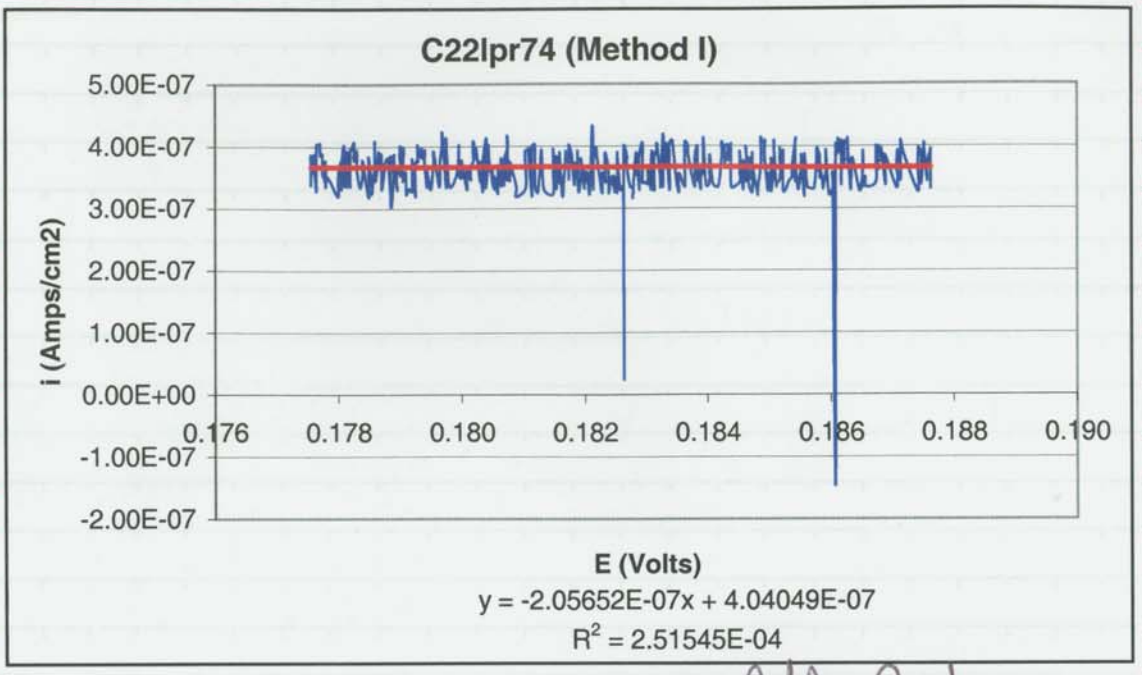
continued on pg. 27

To Page No.

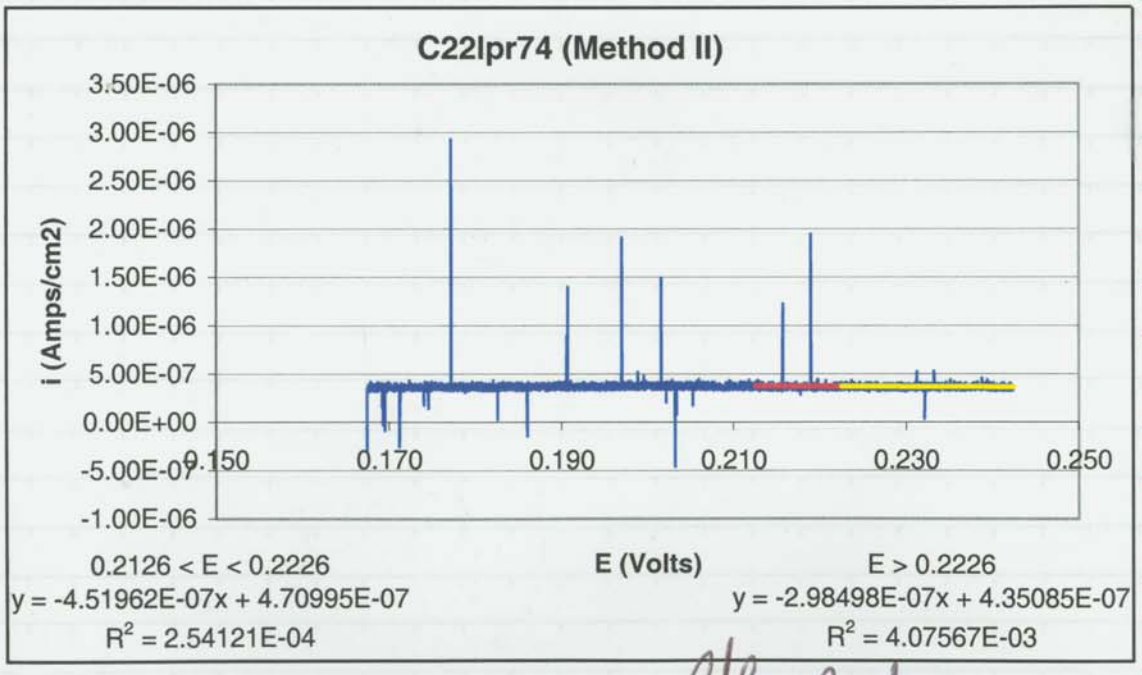
Witnessed & Understood by me,	Date	Invented by	Date
		Recorded by John Bost	7/16/02

From Page No. Polarization Resistance Test for Alloy C-22 (continued from pg. 26)

Data:



Arthur Boot 7/16/02



Arthur Boot

continued on pg. 28

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Witnessed & Understood by me,	Date	Invented by	Date
		Recorded by Arthur Boot	7/16/02

Project No._____
Book No._____ TITLE Polarization Resistance Test for Alloy C22

From Page No.___ | Polarization Resistance Test for Alloy C22 (continued from pg. 27)

Test: C22lpr 75

Scan: -15mV to +60mV vs. open circuit potential

Scan Rate: 0.001 mV ~~vs. SCE~~ JJ 7/16/02

E_{corr}: 0.2208 V vs. SCE

Results Method I (see formulas in Notebook 520, pg. 11)

$(\partial E/\partial I)_{E_{corr}} = -1.21271 \times 10^{-6}$

$R_p = -8.2460 \times 10^{5}$ ~~$\Omega \cdot cm^2$~~ JJ 7/16/02 $\Omega \cdot cm^2$

$i_{corr} = -6.3158 \times 10^{-8}$ A/cm^2

C.R. = -0.000619 mm/yr

Method II (see formulas in Notebook 520, pg. 11)

A. Data: +30mV to +40mV vs. open circuit potential
(0.2508 < E < 0.2608)

$b = 3.62041 \times 10^{-7}$
$m = -1.18201 \times 10^{-7}$
$i_{corr} = 3.35942 \times 10^{-7}$ A/cm^2
C.R. = 0.003294 mm/yr

B. Data: +40mV to +60mV vs. open circuit potential
~~(E > 0.2608)~~ (E > 0.2608) QD 4/03/03

$b = 2.92312 \times 10^{-7}$ ~~2.9223×10^{-7}~~ QD 4/3/03
$m = 1.76210 \times 10^{-7}$
$i_{corr} = 3.31215 \times 10^{-7}$ A/cm^2
C.R. = 0.003245 mm/yr

Data: C22lpr 75 (Method I) pg. 29
C22lpr 75 (Method II) pg. 29

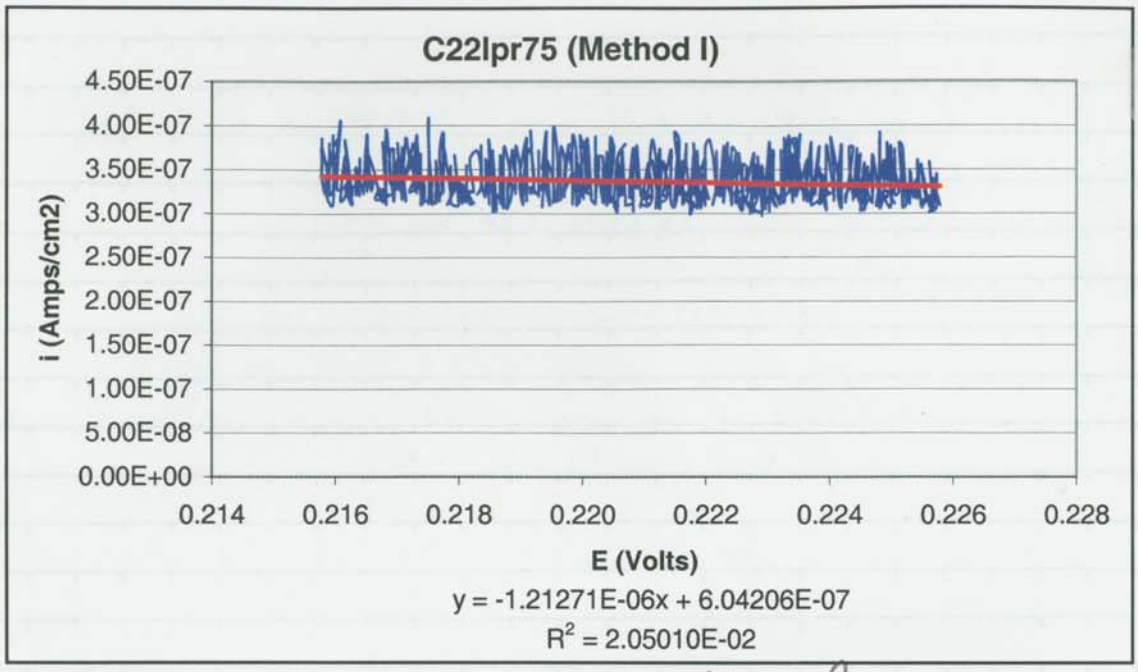
continued on pg. 29

To Page No._____

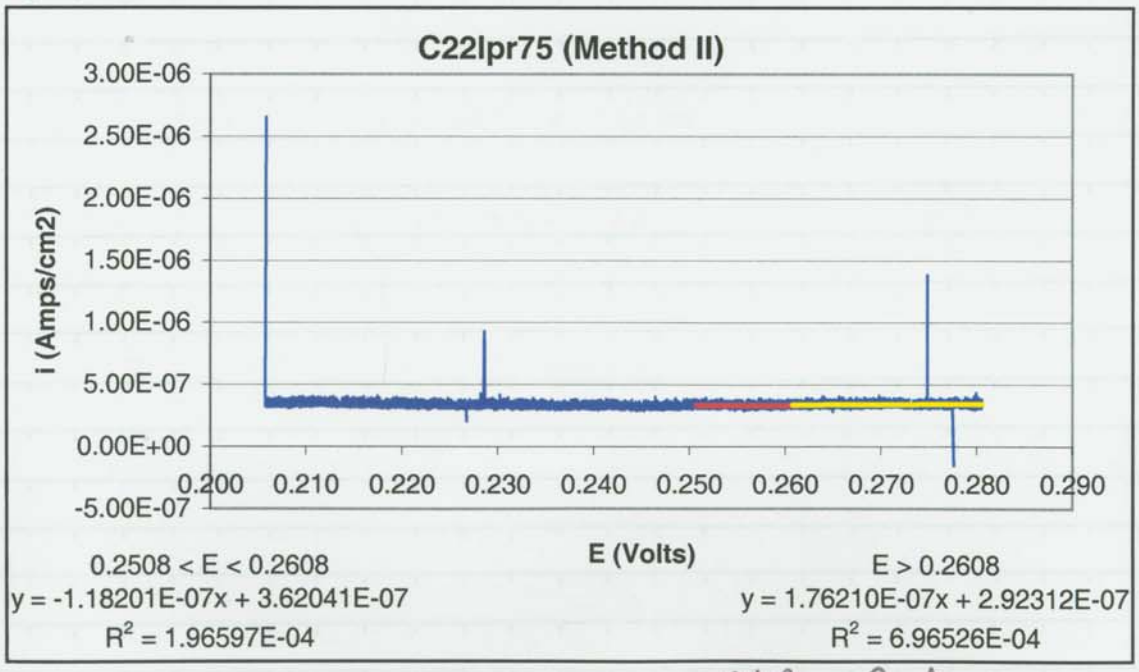
Witnessed & Understood by me,	Date	Invented by	Date
		Recorded by John Bart	7/16/02

From Page No. Polarization Resistance Test for Alloy C-22 Continued from pg 28

Data:



John Bost 7/16/02



John Bost 7/16/02

To Page No.

Witnessed & Understood by me,	Date	Invented by	Date
		Recorded by John Bost	7/16/02

Project No._____
Book No._____ TITLE _____

From Page No.___ | Electrochemical Impedance Test for Alloy C-22

objective: same as pg. 2

specimen: C-22 heat: 2277-8-3175 Polished to a 600 grit finish

start wt: 12.44580 g Sartorius Genius S/N 12809099 cal 6/4/02
End wt: 12.44530 g
same test specimen as Notebook 520 pg. 8

Solution: 0.028M NaCl
3.296 g NaCl Lot: 020814
+DI H_2O up to 2000ml

pH start: 6.015 Fisher Accumet 950 meter S/N 3340 cal 7/29/01
pH End: 6.447 pH probe # 13-620-296 S/N 1100 208

Impedance Analyzer: Solartron 1260

Counter Electrode: Pt flag

Reference: Fisher 13-620-52 S/N 0052132

Temperature: 95°C Hg Thermometer S/N H98-162 cal 4/22/02

E_{corr}: -314 mV Keithley Model 614 S/N 704936 cal 5/26/02
E_{Pt}: 127.5 mV

Solution Deaerated with 99.999% N_2

Specimen Examination: No staining or localized corrosion visible

Cell info: Area : 8 cm^2
Density : 8.69 g/cm^3
Equivalent weight: 26.04 gm 7/17/02

Continued on pg. 31

To Page No._____

Witnessed & Understood by me,	Date	Invented by	Date
		Recorded by John Bost	7/18/02

Project No._____
TITLE _____ Book No._____

From Page No.___ | Electrochemical Impedance Test for Alloy C-22 (from pg. 30)

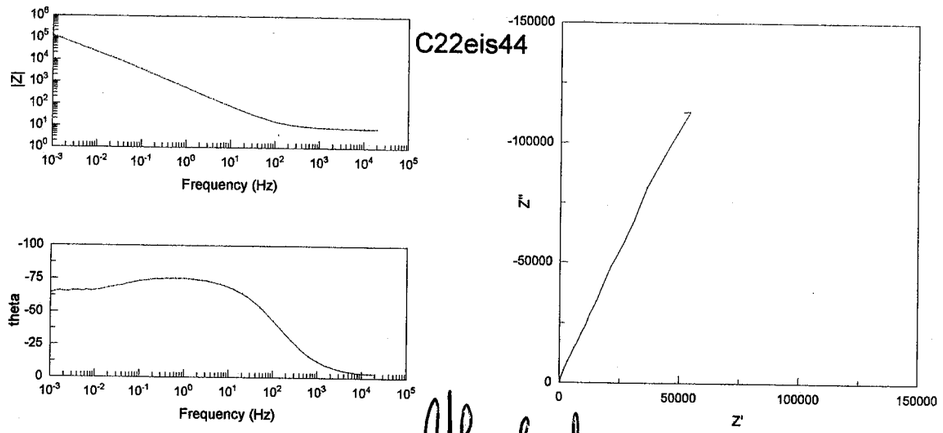
Test: C22 eis 44

Initial Frequency: 20000 Hz
Final Frequency: 0.001 Hz

10 steps per decade

Integration Time: 5 seconds
Delay: 2 seconds

Data: C22_eis 44



John Bost 7/18/02

Continued on pg. 32

To Page No._____

Witnessed & Understood by me,	Date	Invented by	Date
		Recorded by John Bost	7/18/02

Project No._____
Book No._____ TITLE Electrochemical Impedance Test for Alloy C-22 (From pg. 31)

From Page No.___

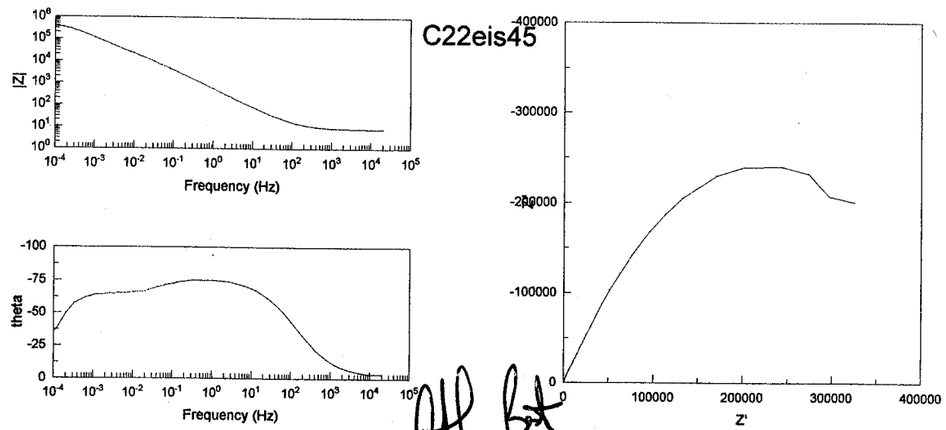
Test: C22 eis 45

Initial frequency: 20000 Hz
Final frequency: 0.0001 Hz

10 steps per decade

Integration time 5 seconds
Delay 2 seconds

Data: C22eis 45



7/18/02

To Page No._____

Witnessed & Understood by me,	Date	Invented by	Date
		Recorded by	7/18/02

Project No._____
TITLE_____ Book No._____

From Page No.___ Electrochemical Impedance Test for Alloy C-22

Objective: same as pg 2

Specimen: C-22 heat: 2277-8-3175 polished to a 600 grit finish

start wt: 12.44580 g Sartorius Genius s/N 12801099 cal 6/4/02
End wt: 12.44530 g
same test specimen as Notebook 520, pg. 8

Solution: 0.028 M NaCl
3.296 g NaCl Lot # 020814
+ DI H_2O up to 2000 ml

pH start: 6.015 Fisher Accumet 950 meter s/N 3340 cal 7/21/01
pH end: 6.447 pH probe # 13-620-296 s/N 1100208

cell info: Area: 8 cm^2
Density: 8.69 g/cm^3
Equivalent: 26.04

Impedance Analyzer: Solartron 1260

Counter Electrode: Pt flag

Reference: Fisher 13-620-58

Temperature: 80°C Hg Thermometer s/N 498-162 cal 4/22/02

E_{corr}: -319 mV Keithley Model 614 704936 cal 5/26/02
E_{pt}: 127.5 mV

Solution Deaerated with 99.999% N_2

Specimen Examination: No staining or localized corrosion visible

continued on pg. 34

To Page No._____

Witnessed & Understood by me,	Date	Invented by	Date
		Recorded by	7/18/02

Project No._____
Book No._____ TITLE _____

From Page No.___ | Electrochemical Impedance Test for Alloy C-22 (from pg 33)

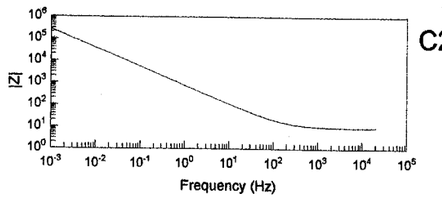
Test: C22eis46

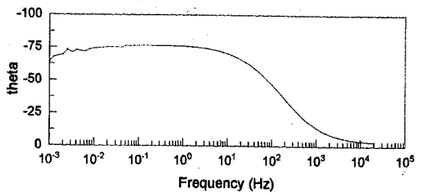
Initial frequency: 20000 Hz
Final frequency 0.001 Hz

10 steps per decade

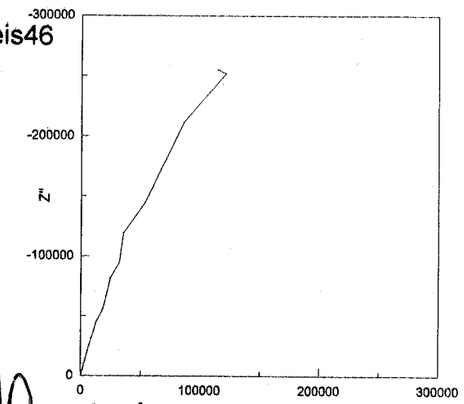
Integration time: 5 seconds
Delay: 2 seconds

Data: C22eis46





C22eis46



John Bat 7/18/02

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To Page No._____

Witnessed & Understood by me, | Date | Invented by | Date
Recorded by | 7/18/02

Project No._____
TITLE _____ Book No._____

From Page No.___ | Electrochemical Impedance Test for alloy C-22 (from pg 34)

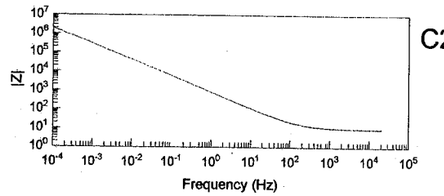
Test: C22 eis 47

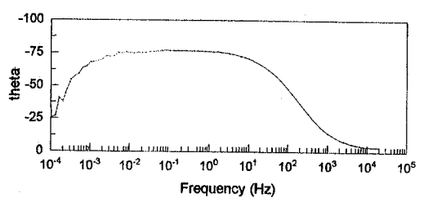
Initial frequency: 20000 Hz
Final frequency: 0.0001 Hz

10 steps per decade

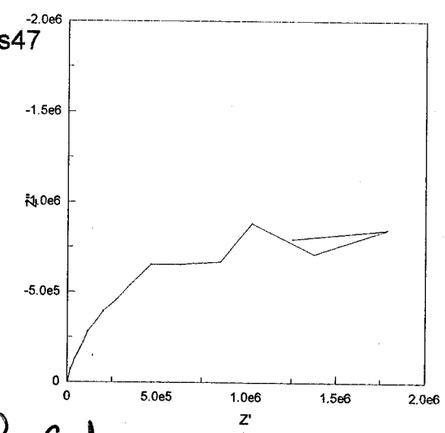
Integration Tim 5 seconds
Delay: 2 seconds

