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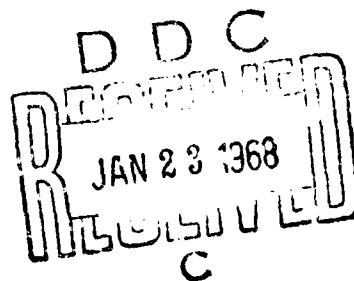
**School of Engineering**  
**AIR FORCE INSTITUTE OF TECHNOLOGY**  
**Air University**

ANODIC POLARIZATION BEHAVIOR OF NICKEL 270  
IN  $H_2$ -SATURATED, IN  $H_2SO_4$

by

JAMES R. MYERS

Technical Report 67-6



**Wright-Patterson Air Force Base, Ohio**

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Technical Report 67-6

1967

ANODIC POLARIZATION BEHAVIOR OF NICKEL 270

IN  $H_2$ -SATURATED, IN  $H_2SO_4$

by

JAMES R. MYERS

Associate Professor

Department of Mechanics

Air Force Institute of Technology

Wright-Patterson Air Force Base, Ohio

ANODIC POLARIZATION BEHAVIOR OF NICKEL 270  
IN H<sub>2</sub>-SATURATED, 1N H<sub>2</sub>SO<sub>4</sub>\*

Compiled By

J. R. Myers  
Corrosion Research Laboratory  
Air Force Institute of Technology  
Wright-Patterson AFB, Ohio 45433



\*Results of a round-robin test program conducted by National Association of Corrosion Engineers Technical Committee T-3L for Anodic Protection.

## Background

At the March 1965 meeting of National Association of Corrosion Engineers (N.A.C.E.) Technical Committee T-3L for Anodic Protection a large number of attendees expressed an interest in participating in a round-robin potentiostatic anodic polarization test program. Since a large amount of data have been reported in the technical literature on the anodic behavior of nickel in sulfuric acid solutions, it was decided that the T-3L Program should consist of conducting a potentiostatic anodic polarization curve for pure nickel in hydrogen-saturated, 1N  $\text{H}_2\text{SO}_4$  at 25°C using the experimental technique usually used in each participant's laboratory. Each participant was requested to submit a potentiostatic anodic polarization curve and supplemental data which were to include values for: (1) corrosion potential ( $E_{\text{corr}}$ ), (2) cathode potential, (3) critical current density ( $i_{\text{cr}}$ ), (4) critical potential ( $E_{\text{cr}}$ ), (5) passive current density ( $i_{\text{p}}$ ), and (6) Tafel slopes for anodic dissolution and transpassive behavior. All data were to be reported in accordance with the generalized potentiostatic anodic polarization curve (Figure 1) which was tentatively agreed upon at the March 1965 T-3L Committee Meeting.

Since it is well known that experimental procedure can strongly affect the potentiostatic anodic polarization curve, it was anticipated that widely different results would be reported. However, it was believed that the completion of such a round-robin test program would permit a more meaningful comparison of the data reported by various investigators and focus attention to the need for a standardized technique for conducting potentiostatic anodic polarization studies.

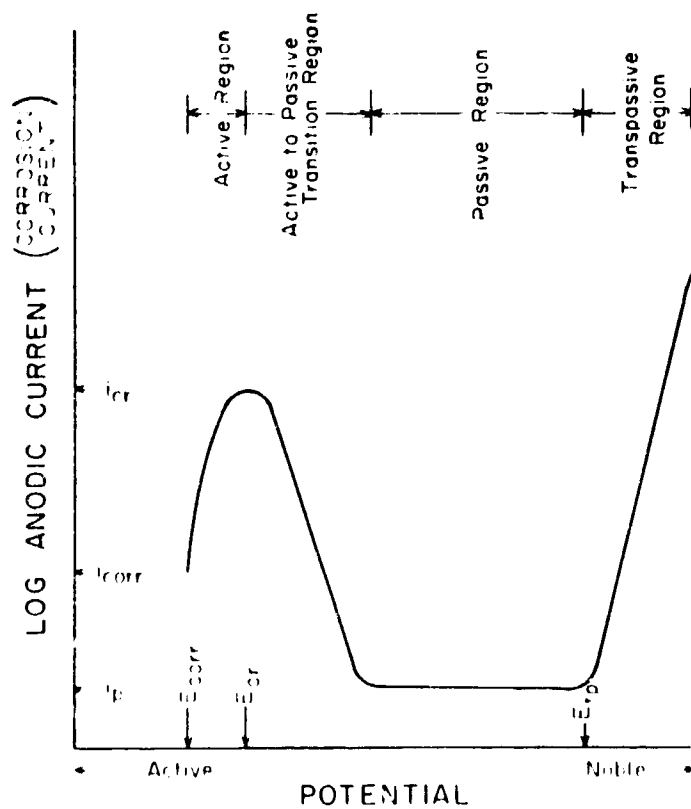


Figure 1 - Generalized Potentiostatic Anodic Polarization Curve Tentatively Agreed upon at March 1965 T-3L Meeting.

Subsequent to the 1965 T-3L Committee Meeting, specimens of pure nickel (Nickel 270) were provided the twenty-five investigators expressing a desire to actively participate in the round-robin test program. Of these twenty-five participants, fifteen (Table I) submitted results. These data were collected and compiled at the AFIT Corrosion Research Laboratory.