Data: C22eis 47





C22eis47



John Bat 7/19/02

To Page No._____

Witnessed & Understood by me, | Date | Invented by | Date
Recorded by | 7/18/02

Project No._____
Book No._____ TITLE Electrochemical Impedance Test for Alloy C-22

From Page No.____

objective: same as pg. 2

specimen: C-22 heat: 2277-8-3175 Polished to a 600 grit finish

start wt: 12.44580 g Santorius Genius s/N 12806099 cal 6/4/02
End wt: 12.44530 g
Same test specimen as Notebook 57, pg. 8

Solution: ↑ 11/4/02 0.028M NaCl
2.296 g NaCl Lot # 020814
+DI H_2O up to 2000 ml

pH start: 6.015 Fisher Accumet 950 meter s/N 3340 cal 7/24/01
pH End: 6.447 pH probe # 13-620-296 s/N 1100208

cell info: Area 8 cm^2
Density: 8.69 g/cm^3
Equivalent wt: 26.04

Impedance Analyzer: Solartron 1260
Counter Electrode: Pt flag
Reference: Fisher 13-620-52 s/N 005-2132

Temperature: 60°C Hg Thermometer s/N H98-162 cal 4/22/02

E_{corr} = -319 mV Keithley 614 s/N 704936 cal 5/26/02
E_{pt} = 127.5 mV

Solution Deaerated with 99.999% N_2

Specimen Examination: No staining or localized corrosion

continued on pg 37

To Page No.____

Witnessed & Understood by me, Date Invented by Date

Recorded by John Bass 7/19/02

Project No._____
TITLE Electro Chemical Impedance Test for Alloy C-22 (from pg 36) Book No._____

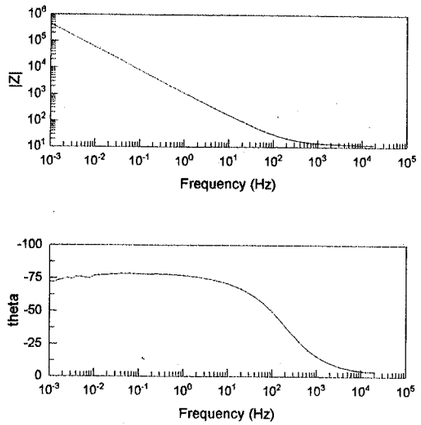
From Page No.____

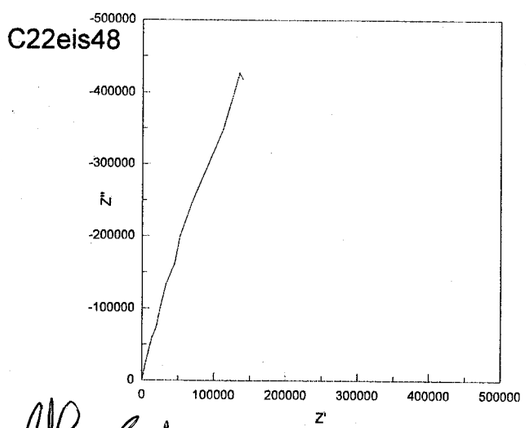
Test: C22eis48
↑ 7/19/02
~~Scan~~
Initial frequency: 20000 Hz
Final frequency: 0.001 Hz

10 steps per Decade

Integration Time: 5 seconds
Delay: 2 seconds

Data: C22eis48





John Bass 7/22/02

continued on pg 38

To Page No.____

Witnessed & Understood by me, Date Invented by Date

Recorded by John Bass 7/19/02

Project No._____
Book No._____ TITLE_____

From Page No.___ | Electrochemical Impedance Test for Alloy C22 (Room pg. 37)

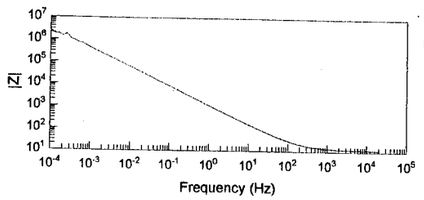
Test: C22 eis 49

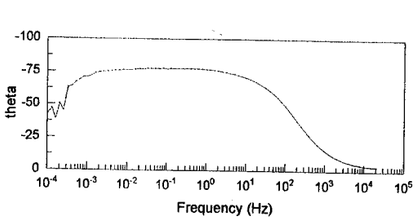
Initial Frequency: 20000 Hz
Final Frequency: 0.0001 Hz

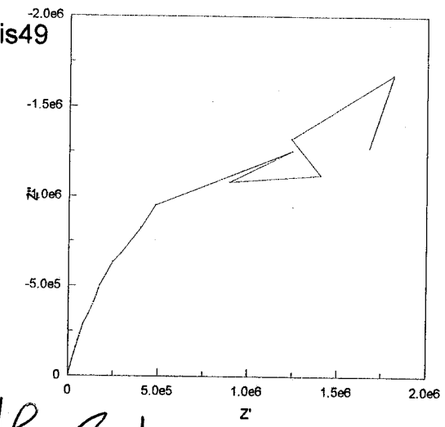
10 steps per decade

Integration time: 5 seconds
Delay: 2 seconds

Data: C22 eis 49







7/22/02

To Page No._____

Witnessed & Understood by me, | Date | Invented by | Date

Recorded by 7/14/02

TITLE_____ Project No._____ Book No._____

From Page No.___ | Electrochemical Impedance Test for Alloy C-22 #3 7/15/02

Objective: same as pg. 2

specimen: C-22 heat: 2277-8-3175 polished to a 600 grit finish

start wt: 12.44580 g Sartorius Genius s/N 12809099 cal 6/4/02
End wt: 12.44530 g
same test specimen S20, pg. 8

Solution: 0.028M NaCl
3.296 g NaCl Lot: 020814
+ DI H_2O up to 2000 ml

pH start: 6.015 Fisher Accumet 950 meter s/N 3340 cal 7/24/01
pH End: 6.447 pH probe # 13-620-296 s/N 1100208

cell info: Area: 8 cm^2
Density: 8.69 g/cm^3
Equivalent wt: 26.09

Impedance Analyzer: Solartron 1260

Counter Electrode: Pt flag

Reference: Fisher 13-620-52 s/N 40052132

Temperature: 40°C Hg Thermometer s/N H98-162 cal 4/22/02

E_{corr} = -319 mV Keithley Model 614 s/N 704936 cal 5/26/02
E_{pb} = 127.5 mV

Solution Deaerated with 99.999% N_2

Specimen Examination: No staining or localized corrosion visible

continued on pg. 40

To Page No._____

Witnessed & Understood by me, | Date | Invented by | Date

Recorded by 7/14/02

Project No._____
Book No._____ TITLE_____

From Page No.____ Electrochemical Impedance Test for Alloy C-22 (From pg. 39)

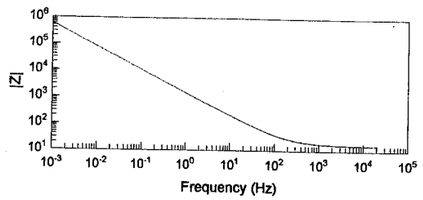
Test: C22eis50

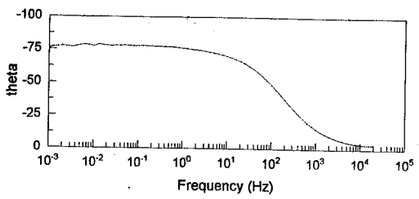
Initial Frequency: 20000 Hz
Final Frequency: 0.001 Hz

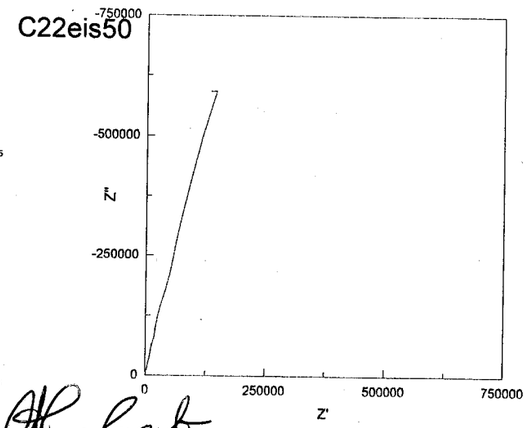
10 steps per Decade

Integration Time: 5 seconds
Delay: 2 seconds

Data: C22eis50







7/22/02

continued on pg 41

To Page No._____

Witnessed & Understood by me, | Date | Invented by | Date

Recorded by 7/19/02

Project No._____
TITLE_____ Book No._____

From Page No.____ Electrochemical Impedance Test for Alloy C-22 (From pg. 40)

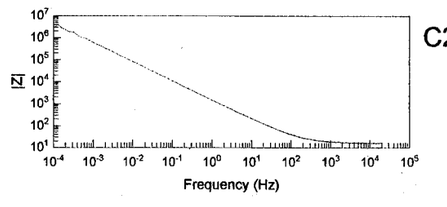
Test: C22eis51

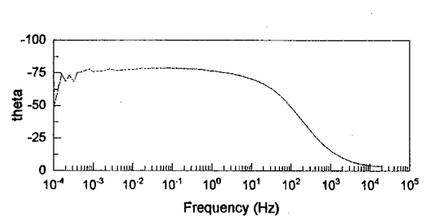
Initial Frequency: 20000 Hz
Final Frequency: 0.0001 Hz

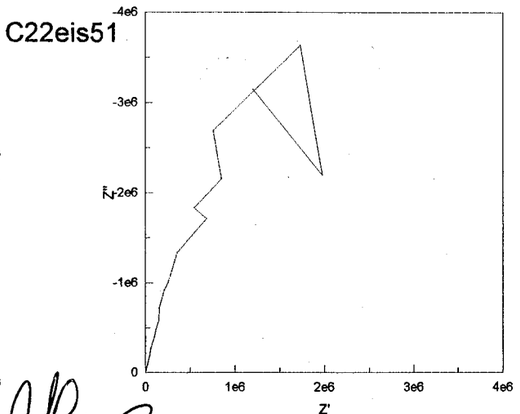
10 steps per decade

Integration Time: 5 seconds
Delay 2 seconds

Data: C22eis51







7/22/02

To Page No._____

Witnessed & Understood by me, | Date | Invented by | Date

Recorded by 7/19/02

From Page No.___ | Electrochemical Impedance Test for Alloy C-22

Objective: same as pg. 2

Specimen: C-22 heat: 2277-8-3175 Polished to a 600 grit finish

start wt: 12.44580g Sartorius Genius S/N 12889099 cal 6/4/02
End wt: 12.44530g
Same test specimen as Notebook 520, pg. 8

Solution: 0.028 M NaCl
3.296g NaCl Lot: 020819
+DI H_2O up to 2000ml

pH start: 6.015 Fisher Accumet 950 meter S/N 3340 cal 7/24/01
pH End: 6.447 pH probe # 13-620-256 S/N 1100208

Cell info: Area: 8 cm^2
Density: 8.69 g/cm^3
Equivalent wt: 26.04

Impedance Analyzer Solartron 1260

Counter Electrode: Pt flag

Reference: Fisher 13-620-52 S/N 005 2132

Temperature 25°C Hg Thermometer S/N HG8-162 Cal 4/22/02

E_{pp} 1 -315mV Keithley 614 S/N 704936 cal 5/26/02
E_{pp} 2 127.5mV

Solution Deaerated with 99.999% N_2

Specimen Examination: No staining or localized corrosion visible

continued on pg 43

To Page No._____

Witnessed & Understood by me, | Date | Invented by | Date 7/22/02
Recorded by John Bart

From Page No.___ | Electro Chemical Impedance Test for Alloy C-22 (continued from pg 42)

Test: C22eis52

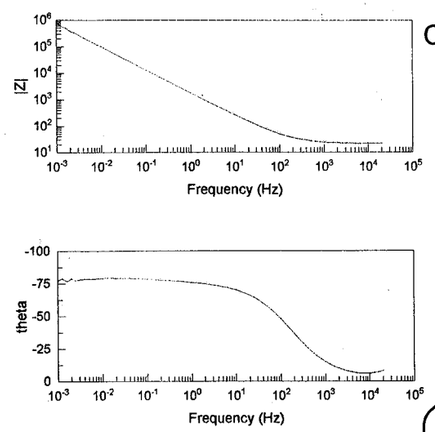
Initial frequency: 20000 Hz
Final frequency: 0.001 Hz

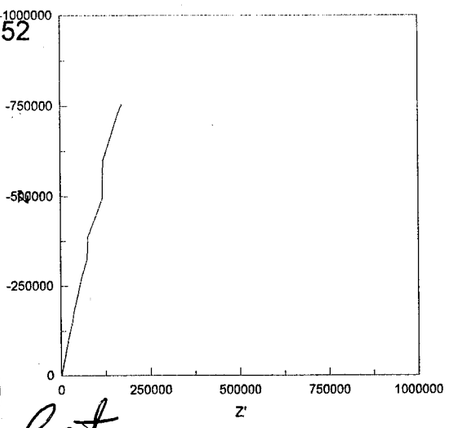
10 steps per decade

Scan 3 7/22/02

Integration time 5 seconds
Delay 2 seconds

Data: C22e3 52





John Bart 7/22/02

continued on pg 44

To Page No._____

Witnessed & Understood by me, | Date | Invented by | Date 7/22/02
Recorded by John Bart

Project No._____
Book No._____ TITLE Electrochemical Impedance Test for Alloy C-22 (continued from pg 43)

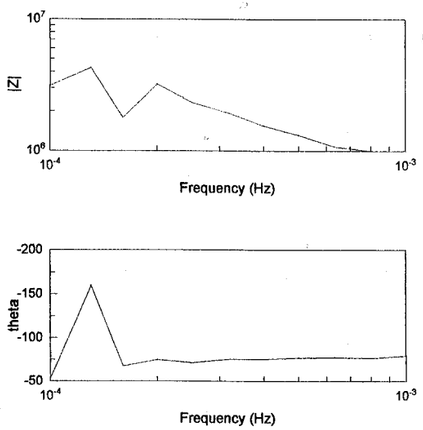
From Page No.___

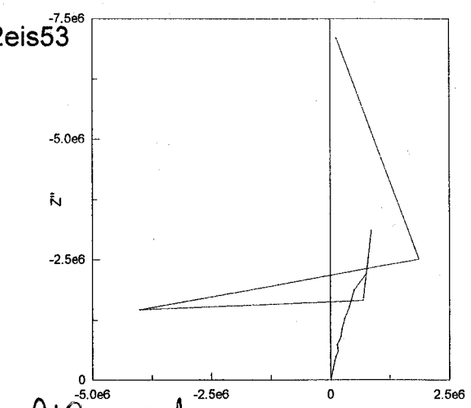
Test: C22eis53

Integration time: 5 seconds
Delay: 2 seconds

10 steps per Decade

Initial frequency: 20000 Hz
Final frequency: 0.0001 Hz





John Bost
7/23/02

To Page No._____

Witnessed & Understood by me,	Date	Invented by	Date
		Recorded by John Bost	7/23/02

Project No._____
TITLE_____ Book No._____

From Page No.___

To Page No._____

Witnessed & Understood by me,	Date	Invented by	Date
		Recorded by John Bost	8/8/02

Project No._____
Book No._____ TITLE_____

From Page No.____ | Polarization Resistance Test for Alloy C-22

Objective: Same as pg. 1

Specimen: C-22 heat: 2277-8-3175 Thermally Aged at 870°C for 40 hours Polished to a 600 grit finish.
start wt: 11.93944 g Sartorius Genius S/N 12809099 cal 6/4/02
End wt: cal due: 12/04/02

Solution: 0.028M NaCl
3.296 g NaCl Lot: 020814
+ DI H_2O up to 2000 ml

pH start: $\frac{5.542}{3.296}$ JB 7/29/02 Orion 720A S/N 005885 cal: 7/10/02 due: 7/10/03
pH End: pH probe # 13-620-296 S/N 1100208

Potentiostat: Solartron 1287

Counter electrode: Pt flag

Reference: Fisher 13-620-52 S/N 005132

Temperature: 95°C Hg Thermometer S/N H58-162 cal 4/22/02 due: 4/22/03

E_{corr}: -314 mV Keithley 614 S/N 704431 cal 5/26/02 due: 5/26/03
E_{Pb}: 23.4 mV

Solution Deaerated with 99.999% N_2

Specimen Examining:

continued on: pg 47

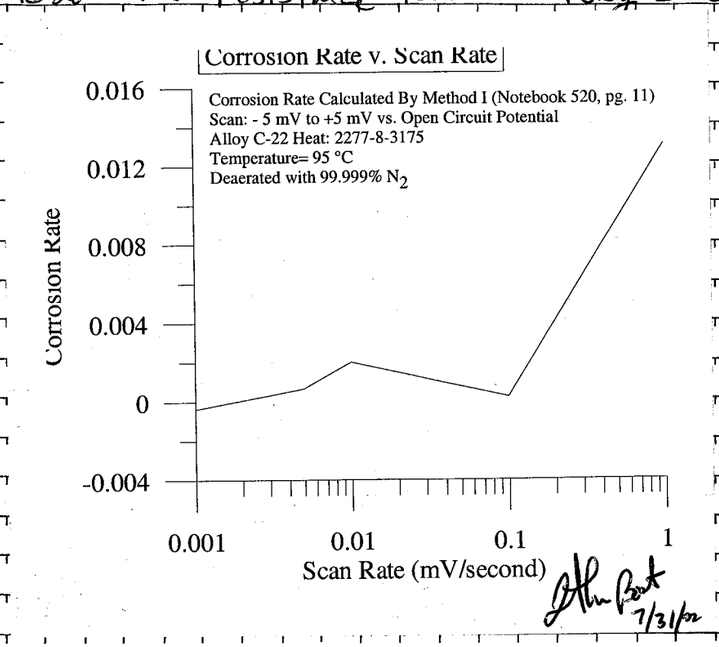
To Page No.____

Witnessed & Understood by me, | Date | Invented by | Date 7/29/02
Recorded by

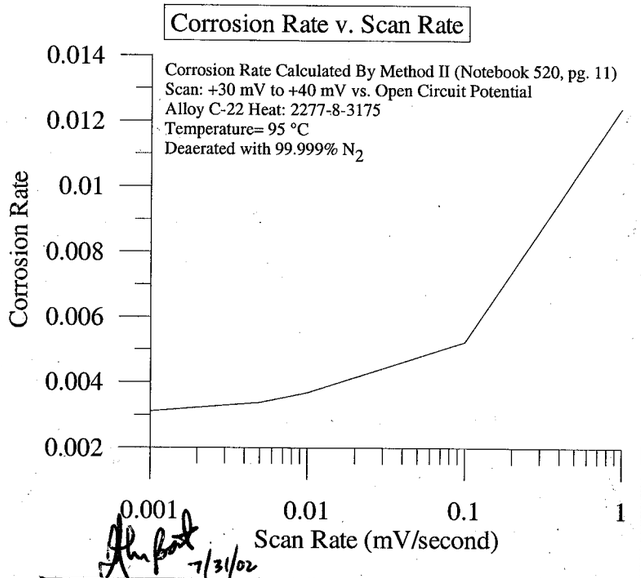
Project No._____
TITLE_____ Book No._____

From Page No.____ | Polarization Resistance Test for Alloy C-22 (From pg. 46

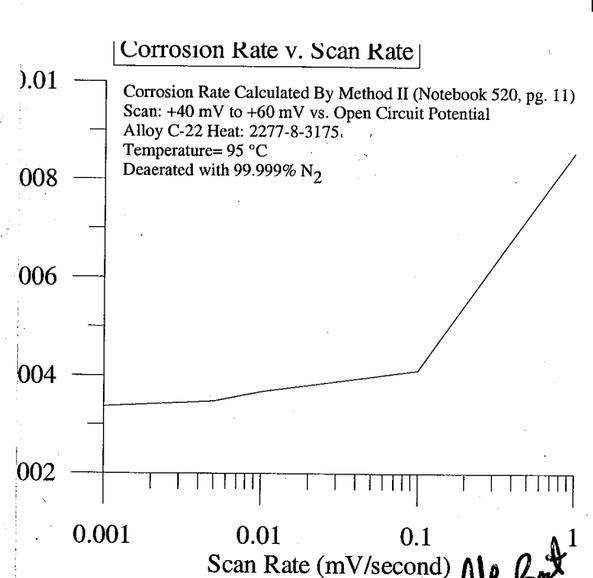
Data:



JB 7/31/02



JB 7/31/02



JB 7/31/02

continued on pg 48

To Page No.____

Witnessed & Understood by me, | Date | Invented by | Date 7/31/02
Recorded by

Project No._____
Book No._____ TITLE _____

From Page No.___ | Polarization Resistance test for Alloy C-22 (from pg. 47)

Test: C22 Rpr-76

Scan: -15mV to +60mV vs. open circuit potential

Scan Rate: 1 mV/second

E_{corr} = -0.3181 V vs. SCE

Results: Method I (see formulas in Notebook 520, pg. 11)

$(\Delta E/\Delta I)_{Ecorr}$ = 2.56530 x 10^{-5}

R_p = 3.8982 x 10^{4} $\Omega \cdot cm^2$

i_{corr} = 1.3360 x 10^{-6} A/cm^2

C.R. = 0.0131 mm/yr

Method II (see formulas in Notebook 520, pg. 11)

A. for Data: +30mV to +40mV vs. open circuit potential
(-0.2881 < E < -0.2781)

b = 1.03475 x 10^{-6}

m = -7.06448 x 10^{-7}

i_{corr} = 1.26447 x 10^{-6} A/cm^2

C.R. = 0.0124 mm/yr

B. for Data +40mV to +60mV vs. open circuit potential
(E > -0.2781)

b = 3.92350 x 10^{-6}

m = 9.58755 x 10^{-7}

i_{corr} = 8.7370 x 10^{-7}

C.R. = 0.00856 mm/yr

Data: C22 Rpr 76 (Method I) pg. 45
C22 Rpr 76 (Method II) pg. 45

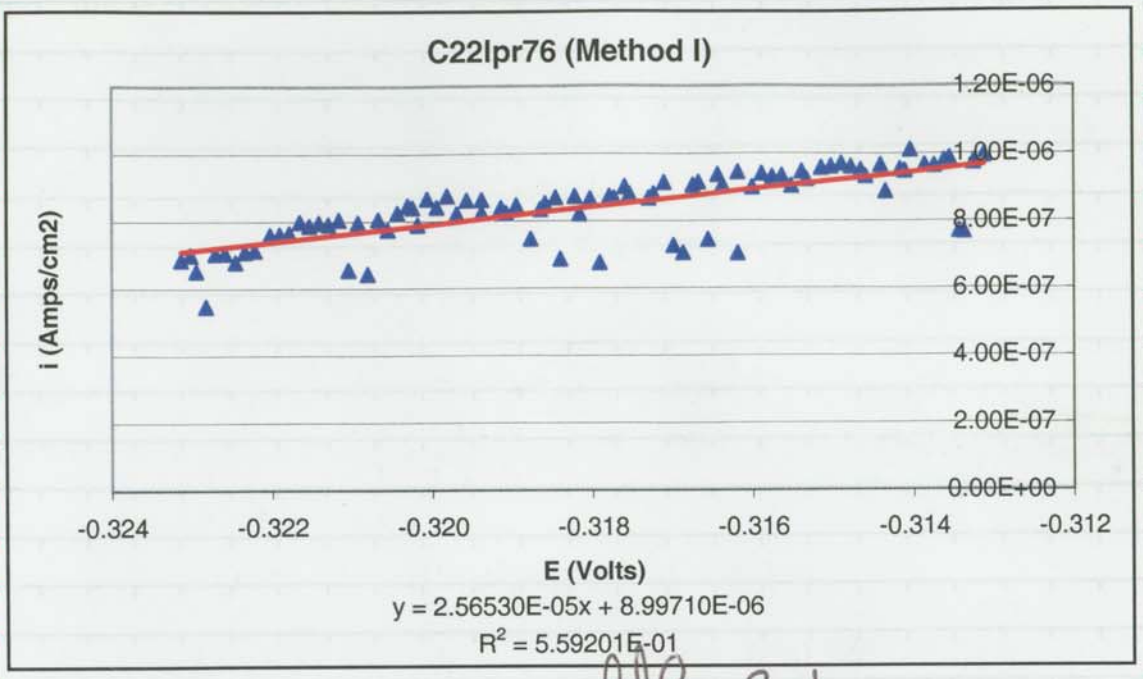
Continued on pg. 44

To Page No._____

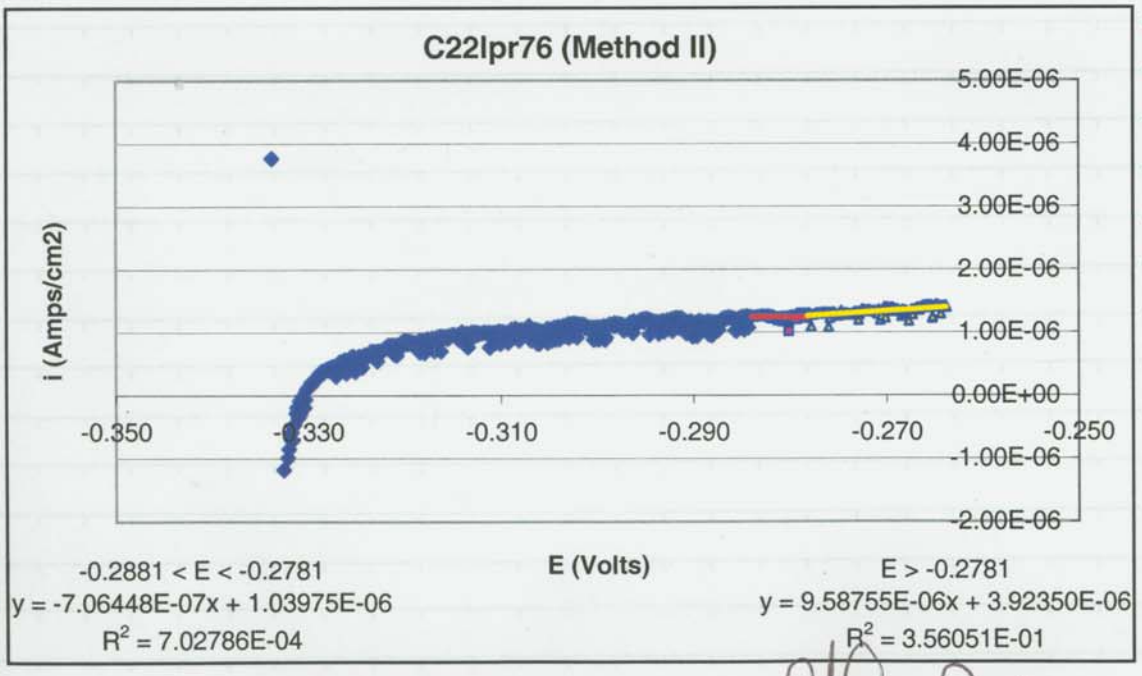
Witnessed & Understood by me,	Date	Invented by	Date
		Recorded by	7/24/02

From Page No. | Polarization Resistance Test for Alloy G22 (from pg. 48)

Data



7/29/02



7/29/02

continued on pg. 50

To Page No.

Witnessed & Understood by me,	Date	Invented by	Date
		Recorded by	7/29/02

Project No._____ Book No._____ TITLE_____

From Page No.___ Polarization Resistance Test for Alloy C-22 (From pg. 45)

Test: C22 lpr 77

Scan: -15 mV to +60 mV vs. open circuit potential

Scan Rate: ~~0.01~~ JB 7/29/02 0.1 mV/s

E_{corr} = -0.3355 V vs. SCE

Results: Method I (see formulas in Notebook 520, pg. 11)

$(\partial E/\partial I)_{E_{corr}} = 4.17211 \times 10^{-7}$

$R_p = 2.3969 \times 10^{6}\ \Omega \cdot cm^2$

$i_{corr} = 2.1728 \times 10^{-8}\ A/cm^2$

C.R. = 0.000213 mm/yr

Method II (see formulas in Notebook 520, pg. 1)

A. For Data +30 mV to +40 mV vs. open circuit potential

(-0.3055 < E < -0.2955)

$b = 8.55227 \times 10^{-7}$

$m = 9.57419 \times 10^{-7}$

$i_{corr} = $ ~~$5.5067 \times 10^{-7}\ A/cm^2$~~ JB 7/29/02 $5.34013 \times 10^{-7}\ A/cm^2$

C.R. = ~~0.00540 mm/yr~~ JB 7/29/02

0.00523 mm/yr

B. For Data +40 mV to +60 mV vs. open circuit potential

(E > -0.2955)

$b = 1.77498 \times 10^{-6}$

$m = 4.05322 \times 10^{-6}$

$i_{corr} = $ ~~$4.9065 \times 10^{-7}\ A/cm^2$~~ JB 7/29/02 $4.20125 \times 10^{-7}\ A/cm^2$

C.R. = ~~0.00481 mm/yr~~ JB 7/29/02

0.00412 mm/yr

Data: C22 lpr 77 (Method I) pg. 51

C22 lpr 77 (Method II) pg. 51

continued on pg. 51

To Page No._____

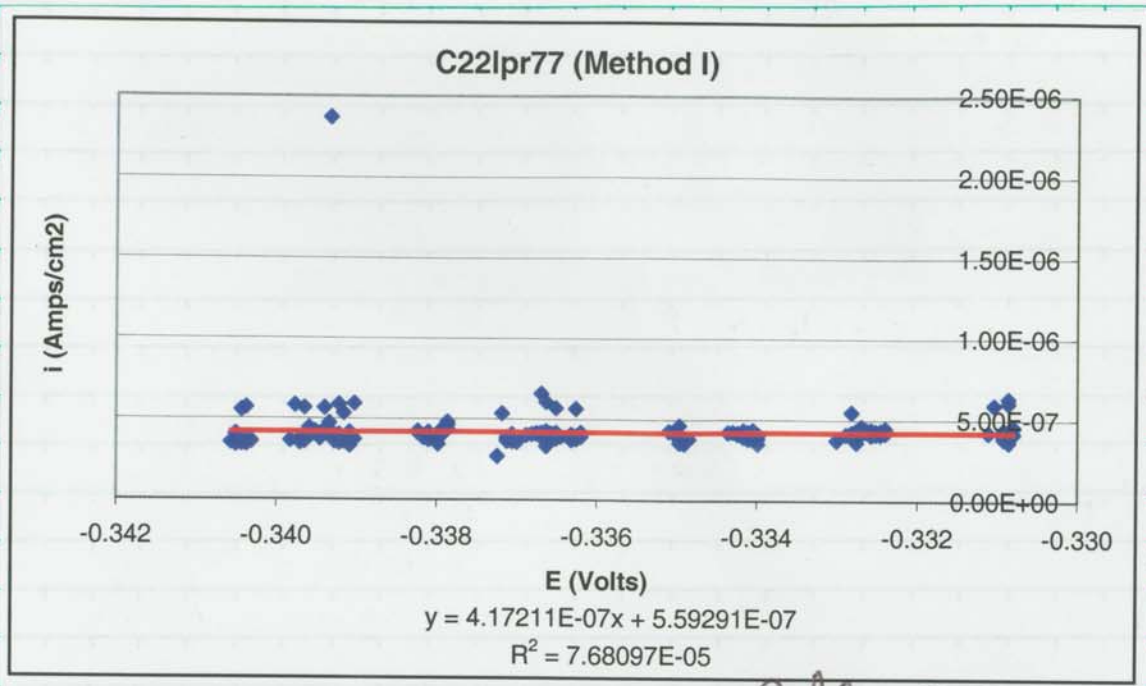
Witnessed & Understood by me, Date

Invented by Date

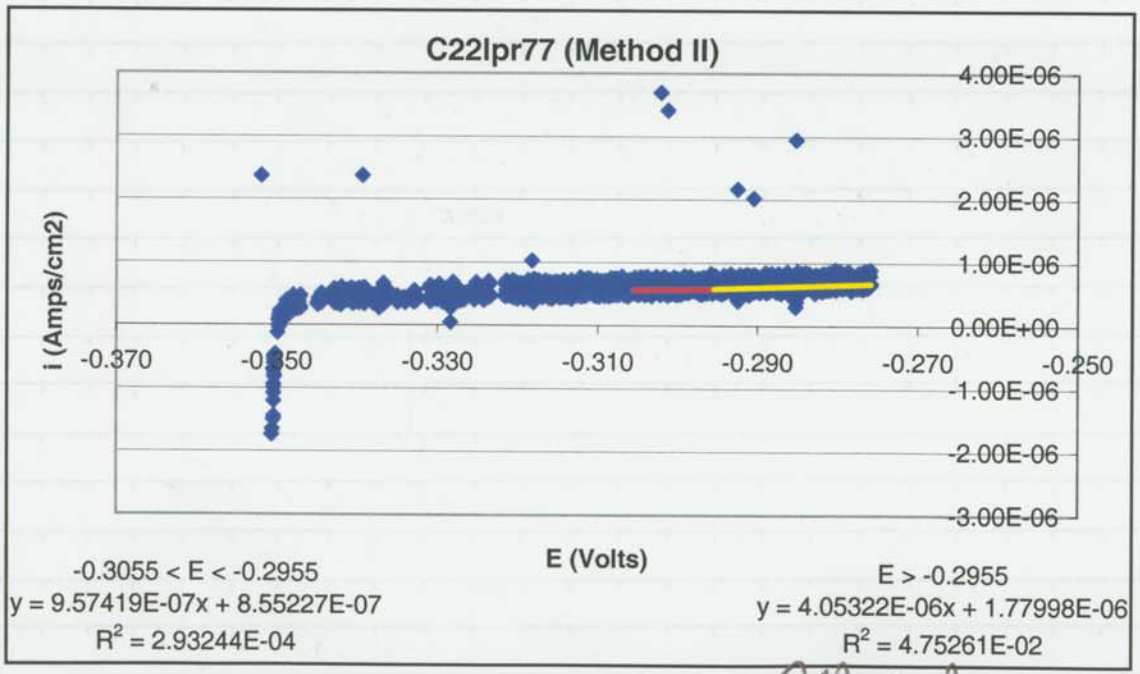
Recorded by JB 7/29/02

From Page No. Polarization Resistance Test for Alloy C-22 (from pg. 58)

Data:



7/29/02



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continued on pg. 52

To Page No.

Witnessed & Understood by me,	Date	Invented by	Date
		Recorded by	7/29/02

From Page No. | Polarization Resistance Test for Alloy C-22 (from pg. 51)

Test: C22 lpm 78

Scan: -15 mV to +60 mV vs. open circuit potential

Scan Rate: 0.01 mV/s

E_{corr} = -0.3457 V vs. SCE

Results: Method I (see formulas in Notebook 520, pg. 11)

$(\Delta E/\Delta I)_{E_{corr}} = 3.93963 \times 10^{-6}$

$R_p = 2.53833 \times 10^{5}$ $\Omega \cdot cm^2$

$i_{corr} = 2.05118 \times 10^{-7}$ A/cm^2

C.R. = 0.00201 mm/yr

Method II (see formulas in Notebook 520, pg. 11)

A. for Data +30 mV to +40 mV vs. open circuit potential
($-0.3157 < E < -0.3057$)

$b = 9.21699 \times 10^{-7}$

$m = 1.58122 \times 10^{-6}$

$i_{corr} = 3.75071 \times 10^{-7}$

C.R. = 0.00368 mm/yr

B. for Data +40 mV to +60 mV vs. open circuit potential
($E > -0.3057$)

$b = 9.08265 \times 10^{-7}$

$m = 1.54279 \times 10^{-6}$

$i_{corr} = 3.74922 \times 10^{-7}$ A/cm^2

C.R. = 0.00367 mm/yr

Data: C22 lpm 78 (Method I) pg. 53
C22 lpm 78 (Method II) pg. 53

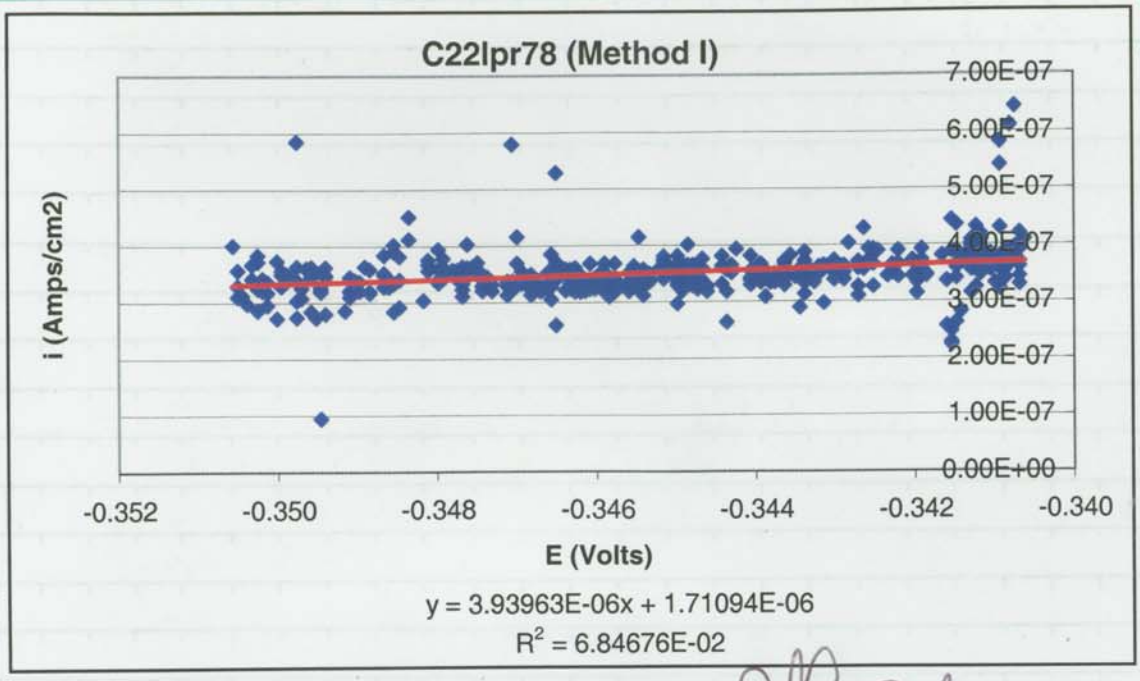
continued on pg. 53

To Page No.

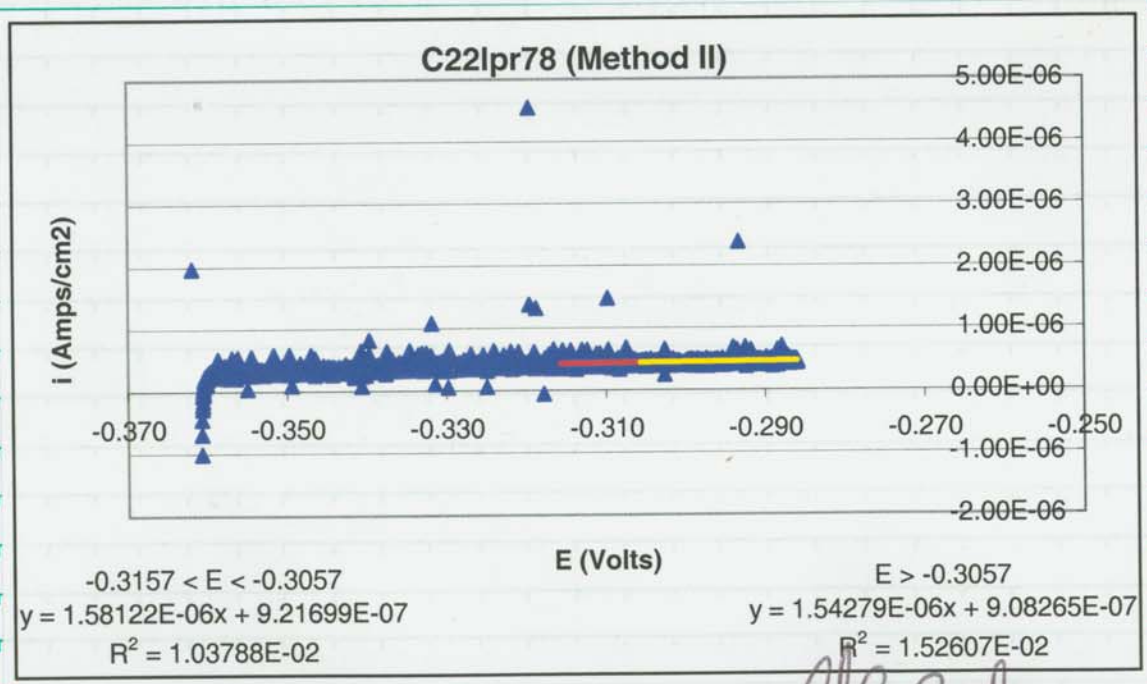
Witnessed & Understood by me,	Date	Invented by	Date
		Recorded by [signature]	7/30/02

From Page No. Polarization Resistance Test for Alloy C-22 (From pg. 52)

Data:



7/30/02



7/30/02

continued on pg. 54

To Page No.

Witnessed & Understood by me,	Date	Invented by	Date
		Recorded by	7/30/02

Project No._____
Book No._____ TITLE _____

From Page No.___ Polarization Resistance for Alloy C-22 (from pg. 53)

Test: C22lpr 79

Scan: -15 mV to +60 mV vs. open circuit potential

Scan Rate: 0.005 mV/s

E_{corr} = -0.3485 V vs. SCE

Results: Method B (see formulas in Notebook 520, pg. 11)

$(\delta E/\delta I)_{E_{corr}} = 1.31323 \times 10^{-6}$

$R_p = 7.6148 \times 10^5$ Ω·cm²

$i_{corr} = 6.8343 \times 10^{-8}$ A/cm²

C.R. = 0.000670 mm/yr

Method II (see formulas in Notebook 520, pg. 11)

A. for Data +30 mV to +40 mV vs. open circuit potential

~~EIS 7/29/02~~ (-0.3185 < E < -0.3085)

$b = 7.66353 \times 10^{-7}$

$m = 1.21151 \times 10^{-6}$

$i_{corr} = 3.44142 \times 10^{-7}$ A/cm²

C.R. = 0.00337 mm/yr

B. for Data +40 mV to +60 mV vs. open circuit potential

(E > -0.3085)

$b = 6.90480 \times 10^{-7}$

$m = 9.62518 \times 10^{-7}$

$i_{corr} = 3.55092 \times 10^{-7}$

C.R. = 0.00348 mm/yr

Data: C22 lpr 79 (Method I) pg. 55

C22 lpr 79 (Method II) pg. 55

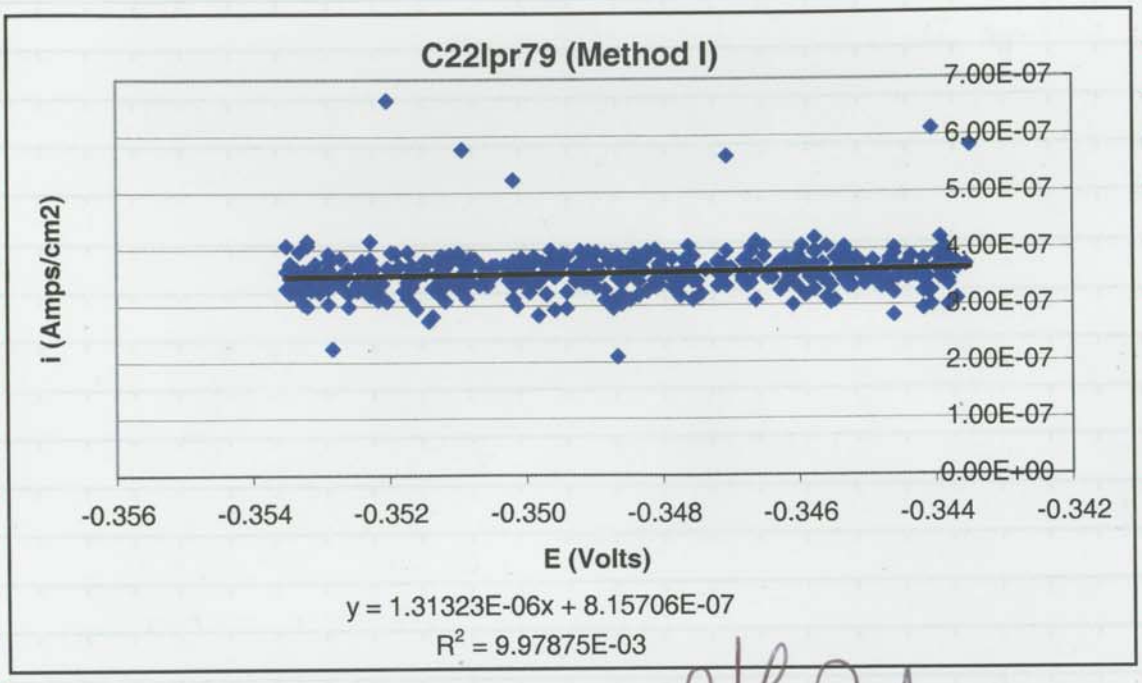
continued on pg. 55

To Page No.____

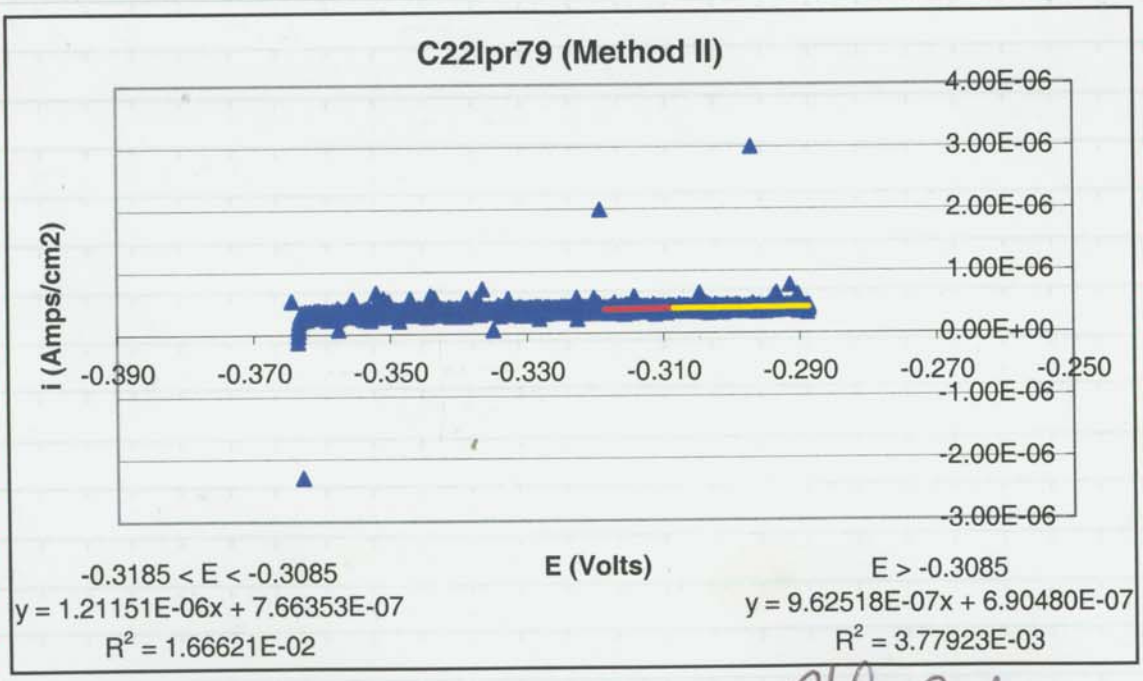
Witnessed & Understood by me,	Date	Invented by	Date
		Recorded by John Bost	7/30/02

From Page No. Polarization Resistance for Alloy C22 (from pg. 52)

Data:



7/30/02



7/30/02

continued on pg. 56

To Page No.

Witnessed & Understood by me, Date

Invented by Date

Recorded by 7/30/02

Project No._____
Book No._____ TITLE_____

From Page No.___ | Polarization Resistance Test for Alloy C-22 (From pg. 55)

Tst: C22 lpr 80

Scan: -15mV to +60mV vs. open circuit potential

Scan Rate: 0.001 mV/s

E_{corr}: -0.3380 V vs. SCE

Results: Method I (see ~~calc~~ JB 7/29/02 formulas in Notebook 520, pg 11)

$(\partial E/\partial I)_{E_{corr}} = -7.26104 \times 10^{-7}$

$R_p = -1.3772 \times 10^{6}\ \Omega \cdot cm^2$

$i_{corr} = -3.7815 \times 10^{-8}\ A/cm^2$

C.R. = -0.000371 mm/yr

Method II (see formulas in Notebook 520, pg 11)

A. for Data +30 mV to +40mV vs. open circuit potential

~~(-0.3430 < E < -0.2330)~~ JB 7/31/02 (-0.3080 < E < -0.2980)

b = 6.49226×10^{-7}

n = 9.85281×10^{-7}

$i_{corr} = 3.16201 \times 10^{-7}\ A/cm^2$

C.R. = 0.00310 mm/yr

B. for Data +40mV to +60mV vs. open circuit potential

(E > ~~-0.333~~ JB 7/31/02 -0.2980)

b = 3.97278×10^{-7}

n = 1.56644×10^{-7}

$i_{corr} = 3.44332 \times 10^{-7}$

C.R. = 0.00337 mm/yr

Data: C22 lpr 80 (Method I) pg 57
C22 lpr 80 (Method II) pg 57

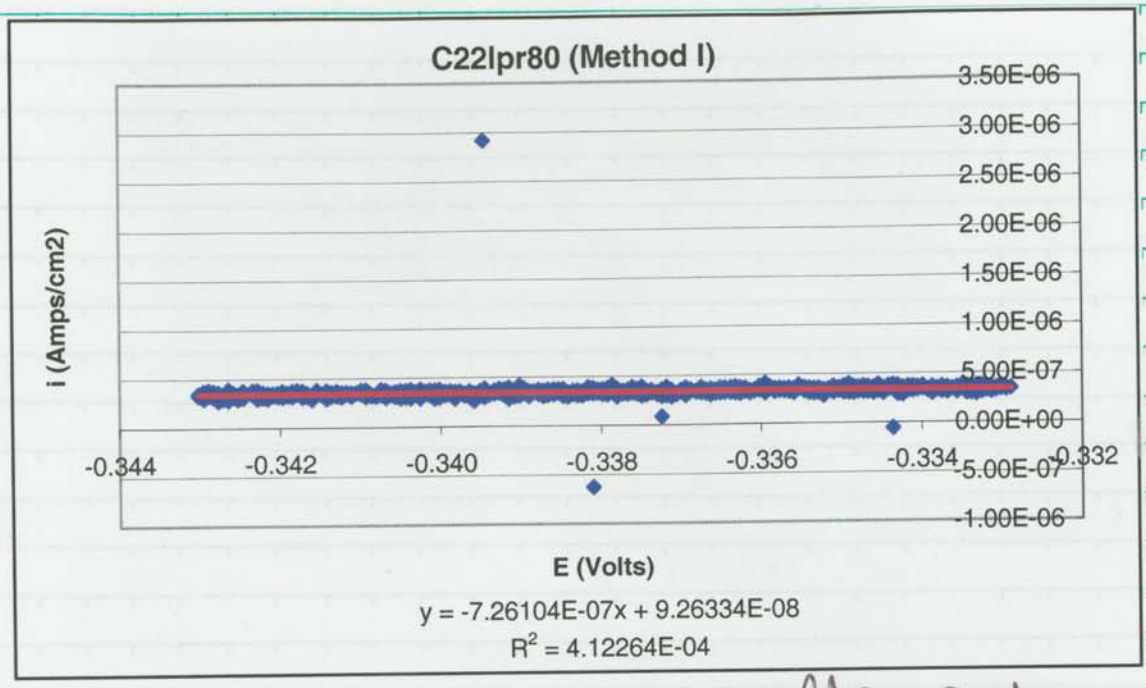
continued on pg 57

To Page No._____

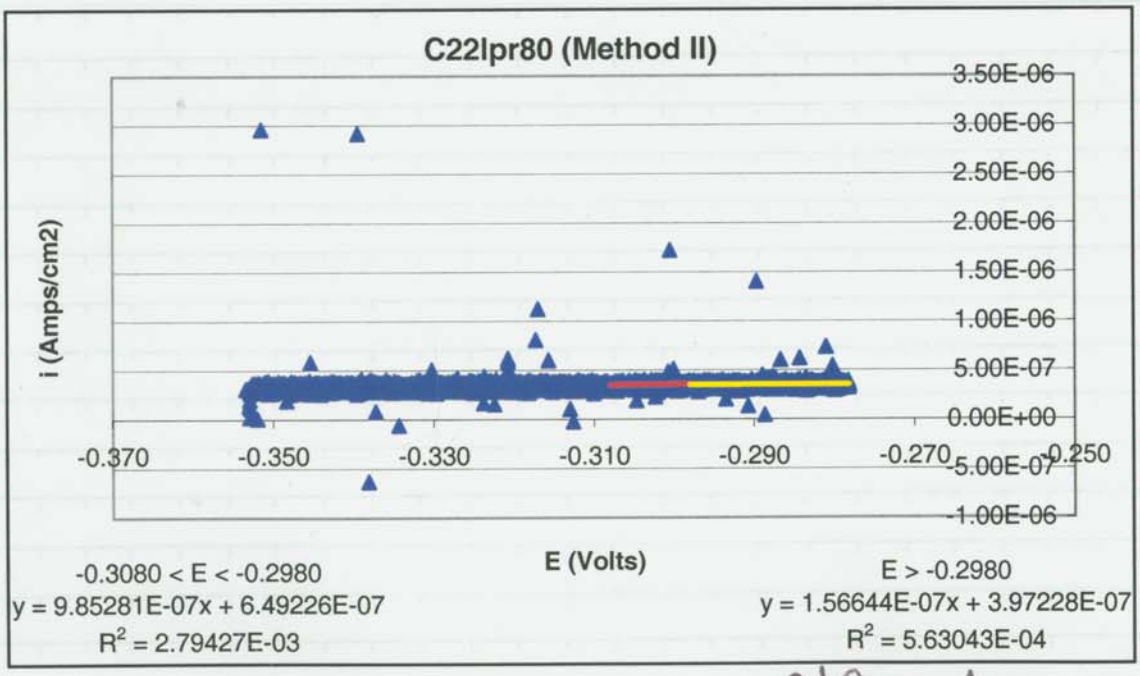
Witnessed & Understood by me,	Date	Invented by	Date
		Recorded by John Bodt	7/31/02

From Page No. Polarization Resistance Test for Alloy C-22 (From pg. 56)

Data:



7/21/02



7/31/02

To Page No.

Witnessed & Understood by me,	Date	Invented by	Date
		Recorded by	7/31/02

Project No._____
Book No._____ TITLE_____

From Page No.___ | Electrochemical Impedance Test for Alloy C-22

objective: same as pg 2

Specimen: Alloy C-22 heat: 22 77-8-3175 Thermally aged @ 870°C for 4 hours; Polished to a 600 grit finish, same test specimen as pg. 46
start wt: 11.93949 g Sartorius gains S/N 12809099 cal: 6/4/02
End wt: due 12/04/02

Solution: 0.028M NaCl
3.296 g NaCl Lot: 020814
+DI H_2O up to 2000 ml

pH start: 5.552 Orion 720A S/N 005385 cal: 7/10/02 due: 7/10/03
pH end: pH probe # 13-620-256 S/N 1100208

Cell info: Area: 8 cm^2
density: 8.64 g/cm^3
Equivalent wt: 26.04

Impedance Analyzer: Solartron 1260

Counter electrode: Pt Alloy

Reference: Fisher 13-620-52 S/N 0052132

Temperature: 95°C Hg Thermometer S/N H98-162 cal 4/22/02 due: 4/22/03

E_{corr}: -314 mV Ref: Hg/Hg$_2$SO$_4$ 614 S/N 709936 cal 5/21/02 due: 5/26/03
E_{pit}: 127.5 mV

Solution Deaerated with 99.999% N_2

Specimen examination:

continued on pg 59 | To Page No._____

Witnessed & Understood by me, | Date | Invented by | Date
Recorded by John Bost | 8/1/02

TITLE_____ Project No._____
Book No._____

From Page No.___ | Electrochemical Impedance Test for Alloy C-22 (from pg. 58

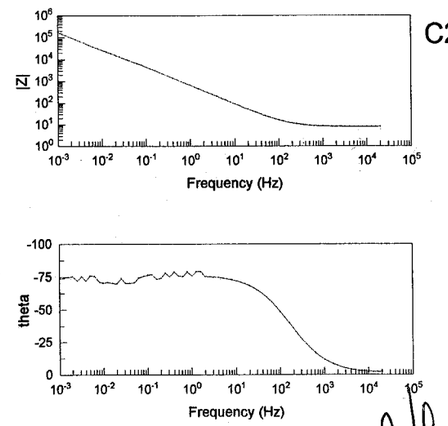
Test: C22eis54

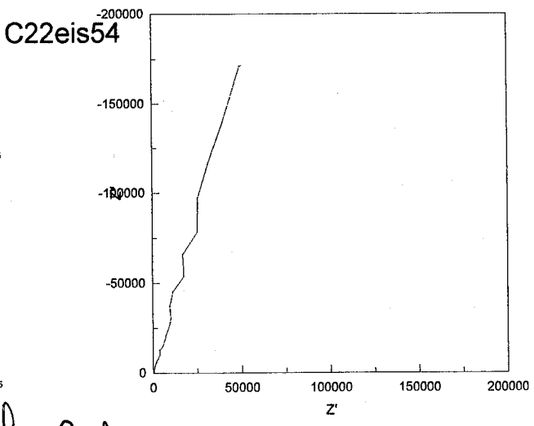
Initial frequency: 20000 Hz
Final frequency: 0.001 Hz

10 steps per decade

Integration time: 5 seconds
Delay: 2 seconds

Data: C22eis54





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Recorded by John Bost | 8/1/02

Project No._____
Book No._____ TITLE Electrochemical Impedance Test for Alloy C-22

From Page No.___

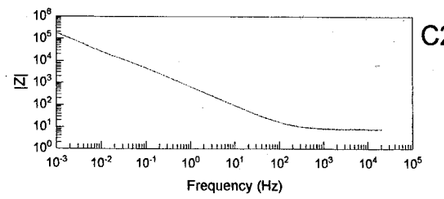
Test: C22 eis 55

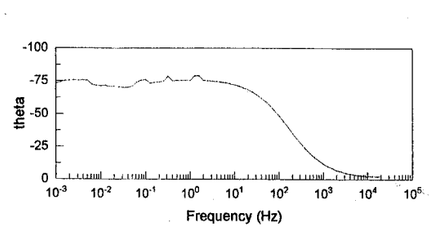
Initial frequency: 20000Hz
Final frequency: 0.001Hz

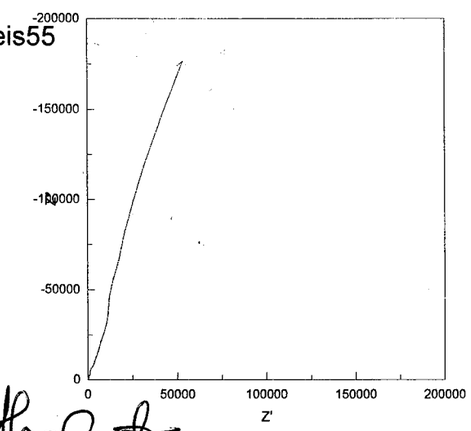
10 steps per decade

Integration time: 5 seconds
Delay: 2 seconds

Data: C22 eis 55







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continued on pg. 61

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Witnessed & Understood by me, Date

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Recorded by 8/1/02

Project No._____
TITLE _____ Book No._____

From Page No.___ Electrochemical Impedance Test for Alloy C-22 (From pg. 60)

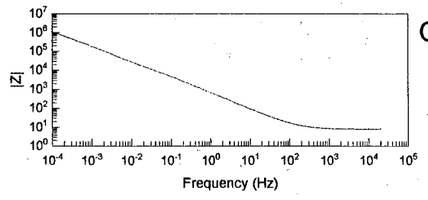
Test: C22 eis 56

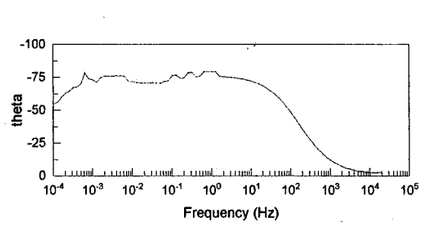
Initial frequency: 20000 Hz
Final frequency: 0.0001 Hz

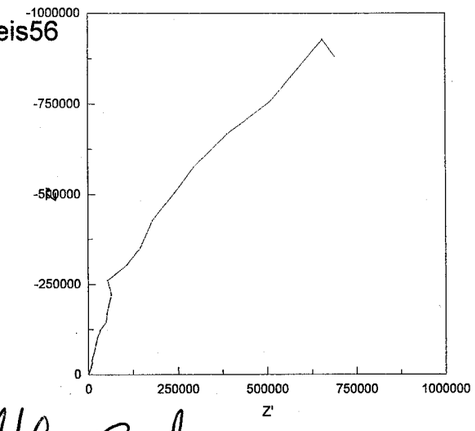
10 steps per decade

Integration time: 5 seconds
Delay: 2 seconds

Data: C22 eis 56







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Witnessed & Understood by me, Date

Invented by Date

Recorded by 8/1/02

From Page No.

Polarization Resistance Test for Alloy C-22

Objective: Same as pg. 1

Specimen: C-22 heat: 2277-8-3175 Thermally Aged at 870°C for 4 hours
Polished to a 600 grit finish; same test specimen as pg. 4/2

start wt: 11.93949 g Sartorius genius S/N 12805095 cal: 6/4/02
End wt: 11.93943 g due: 12/4/02

Solution: 0.028M NaCl
3.296g NaCl Lot 020814
+DI H_2O up to 2000ml

pH start: 5.592 Orion 720A S/N 005285 cal 7/10/02 due 7/10/03
pH End: 6.108 pH probe # 13-620-294 S/N 1106208

Potentiostat: Solartron 1287

Counter electrode: Pt flag

Reference: Fisher 13-620-52 S/N 00552132

Temperature: 80°C Hg Thermometer S/N H48-162 cal 4/22/02 due: 4/22/03

E_{open} = -3/4mV Ktthley 614 S/N 709936 Cal 5/22/02 due 5/26/03

E_{pp} = 23.4mV

Solution Deaerated with 99.999% N_2

Specimen examination; No staining on Any of Surface And No visable signs of Corrosion on Specimen

continued on pg 63

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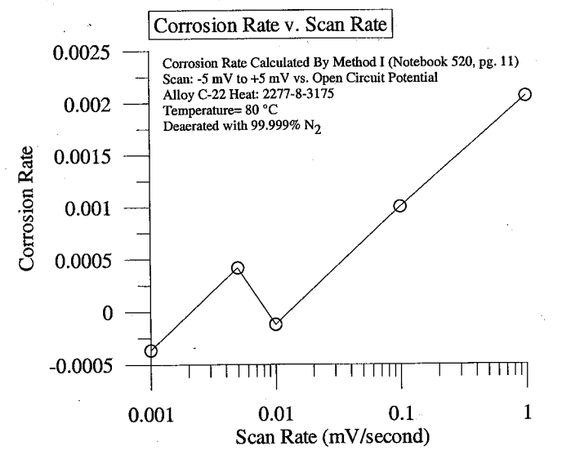
Witnessed & Understood by me, | Date | Invented by | Date

Recorded by John Bost 8/1/02

From Page No. Polarization Resistance Test for Alloy C-22 (Cont. pg. 62)

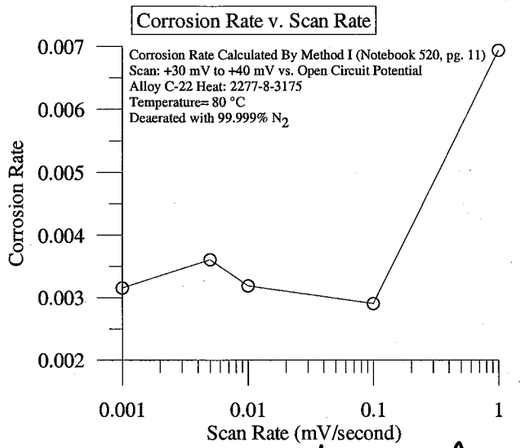
Date:

Method I:



John Bost 8/6/02

Method II:



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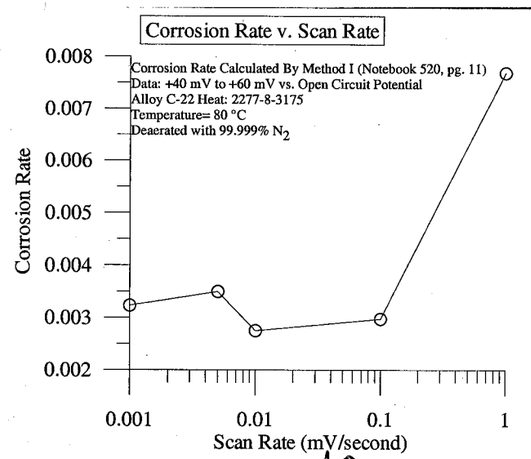

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Project No._____
Book No._____ TITLE _____

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From Page No.___ | Polarization Resistance Test for Alloy C-22 (from pg. 63)

Test: C22 R_p 81

Scan: -15 mV vs. open circuit potential to +60 mV vs. open circuit potential

scan Rate: 1 mV/second

E_{corr} = -0.2106 V vs SCE

Results: Method I (see formulas in Notebook 520, pg. 11)

$(\partial E/\partial I)_{corr}$ = 4.04119 x 10^{-6}

R_p = 2.47145 x 10^5 Ω·cm²

i_{corr} = 2.1047 x 10^{-7} A/cm²

C.R. = 0.00206 mm/yr

Method II (see formulas in Notebook 520, pg. 11)

A. Data from +30 mV to +40 mV vs. open circuit potential
(-0.186 < E < -0.170)

B 8/6/02

b = ~~7.69465 x 10^{-6}~~ 2.47966 x 10^{-6}

m = 9.69465 x 10^{-6}

i_{corr} = 7.07907 x 10^{-7} A/cm²

C.R. = 0.00694 mm/yr

B. Data from +40 mV to +60 mV vs. open circuit potential
(E > -0.170)

b = 9.67308 x 10^{-7}

m = 8.61269 x 10^{-7}

i_{corr} = 7.84902 x 10^{-7} A/cm²

C.R. = 0.00769 mm/yr

Data: C22 R_p 81 (Method I) pg. 65
C22 R_p 81 (Method II) pg. 65

continued on pg 65

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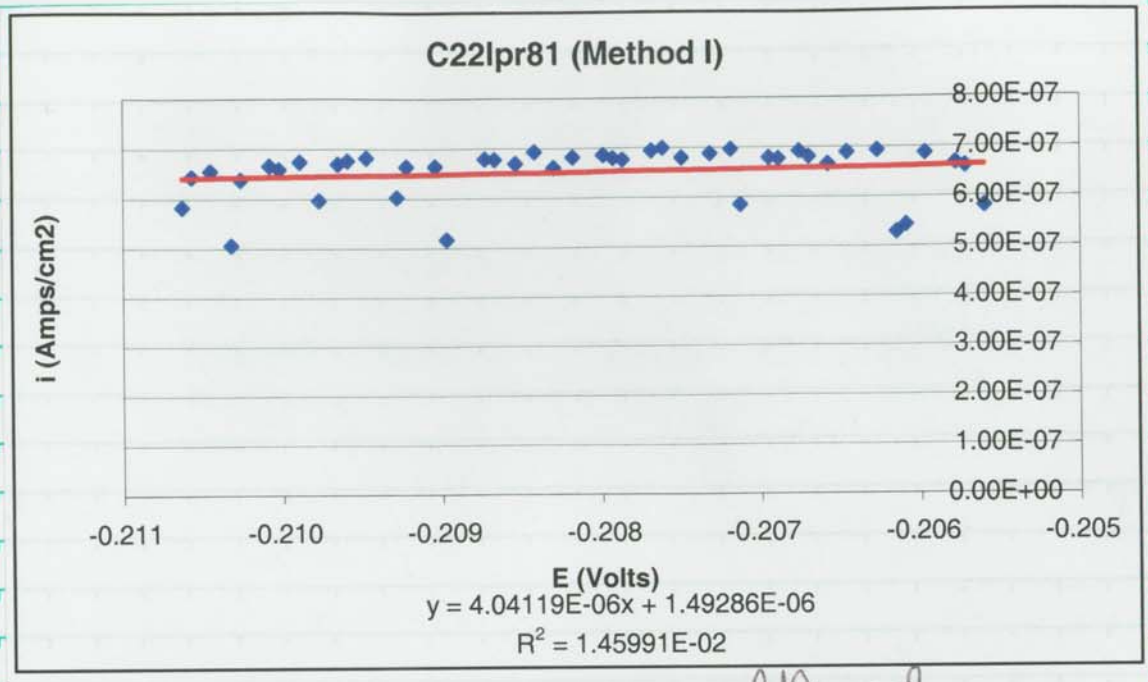
Witnessed & Understood by me,	Date	Invented by	Date
		Recorded by John Bosch	8/6/02

From Page No. Polarization Resistance Test for Alloy C-22 (from pg. 64)

Data:



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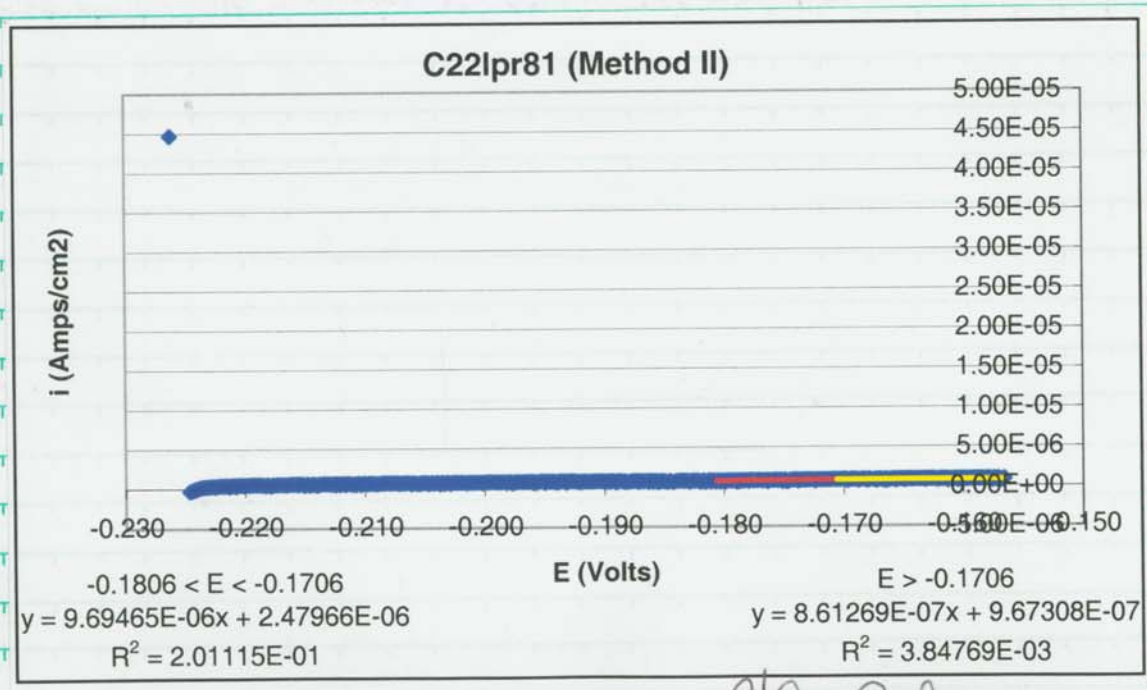

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Project No._____ Book No._____ TITLE_____

From Page No.___ Polarization ~~Resistance~~ B&W2 Resistance Test for Alloy C-22 (from pg. 65)

Test: C22 lpr 82

Scan: -15mV to +60mV vs. open circuit potential

Scan Rate: 0.1mV/second

E_{corr}: -0.1802 V vs. SCE

Results: Method I (see formulas in Notebook 520, pg. 11)

$(\partial E/\partial I)_{E_{corr}} = 1.95874 \times 10^{-6}$

$R_p = 5.1053 \times 10^5\ \Omega\cdot cm^2$

$i_{corr} = 1.0201 \times 10^{-7}\ A/cm^2$

C.R. = 0.00100 mm/yr

Method II (see formulas in Notebook 520 pg. 11)

A. Data from +30mV to +40mV vs. open circuit potential
(-0.1502 < E < -0.1402)

$b = 9.62963 \times 10^{-7}$

$m = 3.69939 \times 10^{-6}$

$i_{corr} = 2.96333 \times 10^{-7}\ A/cm^2$

$CR = 2.90 \times 10^{-3}$ mm/yr = 0.00290 mm/yr

B. Data from +40mV to +60mV vs. open circuit potential
(E > -0.1402)

$b = 8.83082 \times 10^{-7}$

$m = 3.21449 \times 10^{-6}$

$i_{corr} = 3.08831 \times 10^{-7}\ A/cm^2$

C.R. = 0.00298 mm/yr

Data: C22 lpr 82 (Method I) pg. 67
C22 lpr 82 (Method II) pg. 67

Continued on pg. 67

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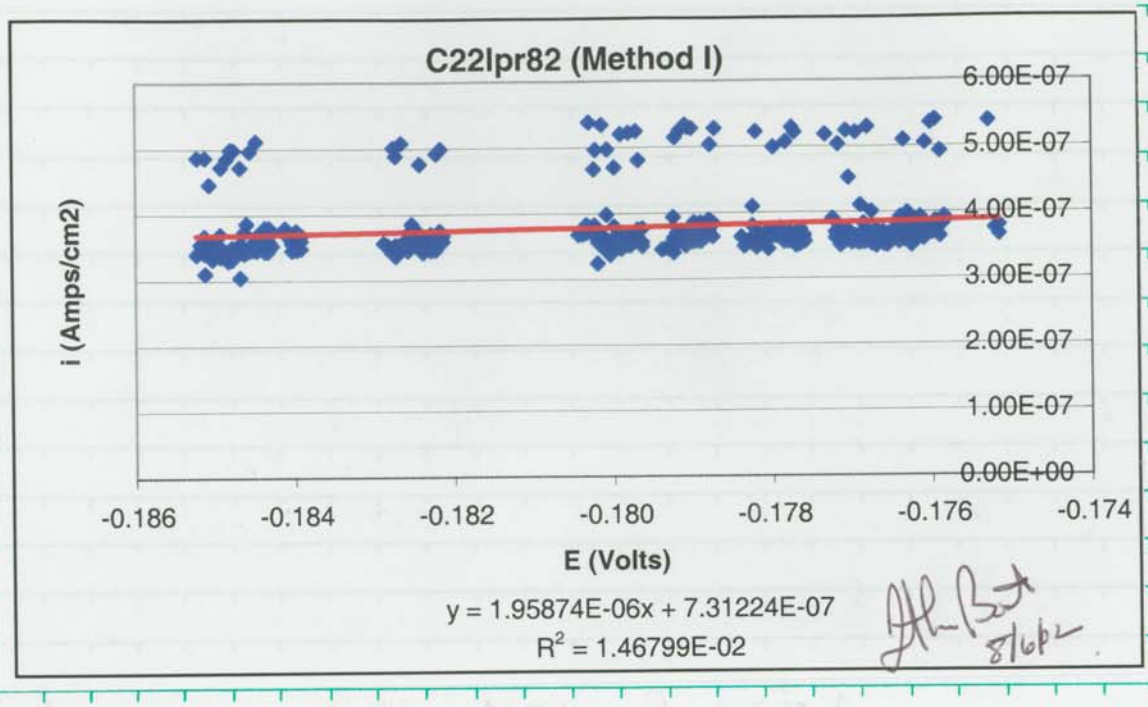
Witnessed & Understood by me,	Date	Invented by	Date
		Recorded by John Bart	8/6/02

From Page No. Polarization Resistance Test for Alloy C22 (from pg. 66

Data:



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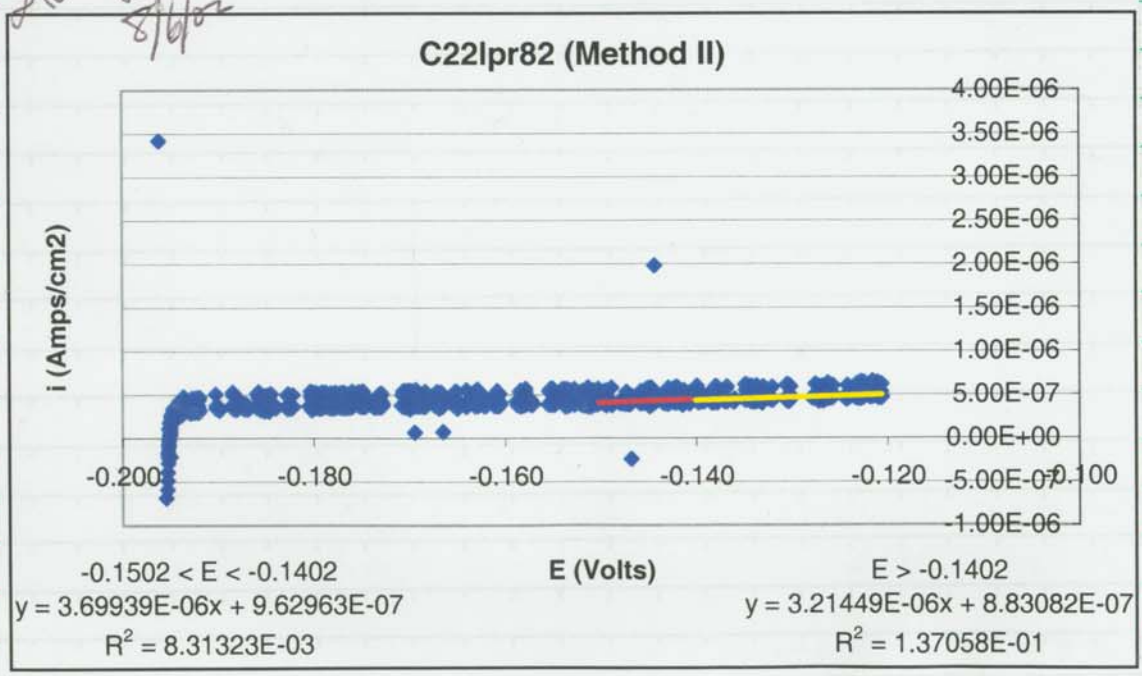

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Invented by

Recorded by

Date 8/6/02

Project No._____
Book No._____ TITLE_____

From Page No.____ | Polarization Resistance Test for Alloy C-22 (from pg. 67)

Test: C22lpr83

Scan: -15 mV to +60 mV vs. open circuit potential

Scan rate: 0.01 mV/second

E_{corr} = -0.1640 V vs. SCE

Results: Method I (see formulas in Notebook 520, pg. 11)

$(\partial E/\partial I)_{E_{corr}} = -2.41537 \times 10^{7}$

$R_p = -4.1402 \times 10^{6}\ \Omega \cdot cm^2$

$i_{corr} = -1.2579 \times 10^{-8}\ A/cm^2$

C.R. = -0.000123 mm/yr

Method II (see formulas in Notebook 520, pg. 11)

JB 8/1/02

A. Data from +30 mV to +40 mV vs. open circuit potential
(-0.1340 < E < -0.1240)

$b = 4.77718 \times 10^{-7}$

$m = 9.29141 \times 10^{-7}$

$i_{corr} = 3.25339 \times 10^{-7}\ A/cm^2$

C.R. = 0.00319 mm/yr

B. Data from +40 mV to +60 mV vs. open circuit potential
(E > -0.1240)

$b = 5.89216 \times 10^{-7}$

$m = 1.88044 \times 10^{-6}$

$i_{corr} = 2.80824 \times 10^{-7}$

C.R. = 0.00275 mm/yr

Data: C22lpr83 (Method I) pg 69
C22lpr83 (Method II) pg 69

continued on pg. 69

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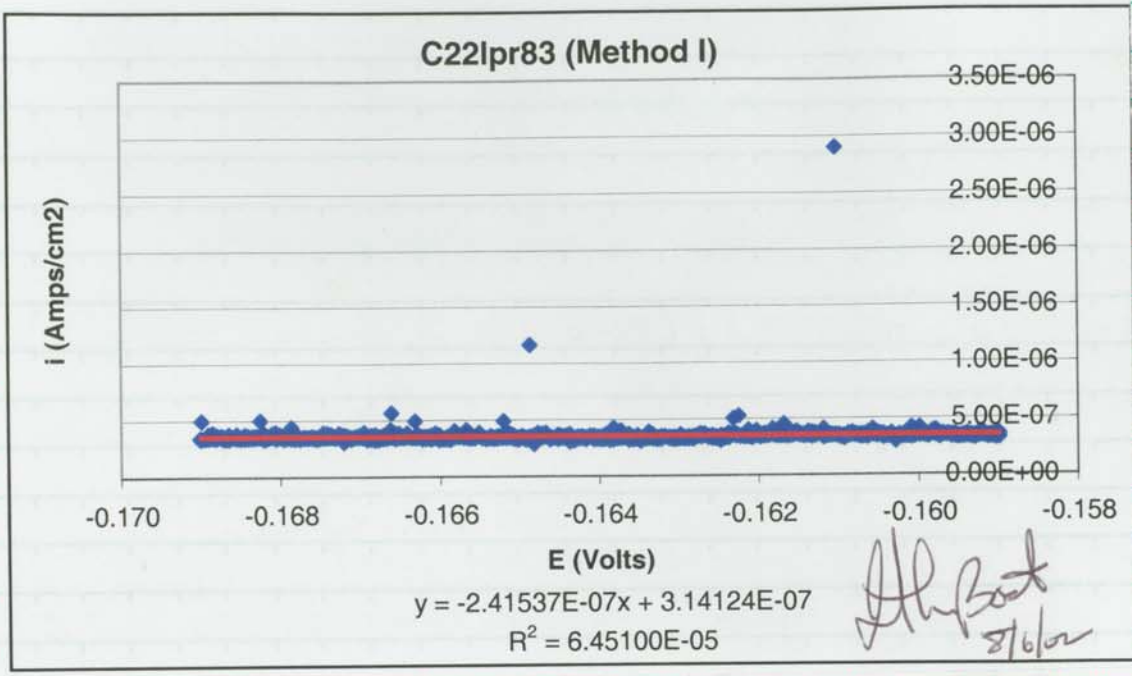
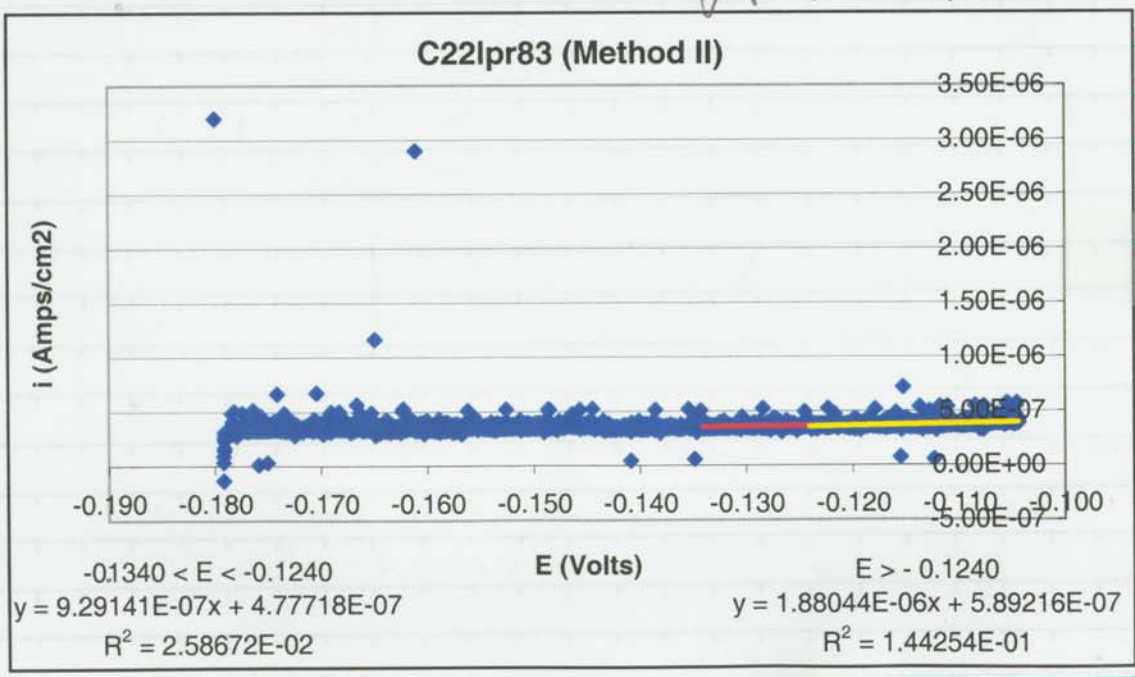
Witnessed & Understood by me,	Date	Invented by	Date
		Recorded by [signature]	8/6/02

From Page No. Polarization Resistance Test for Alloy C-22 (from pg. 68)

Data:



8/6/02



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Witnessed & Understood by me, Date

Invented by

Recorded by

Date 8/6/02

Project No._____
Book No._____ TITLE_____

From Page No.____ | Polarization Resistance Test for Alloy C-22 (From pg. 69)

Test: ~~C22 lpr 83~~ JB 8/1/02 C22 lpr 84

Scan: -15 mV to +60 mV vs. open circuit potential

Scan rate: 0.005 mV/second

E_{corr} = -0.1410 V vs. SCE

Results: Method I (see formulas in Notebook 520, pg. 11)

$(\Delta E/\Delta I)_{E_{corr}} = 8.18437 \times 10^{-7}$

$R_p = 1.2218 \times 10^{6}\ \Omega\cdot cm^2$

$i_{corr} = 4.2624 \times 10^{-8}\ A/cm^2$

C.R. = 0.00048 mm/yr

Method II (see formulas in Notebook 520, pg. 11)

A. Data from +30 mV to +40 mV vs. open circuit potential
(-0.1110 < E < -0.1010)

$b = 3.73563 \times 10^{-7}$

$m = 3.73142 \times 10^{-8}$

$i_{corr} = 3.6830 \times 10^{-7}\ A/cm^2$

C.R. = 0.00361 mm/yr

B. Data from +40 mV to +60 mV vs. open circuit potential
(E > -0.1010)

$b = 4.16351 \times 10^{-7}$

$m = 4.21257 \times 10^{-7}$

$i_{corr} = 3.56954 \times 10^{-7}\ A/cm^2$

C.R. = 0.00350 mm/yr

Data: C22 lpr 84 (Method I) pg. 71
C22 lpr 84 (Method II) pg. 71

continued on pg. 71

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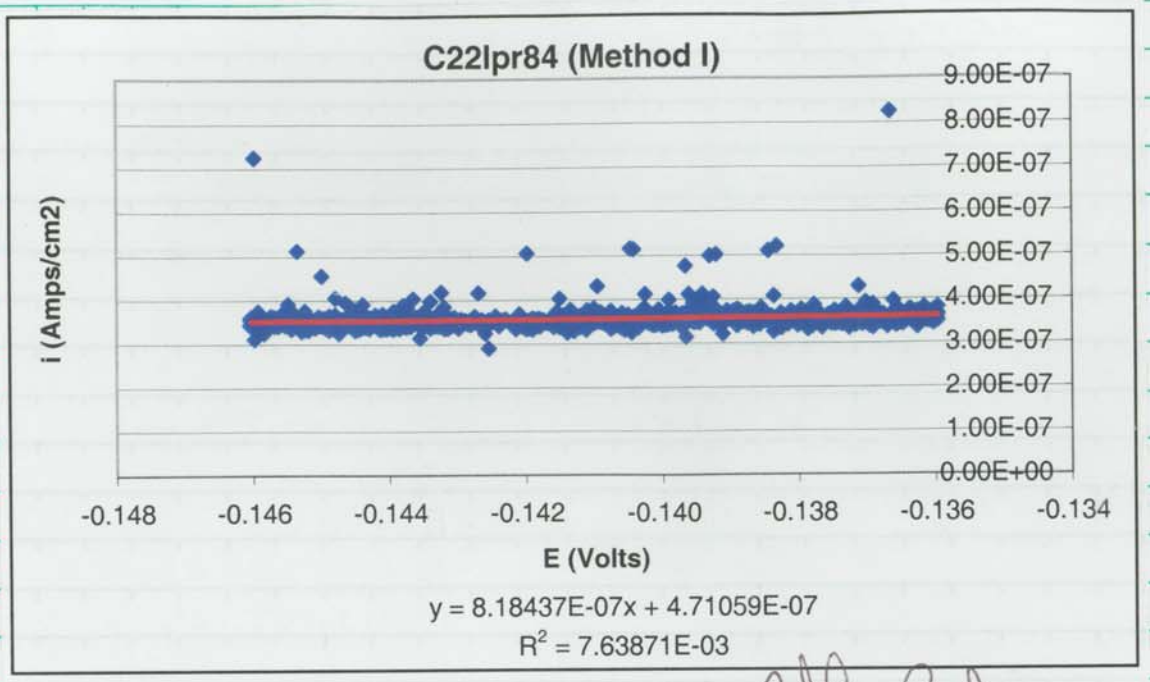
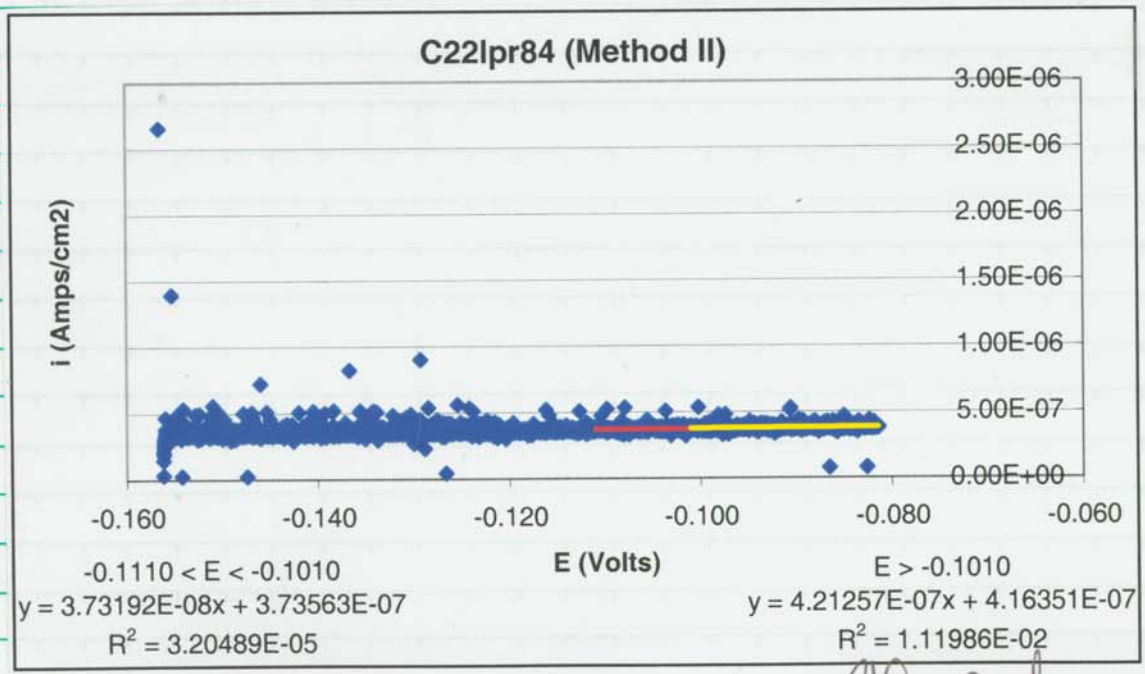
Witnessed & Understood by me,	Date	Invented by	Date
		Recorded by [signature]	8/6/02

From Page No. ___ Polarization Resistance Test for Alloy C-22 (From pg. 70)

Data:



8/6/02



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Continued on pg. 72

To Page No. _____

Witnessed & Understood by me,	Date	Invented by	Date
		Recorded by	8/6/02

Project No.

Book No. TITLE

From Page No. | Polarization Resistance Test for Alloy C-22 (from pg 71)

Test: ~~C22 lpr 84~~ JB 8/1/02 C22 lpr 85

Scan: -15mV to ~~+60~~ JB 8/1/02 +60mV vs. open circuit potential

Scan rate: 0.001 mV/second

E_{corr}: -0.1103

Results: Method I (See formulas in Notebook 520, pg 11)

$(\Delta E/\Delta I)_{E_{corr}} = -7.15925 \times 10^{-7}$

$R_p = -1.3968 \times 10^{6}\ \Omega/cm^2$

$i_{corr} = -3.7285 \times 10^{-8}\ A/cm^2$

C.R. = -0.000365 mm/yr

Method II (see formulas in Notebook 520, pg 11)

A. From Data +30mV to +40mV vs. open circuit potential
(-0.0803 < E < -0.0703)

$b = 4.05205 \times 10^{-7}$

$m = 7.54781 \times 10^{-7}$

$i_{corr} = 3.21986 \times 10^{-7}\ A/cm^2$

C.R. = 0.00316 mm/yr

B. From Data +40mV to +60mV vs. open circuit potential
(E > -0.0703)

$b = 3.80672 \times 10^{-7}$

$m = 4.62587 \times 10^{-7}$

$i_{corr} = 3.29645 \times 10^{-7}\ A/cm^2$

C.R. = 0.00323 mm/yr

Data: C22 lpr 85 (Method I) pg 73
C22 lpr 85 (Method II) pg 73

Continued on pg 73

To Page No.

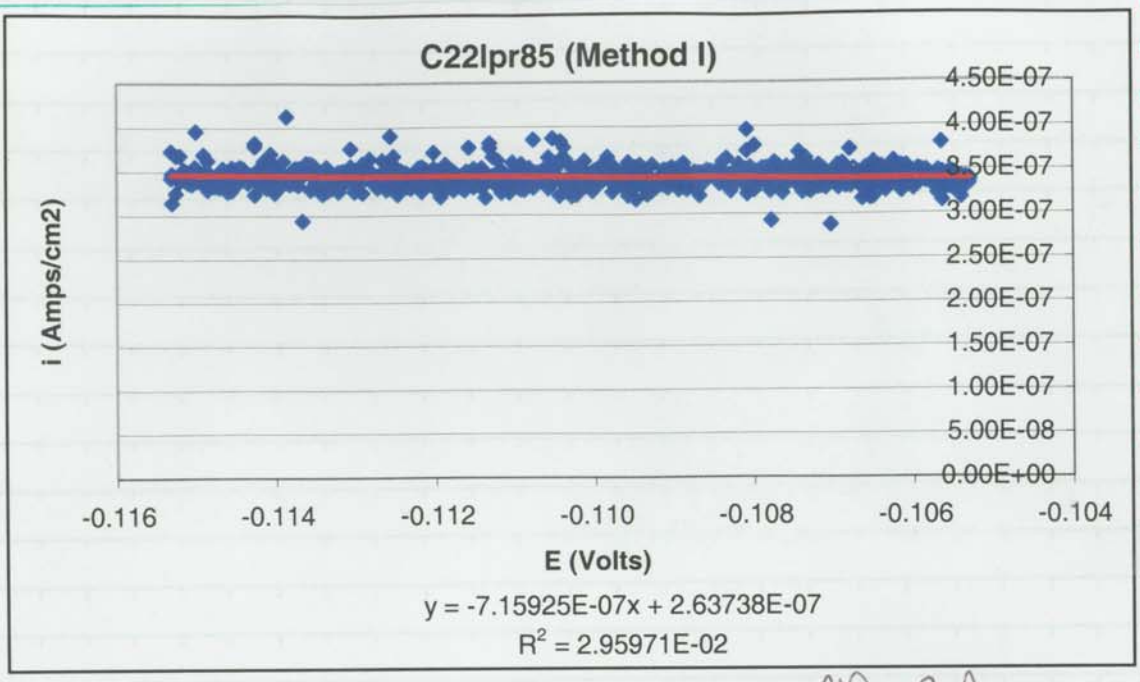
Witnessed & Understood by me, | Date | Invented by | Date

Recorded by John Best | 8/6/02

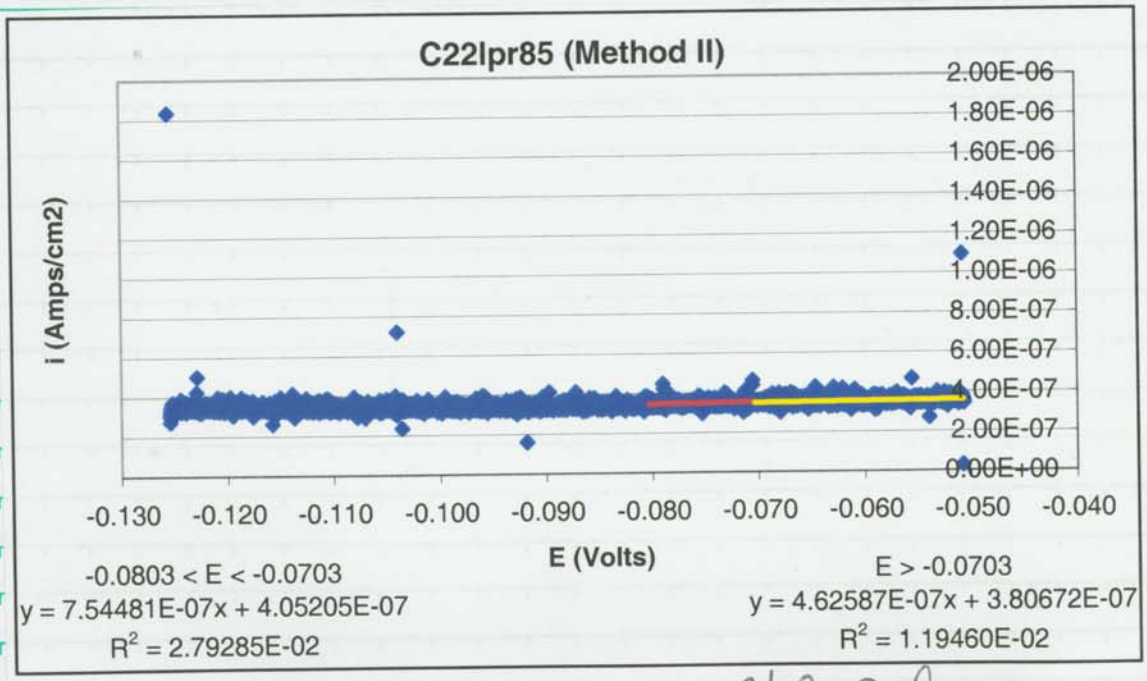
TITLE

From Page No. | Polarization Resistance Test for Alloy C-22 (From pg. 72)

Data:



8/6/02



8/6/02

To Page No.

Witnessed & Understood by me,	Date	Invented by	Date
		Recorded by	8/6/02

Project No._____
Book No._____ TITLE _____

From Page No.___

~~Polarization Resistance Test for Alloy C22 (from pg 73)~~ JB 8/1/02
Electrochemical Impedance Test for alloy C22

~~Test: C22tpr25~~ JB 8/1/02 Objective: same as pg 7

Specimen: C-22 Heat: 22 77.8-3175 Thermally ~~Aged~~ JB 8/1/02 Aged @ 870C for 4 hours.
Polished to a 600 grit finish, same specimen as pg 48

start wt: 11.93949g Santorius Genius S/N 17801055 cal 6/4/02 due: 12/4/02
End wt: 11.93943g

Solution: 0.028M NaCl
3.296g NaCl Lot: 020814
+DI H_2O up to 2000ml

pH start: 5.542 Orion 720 A S/N 005885 cal: 7/10/02 due: 7/10/03
pH End 6.108 pH Probe #13-620-296 S/N 1100288

cell info: Area: 8 cm^2
density: 8.69 g/cm^3
Equivalent: 26.09

Impedance Analyzer: Solartron 1260

Counter Electrode: Pt flag
Fisher QQ 4/3/03

Reference: ~~Fisher~~ 13-620-52 S/N 005132

Temperature: 80°C Hg Thermometer S/N H98-182 cal 4/22/02 due: 4/22/03

E_{corr}: -319mV Keithley 614 S/N 704936 cal 5/26/02 due: 5/26/03

E_{AE}: 127.5mV

Solution Deaerated with 99.999% N_2

Specimen Examination: No staining on surface. No visable signs of corrosion on Specimen

Continued on pg 75

To Page No._____

Witnessed & Understood by me,	Date	Invented by	Date
		Recorded by Allen Bosch	8/1/02

Project No._____
TITLE _____ Book No._____

From Page No.___

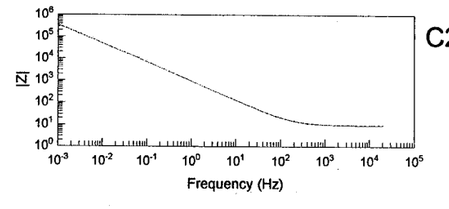
JB 8/1/02 ~~Polarization Resistance Test for Alloy C-22~~ (from pg 74)
JB 8/1/02 Electrochemical Impedance Test for Alloy C-22

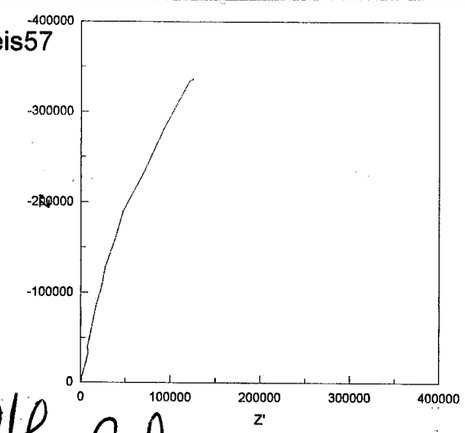
~~Data~~ Test: C22eis77

JB 8/1/02 ~~Scan~~: Initial Frequency: 20000 Hz
Final Frequency: 0.001 Hz
JB 8/1/02 ~~Scan Points~~:
10 steps per decade

Integration Time: 5 seconds
Delay: 2 seconds

Data: JB 8/1/02 ~~Data~~ C22eis77





Allen Bosch 8/6/02

continued on pg 76

To Page No._____

Witnessed & Understood by me,	Date	Invented by	Date
		Recorded by Allen Bosch	8/6/02

Project No.
Book No. TITLE

From Page No. | Electrochemical Impedance Test for Alloy C-22 (from pg. 75)

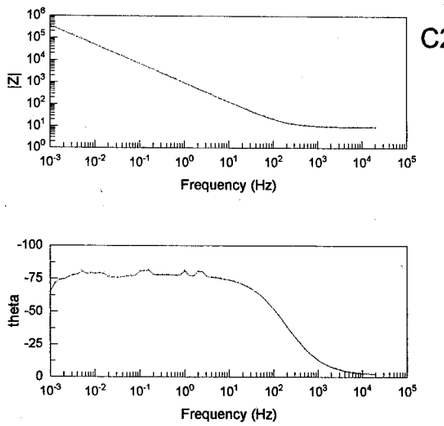
Test: C22eis78

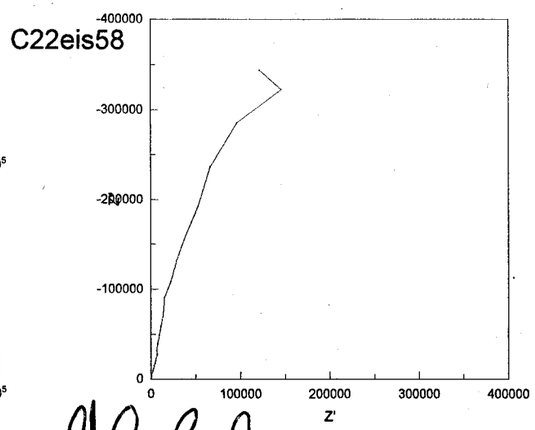
Initial Frequency: 20000Hz
Final Frequency: 0.001 Hz

10 steps per decade

Integration time: 5seconds
Delay: 2seconds

Date: C22eis78





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Witnessed & Understood by me, | Date | Invented by | Date
Recorded by | 8/6/02

Project No.
TITLE Book No.

From Page No. | Electrochemical Impedance Test for Alloy C-22 (from pg. 76)

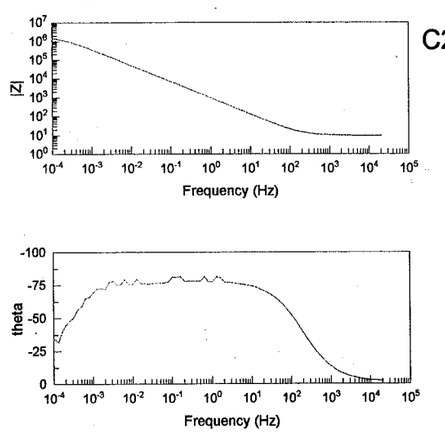
Test C22eis79

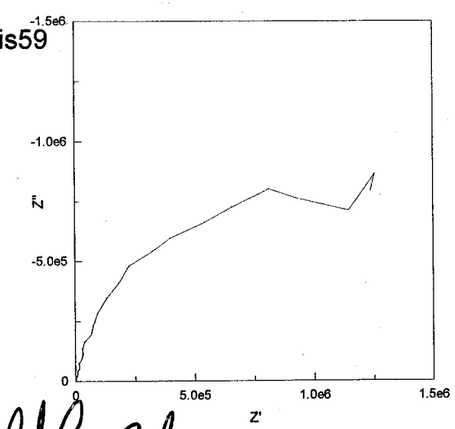
Initial Frequency: 20000Hz
Final Frequency: 0.0001 Hz

10 steps per decade.

Integration time: 5 seconds
Delay: 2 seconds

Date: C22eis79





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To Page No.

Witnessed & Understood by me, | Date | Invented by | Date
Recorded by | 8/6/02

From Page No.

Polarization Resistance Test For Alloy 22

Objective: same as pg. 1

Specimen: C-22 Heat: 2277-8-3175 Thermally Aged at 850°C for 4 hours
Polished to a 600 grit finish. same test specimen as pg. 46
start wt: 11.93949 g Sartorius gram 5/N 12809059 cal 6/4/02
End wt: 11.93943 g due 12/4/02

Solution: 0.028M NaCl
3.296 g NaCl Lot: 020814
+DI H_2O up to 2000ml

pH start: 5.552 Orion 720A s/N 205885 cal 7/10/02 - due 7/10/03
pH End: 6.108 pH probe # 13620-246 s/N 1100208

Potentiostat: Solartron 1287

Counter electrode: Pt flag

Reference: Fisher 13-620-52 S/N 005 2132

Temperature: 60°C Hg Thermometer S/N H98-162 cal 4/22/02 due 4/22/03

E_{corr}: -314 mV Keithley 614 S/N 704936 cal 5/6/02 Due: 5/6/03
E_{pp}: 23.7 mV

Solution Deaerated with 99.999% N_2

Specimen Examination: No staining on Specimen - No Signs of Visable Corrosion on Specimen

continued on pg. 79

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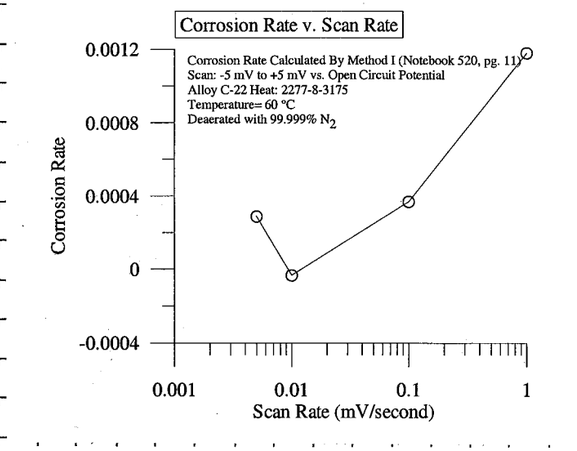
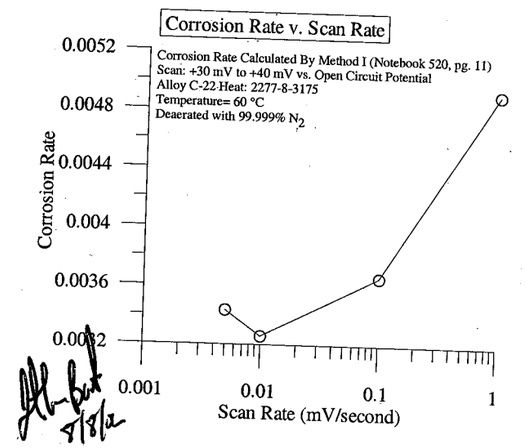
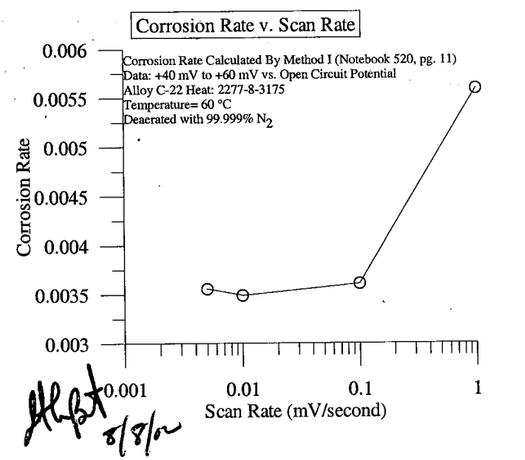
Witnessed & Understood by me,	Date	Invented by	Date
		Recorded by	8/6/02

From Page No. Polarization Resistance Test For Alloy 22 (From pg 78)





8/8/02



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continued on pg. 80

To Page No.

Witnessed & Understood by me,	Date	Invented by	Date
		Recorded by	8/8/02

Project No.

Book No. TITLE

From Page No. | Polarization Resistance Test for Alloy 22 (from pg. 78)

Test: C22lpr86

Scan: -15 mV to +60 mV vs. open circuit potential

Scan Rate: 1 mV/second

E_{corr}: 0.0751 V vs. SCE

Results: Method I (see formulas in Notebook 520, pg. 11)

$(\Delta E/\Delta I)_{E_{corr}}$ = 2.31172×10^{-2}

R_p = 4.3258×10^{5} $\Omega \cdot cm^2$

i_{corr} = 1.2039×10^{-7} A/cm^2

C.R. = 0.00118 mm/yr

Method II (see formulas in Notebook 520, pg. 11)

A. For Data: +30 mV to +40 mV vs. open circuit potential
(0.1051 < E < 0.1151)

b = 3.49454×10^{-7}

m = 2.02754×10^{-6}

i_{corr} = 5.01752×10^{-7} A/cm^2

C.R. = 0.00492 mm/yr

B. For Data: +40 mV to +60 mV vs open circuit potential
(E > 0.1151)

b = 5.34823×10^{-7}

m = 4.91354×10^{-7}

i_{corr} = ~~5.70~~ 8/6/02 5.70924×10^{-7} A/cm^2

C.R. = 0.00559 mm/yr

Data: C22lpr86 (Method I) pg. 81
C22lpr86 (Method II) pg. 81

continued on pg. 81

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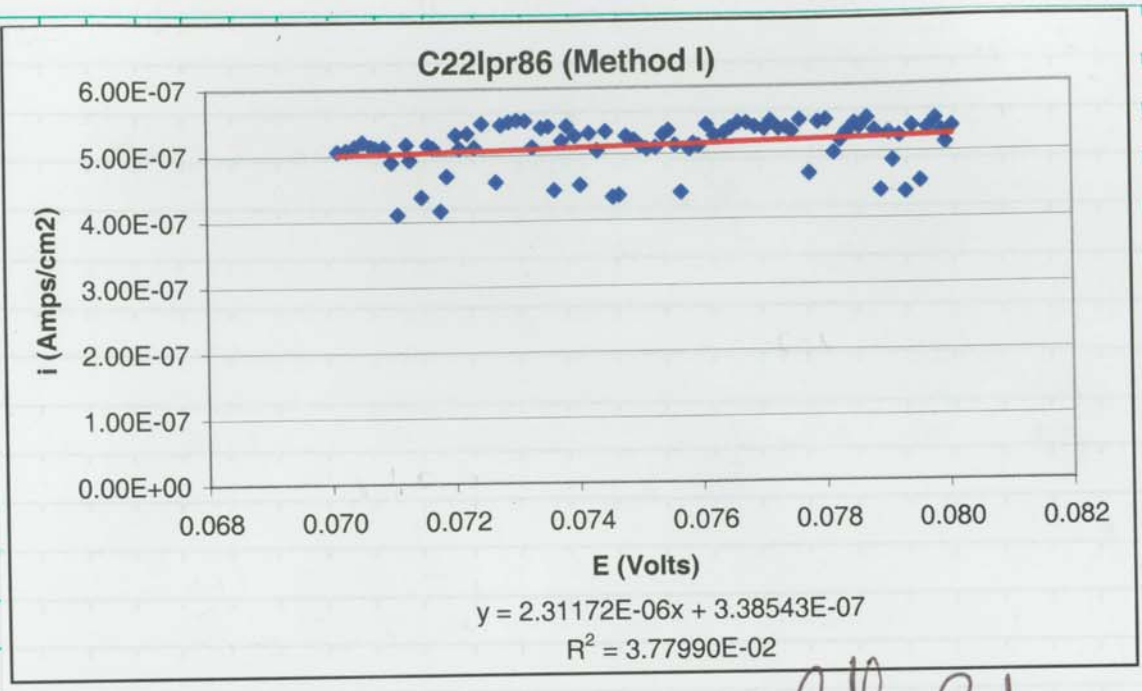
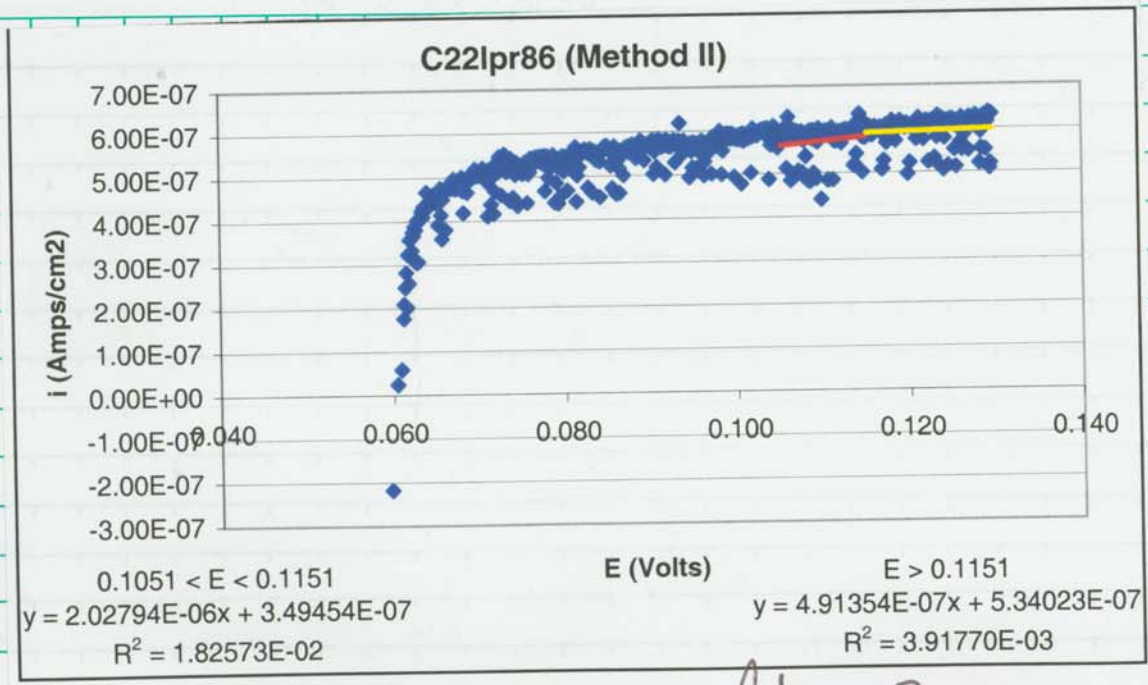
Witnessed & Understood by me,	Date	Invented by	Date
		Recorded by [signature]	8/6/02

From Page No. Polarization Resistance Test for Alloy 22 (from pg. 88)

Data:



8/6/02



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continued pg. 82

To Page No.

Witnessed & Understood by me,	Date	Invented by	Date
		Recorded by	8/6/02

Project No.

Book No. TITLE

From Page No. Polarization Resistance test for Alloy 22 (from pg 81)

Test: C22 Spec 87

Scan: -15mV to +60mV vs. open Circuit Potential

Scan Rate: 0.1 mV/second

E_{corr} = 0.0807 V vs. SCE

Results: Method I (See Formulas in Notebook 520, pg 11)

$(\partial E/\partial I)_{E_{corr}}$ = 7.21921×10^{-7}

R_p = 1.3852×10^{6}

i_{corr} = 3.7598×10^{-8} A/cm²

C.R. = 0.000368 mm/yr

Method II (See Formulas in Notebook 520, pg 11)

A. For Data: +30mV to +40mV vs. open circuit potential
(0.1107 < E < 0.1207)

b = 3.41328×10^{-7} 4/3/03

m = 3.99250×10^{-7} ~~3.99250×10^{-7}~~

i_{corr} = 3.73547×10^{-7} A/cm²

C.R. = 0.00366 ~~$\times 10^{-3}$~~ 8/6/02 mm/yr

B. For Data: +40mV to +60mV vs open circuit potential
(E > 0.1207)

b = 3.24353×10^{-7}

m = 5.44036×10^{-7}

i_{corr} = 3.68257×10^{-7}

C.R. = 0.00361 mm/yr

Data: C22 Spec 87 (Method I) pg 83

C22 Spec 87 (Method II) pg 83

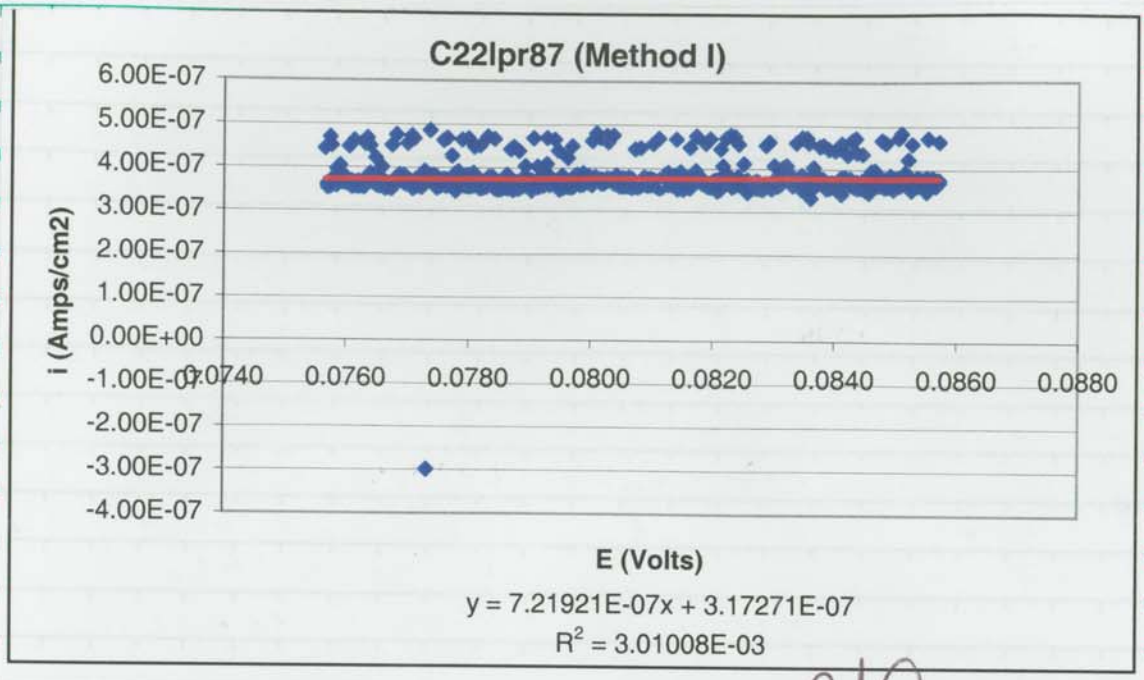
continued on pg 83

To Page No.

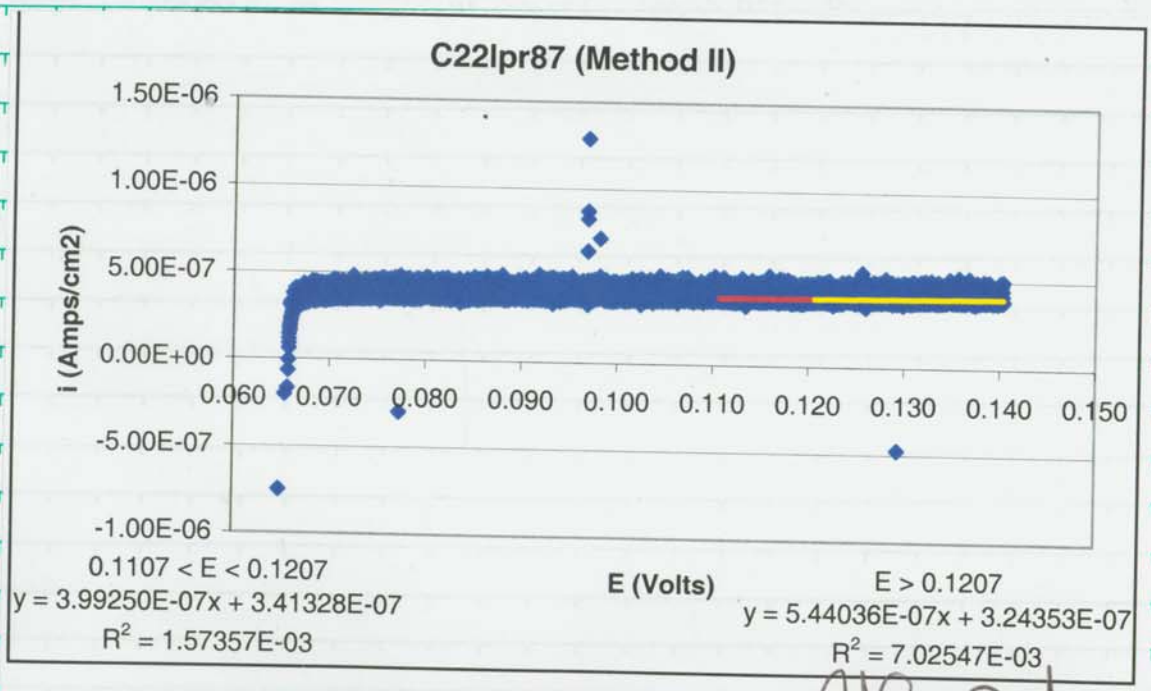
Witnessed & Understood by me,	Date	Invented by	Date
		Recorded by	8/6/02

From Page No. Polarization Resistance Test for Alloy 22 (from pg. 82)

Data:



John Boot 8/6/02



John Boot 8/6/02

continued on pg. 84

To Page No.

Witnessed & Understood by me, | Date | Invented by | Date

Recorded by John Boot 8/6/02

Project No._____
Book No._____ TITLE _____

From Page No.___ | Polarization Resistance Test for Alloy 22 (from pg. 83)

Test: C22lpr88

Scan: -15 mV to +60 mV vs. open circuit potential

Scan Rate: 0.01 mV/second

E_{corr}: 0.0840V vs. SCE

Results: Method I (see formulas in Notebook 520, pg. 11)

$(\Delta E/\Delta i)_{E_{corr}} = -6.52494 \times 10^{-8}$

$R_p = -1.5326 \times 10^{7}\ \Omega \cdot cm^2$

$i_{corr} = -3.3982 \times 10^{-9}\ A/cm^2$

C.R. = -0.0000333 mm/yr

Method II (see formulas in Notebook 520, pg 11)

A. For Data: +30 mV to +40 mV vs. open circuit potential
(0.1140 < E < 0.1240)

b = ~~8.17460 x 10^{-7}~~ 8/6/02 2.63643 x 10^{-7}

m = ~~2.63693 x 10^{-7}~~ JB 8/6/02 8.17460 x 10^{-7}

i_{corr} = ~~8.17460 x 10~~ JB 8/6/02 3.3231 x 10^{-7} A/cm^2

C.R. = 0.00326 mm/yr

B. For Data +40 mV to +60 mV vs open circuit potential
(E > 0.1240)

b = 3.4158 x 10^{-7}

m = 1.71335 x 10^{-7}

i_{corr} = ~~0.00326~~ JB 8/6/02 3.55976 x 10^{-7} A/cm^2

C.R. = 0.00349 mm/yr

Data: C22lpr88 (Method I) pg. 85
C22lpr88 (Method II) pg. 85

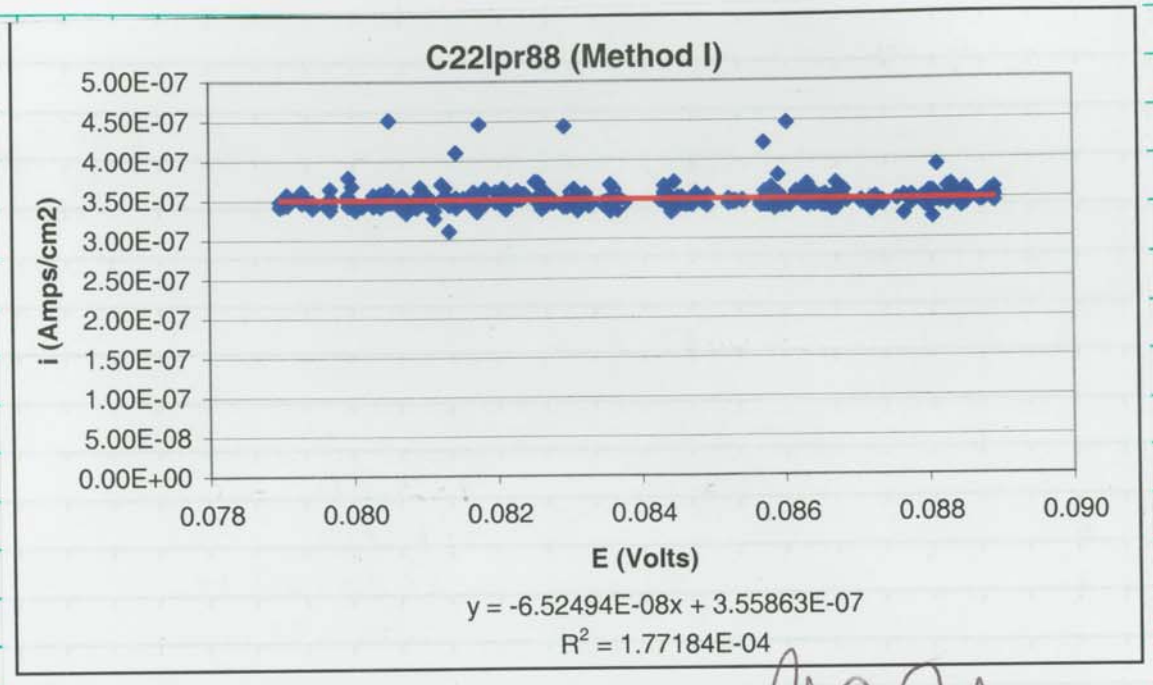
continued on pg. 85

To Page No._____

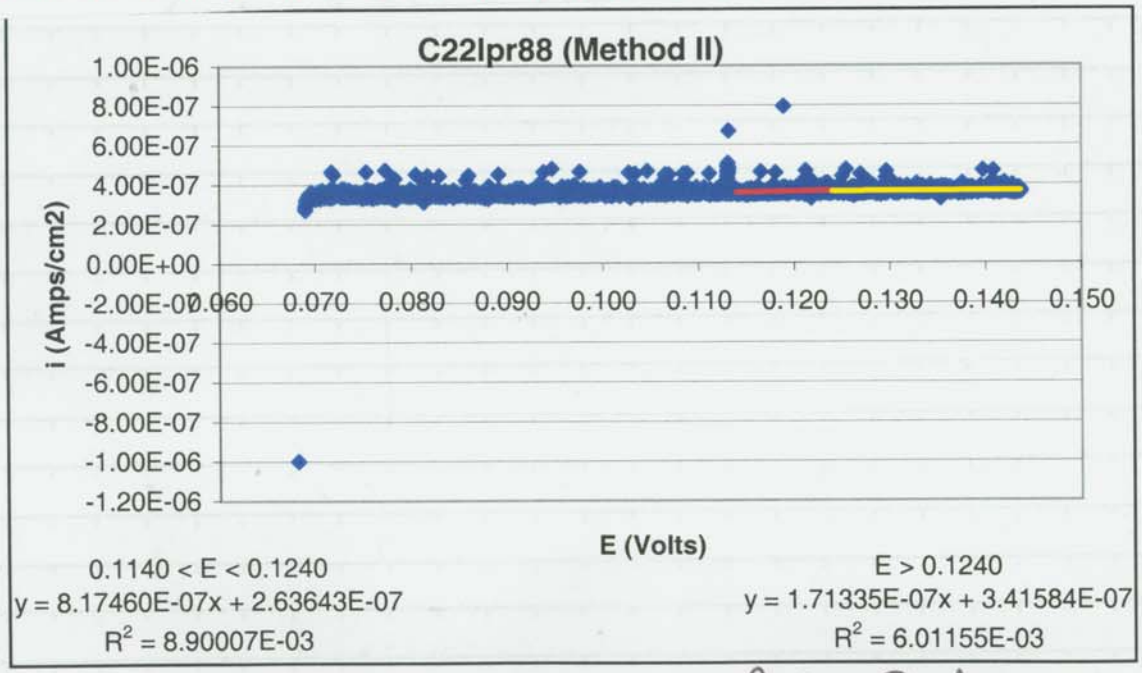
Witnessed & Understood by me,	Date	Invented by	Date
		Recorded by J. Christian Bart	8/6/02

From Page No. Polarization Resistance Test for Alloy 22 (from pg. 84)

Data:



8/6/02



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continued on pg. 86

To Page No.

Witnessed & Understood by me, Date

Invented by Date

Recorded by 10/8/02

Project No._____
Book No._____ TITLE Polarization Resistance Test Cu Alloy 22 (From pg. 85)

From Page No.____

Test: C22 Run 89

Scan: -15mV to +60mV vs. open circuit potential

Scan Rate: 0.005 mV/second

E_{corr} = 0.0881 V vs. SCE

Results: Method I (see formulas in Notebook 520, pg. 11)

$(\partial E/\partial I)_{E_{corr}}$ = ~~2.~~ JB 8/6/02 5.63600 x 10^{3}

R_p = 1.7743 x 10^{6} $\Omega \cdot cm^2$

i_{corr} = 2.9352 x 10^{-8} A/cm^2

CR = 0.000288 mm/yr

Method II (see formulas in Notebook 520, pg. 11)

A. For Data: +30mV to +40mV vs. open circuit potential
(0.1181 < E < 0.1281)

b = 3.13740 x 10^{-7}

m = 4.15513 x 10^{-7}

i_{corr} = JB 8/6/02 3.38247 x 10^{-7} A/cm^2

C.R = 0.00343 mm/yr

B. For Data: +40mV to +60mV vs. open circuit potential
(E > 0.1281)

b = 3.56105 x 10^{-7}

m = 7.8064 x 10^{-8}

i_{corr} = 3.62983 x 10^{-7}

C.R = 0.00356 mm/yr

Data: C22 Run 89 (Method I) pg. 87
C22 Run 89 (Method II) pg 87

continuation pg. 87

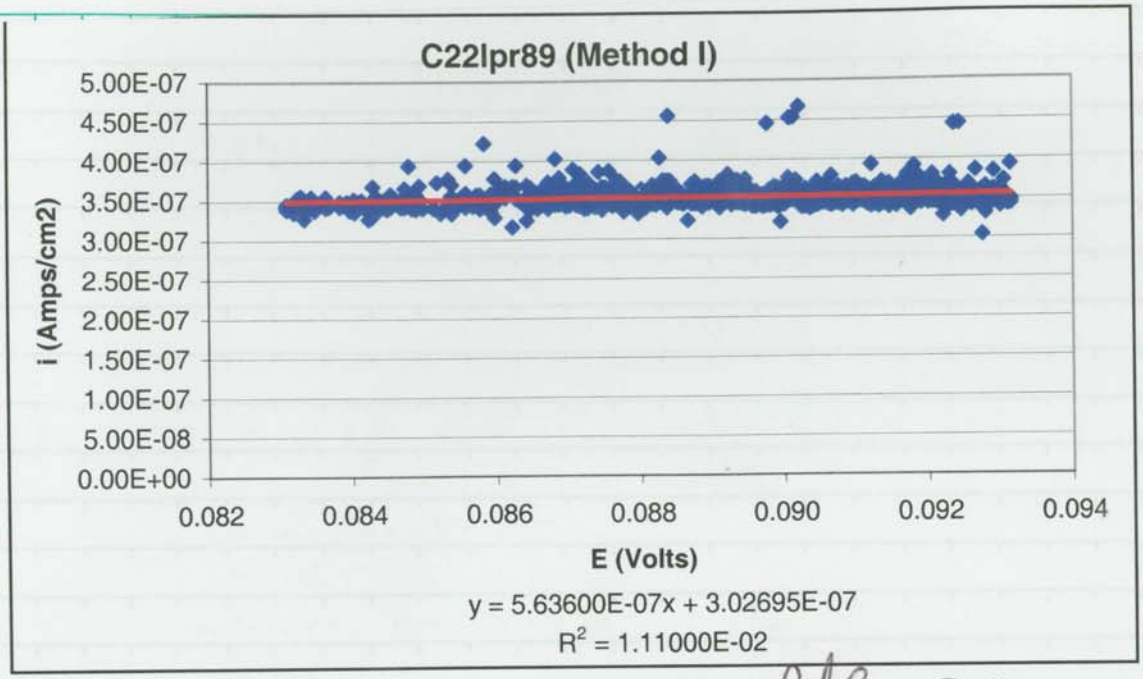
To Page No.____

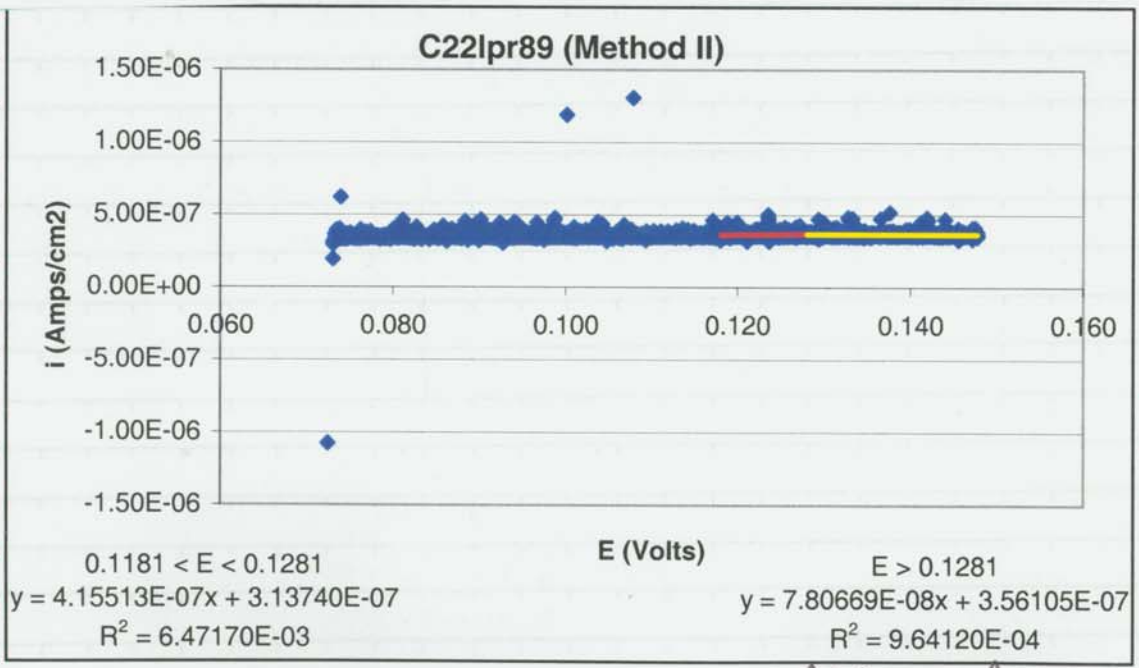
Witnessed & Understood by me, | Date | Invented by | Date

Recorded by JB 8/6/02

From Page No. Polarization Resistance Test for Alloy 22 (From pg. 86)

Data





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continued on pg. 88

To Page No.

Witnessed & Understood by me,	Date	Invented by	Date
		Recorded by	8/6/12

From Page No.___ | Polarization Resistance Test for Alloy C22 (from pg 87)

Test: C22 lpr 90

Scan: -15mV to +60 mV vs. open circuit potential

Scan Rate: 0.001 mV/second

E_{corr} = 0.0915 V vs. SCE

Results: Method I (see formulas in Notebook 520, pg. 11)

$(\Delta E/\Delta I)_{corr}$ = 1.26210 X 10^{-8}

R_p = 7.97233 X 10^{7} $\Omega \cdot cm^2$

i_{corr} = 6.57 X 10^{-10} A/cm^2

C.R. = 0.00000 644 mm/yr

Method II (see formulas in Notebook 520 pg. 11)

A. For Data: +30mV to +40mV vs. open circuit potential

(0.1215 < E < 0.1315)

b = 2.911 48 X 10^{-7}

m = 9.06623 X 10^{-7}

i_{corr} = 3.24104 X 10^{-7} A/cm^2

C.R. = 0.00318 mm/yr

B. For Data +40mV to +60mV vs. open circuit potential

(E > 0.1315)

b = 2.90263 X 10^{-7}

m = 4.89318 X 10^{-7}

i_{corr} = 3.35043 X 10^{-7}

C.R. = 0.06328 mm/yr

Data: C22 lpr 90 (Method I) pg. 87

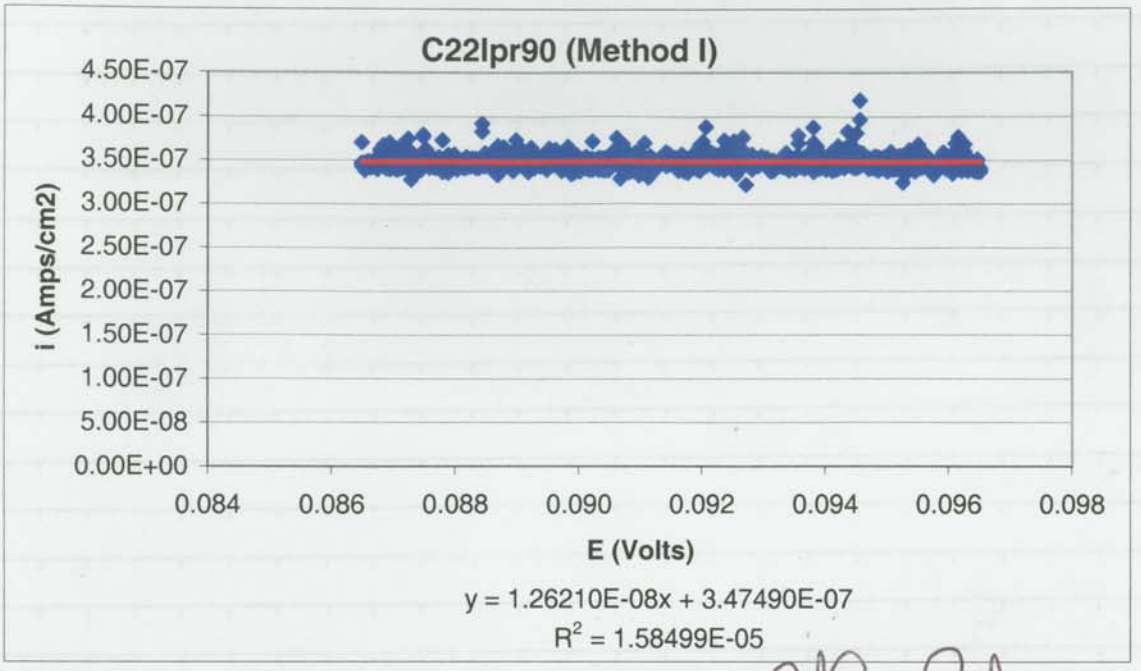
C22 lpr 90 (Method II) pg. 87 JB 8/6/02

continuation pg. 89

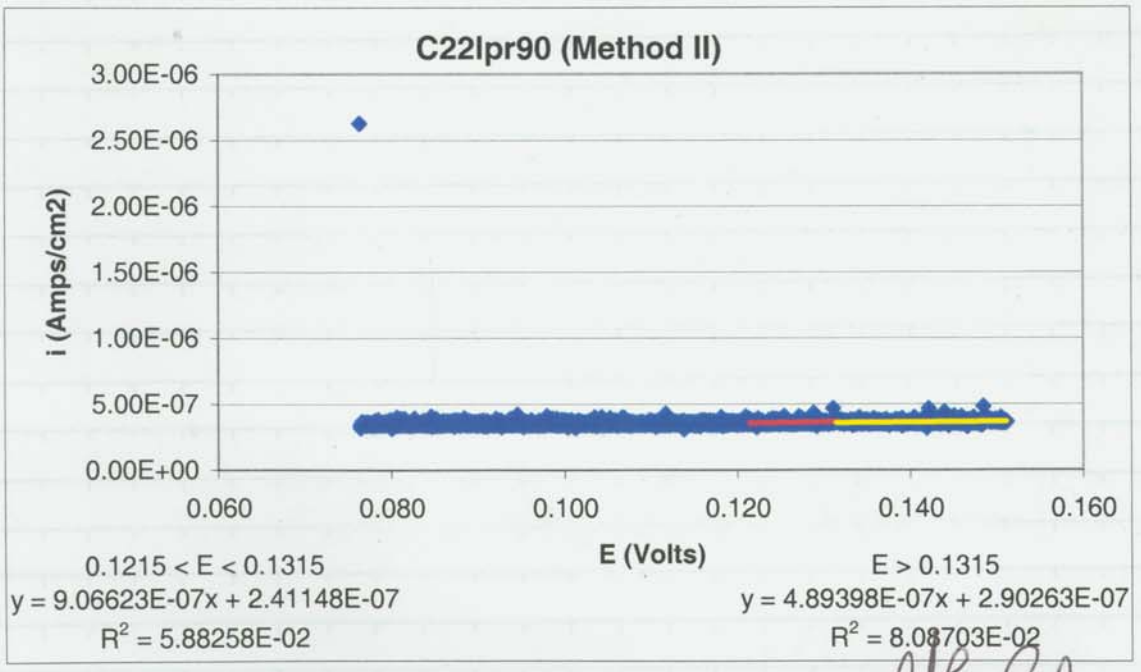
To Page No._____

Witnessed & Understood by me,	Date	Invented by	Date
		Recorded by	8/6/02

From Page No. Polarization Resistance Test for Alloy C22 (from pg. 88)



8/8/02



8/8/02

To Page No.

Witnessed & Understood by me,	Date	Invented by	Date
		Recorded by	8/8/02

Project No._____
Book No._____ TITLE Electrochemical Impedance Test For Alloy 22

From Page No.____

objective: same as pg. 2

Specimen: Alloy C-22 Heat: 2277-8-3175 Thermally aged @ 870°C for 4 hours; polished to a 600 grit finish; same test specimens pg. 46

start wt: 11.93945 g Santorius Genius S/N 12889099 cal 6/4/02
End wt: 11.93943 g due 12/4/02

Solution: 0.028 M NaCl
3.296 g NaCl LA 020814
+ DI H_2O up to 2000 ml
pH start: 5.542 Orion 720A S/N 805885 cal: 7/10/02 due 7/10/03
pH End: 6.108 pH probe #13-620-296 S/N 1100208

Cell Info: Area: 8 cm^2
Density: 8.69 g/cm^2
Equivalents: 26.04

Impedance Analyzer: Solartron 1260

Counter Electrode: Pt Flag

Reference: Fisher 13-620-52 S/N 805283 2

Temperature: 60°C Hg Thermometer S/N H98-162 cal 4/22/02 due: 4/22/03

E_{corr}: -319 mV Keithley 614 S/N 704936 cal 5/28/02 due: 5/26/03

E_{PRE}: 127.3 mV

Solution Deaerated with 99.999% N_2

Specimen Examination: No staining or Specimen: No visable signs of corrosion on specimen

continued on pg. 91

To Page No.____

Witnessed & Understood by me, | Date | Invented by | Date 8/6/02
Recorded by

Project No._____
TITLE _____ Book No._____

From Page No.____ Electrochemical Impedance Test For Alloy 22 (Cont. pg. 90)

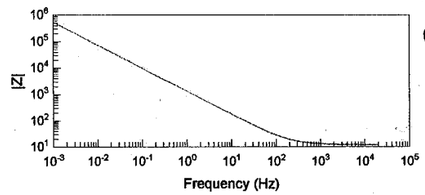
Test: C22eis60

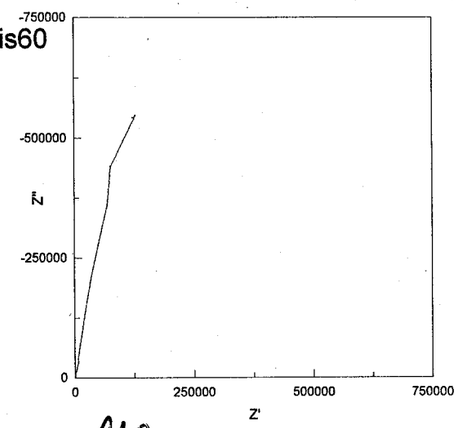
Initial Frequency: 20000 Hz
Final Frequency: 0.001 Hz

10 steps per Decade

Integration time: 5 seconds
Delay: 2 seconds

Data: C22eis60





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continued on pg. 92

To Page No.____

Witnessed & Understood by me, | Date | Invented by | Date 8/7/02
Recorded by

From Page No. | Electrochemical Impedance Test for Alloy 22 (From pg. 91)

B 8/6/02
~~Object 2e:~~

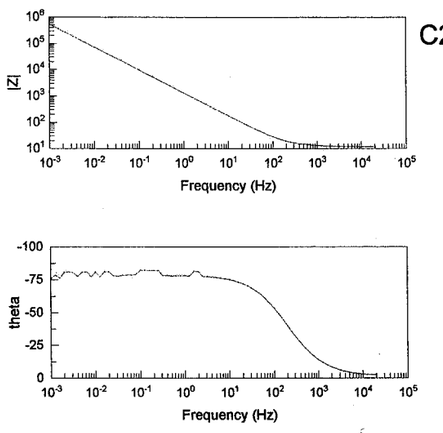
Test: C22e3 61

Initial Freqwy: 2.0000Hz
Final Freqwy: 0.001Hz

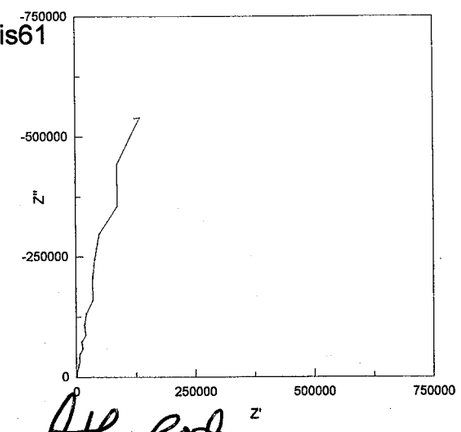
10 steps per decade

Integration time 5 seconds
Delay: 2 seconds

Data: C22e3 61



C22eis61



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		Recorded by John Bost	8/7/02

From Page No. | Electrochemical Impedance Test for Alloy 22 (From pg. 92)

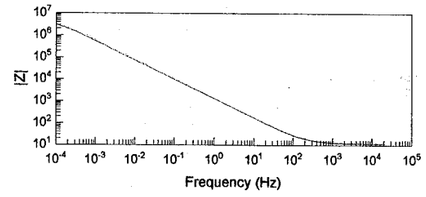
Test: C22e3 62

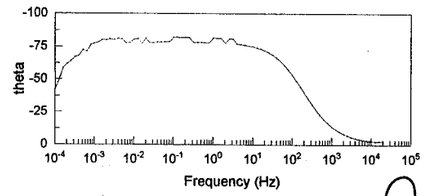
Initial Freqwy: 20000Hz
Final Freqwy: 0.0001Hz

10 steps per decade

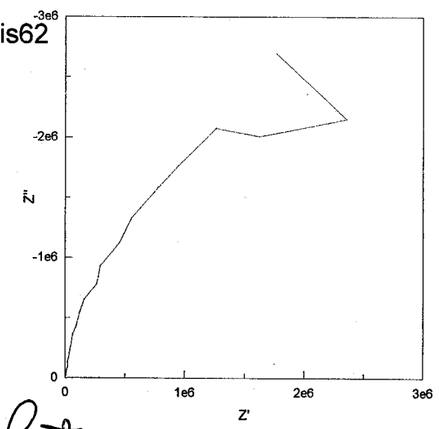
Integration time 5 seconds
Delay: 2 seconds

Data: C22e3 62





C22eis62



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		Recorded by	8/8/02

Project No._____

TITLE _____ Book No._____

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		Recorded by	8/8/02

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Continued Testing in Notebook 541

I have reviewed this scientific notebook and find it in compliance with QAP-001. There is sufficient information regarding procedures used for conducting tests, acquiring and analyzing data so that another qualified individual could repeat the activity.

4/3/03

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		Recorded by	8/8/02