Table I  
Participants in T-3L Round-Robin Test Program

| Investigator                  | Affiliation                                   |
|-------------------------------|-----------------------------------------------|
| James R. Myers                | Air Force Institute of Technology             |
| Richard L. Martin             | Monsanto Company                              |
| Olen L. Riggs                 | Continental Oil Company                       |
| Howard A. Porte               | U. S. Naval Civil Engineering Laboratory      |
| R. F. Steigerwald             | E. I. du Pont de Nemours & Company            |
| Howard Vaeth                  | Republic Steel Corporation                    |
| John D. Hatfield              | TVA National Fertilizer Development Center    |
| George Economy & G. A. DiBari | The International Nickel Company, Inc.        |
| Edward L. Wiehe               | Jones & Laughlin Steel Corporation            |
| G. A. Saltzman                | Crucible Steel Company of America             |
| C. E. Locke                   | Continental Oil Company                       |
| Monte S. Walker               | General Motors Technical Center               |
| G. J. Biefer                  | Mines Branch of Canada                        |
| Inq. M. Prazak CSc.           | State Institute for Material (Czechoslovakia) |
| James W. Johnson              | University of Missouri at Rolla               |

#### Test Material

Because of the large number of investigators expressing an interest in participating in the T-3L test program, it was necessary to use Nickel 270 rod (furnished by The International Nickel Company) from two different heats. Since the test materials were produced using the same mill practice and had nearly the same chemistry (Table II), it was not expected that this possible variable would affect the anodic polarization curve. This was verified by tests conducted in the AFIT Corrosion Research Laboratory (see results reported by J. R. Myers in Appendix A).

Table II  
Chemical Analysis of Nickel 270 Used in T-3L Round-Robin  
Test Program (values expressed in weight percent)

| Heat     | C     | Mn     | Fe     | S      | Si     | Cu     | Cr     | Co     |
|----------|-------|--------|--------|--------|--------|--------|--------|--------|
| NP-327-H | 0.002 | <0.001 | 0.0006 | 0.001  | 0.0005 | <0.001 | 0.0001 | 0.0004 |
| NP-385-H | 0.006 | <0.001 | 0.0005 | <0.001 | 0.0007 | <0.001 | 0.0001 | 0.0003 |

## Results

Anodic polarization data were submitted by the fifteen active participants of the T-3L Round-Robin Test Program. Of these fifteen: (1) eleven conducted their studies using a potentiostatic technique with  $H_2$ -saturated, 1N  $H_2SO_4$ ; (2) two used a potentiostatic technique with  $N_2$ -saturated, 1N  $H_2SO_4$ ; (3) one used a potentiostatic technique with air-saturated, 1N  $H_2SO_4$ ; (4) one used a potentiostatic technique with 1N  $H_2SO_4$  containing no saturating gas; and (5) one used a galvanostatic technique with  $H_2$ -saturated, 1N  $H_2SO_4$ . A compilation of the important polarization data reported by the fourteen participants using a potentiostatic technique is given in Tables IIIa and IIIb. (The data sheets and anodic polarization curves submitted by all fifteen investigators are included in Appendix A.) Examination of Tables IIIa and IIIb revealed that the reported polarization data are within the following limits:

|                                       |                                  |
|---------------------------------------|----------------------------------|
| Cathode Potential                     | -0.240 to -0.269 Volt vs. S.C.E. |
| Corrosion Potential ( $E_{corr}$ )    | -0.200 to -0.300 Volt vs. S.C.E. |
| Anodic Dissolution Tafel Slope        | 0.044 to 0.089 Volt/decade       |
| Critical Current Density ( $i_{cr}$ ) | 6.8 to 190 $ma/cm^2$             |
| Critical Potential ( $E_{cr}$ )       | -0.100 to +0.400 Volt vs. S.C.E. |
| Passive Current Density ( $i_p$ )     | 0.0022 to 0.3 $ma/cm^2$          |
| Early Transpassive Tafel Slope        | 0.040 to 0.185 Volt/decade       |
| Oxygen Evolution Tafel Slope          | 0.08 to 0.485 Volt/decade        |

## Conclusions

It has been established that experimental technique strongly affects the potentiostatic anodic polarization data for Nickel 270 in 1N  $H_2SO_4$ . However, as a result of this round-robin test program, it should be possible for the active participants to more meaningfully compare future data.

## Recommendations

It is recommended that a statistical study be made (by an appointed committee) of the data contained in this report to quantitatively evaluate the effect of experimental technique on the potentiostatic anodic polarization curve.

Table IIIa

Comparison of Data Reported by Various Investigators for  
Potentiostatic Anodic Polarization Behavior of Nickel 270 in 1N H<sub>2</sub>SO<sub>4</sub>.

| Investigator     | Specimen Heat No. | Sat. Gas       | Polarization Technique | Cathode Potential, Volt vs. S.C.E. | Corrosion Potential (E <sub>corr</sub> ), Volt vs. S.C.E. | Anodic Dissolution Tafel Slope, volt/decade | Critical Current Density (i <sub>cr</sub> ), ma/cm <sup>2</sup> |
|------------------|-------------------|----------------|------------------------|------------------------------------|-----------------------------------------------------------|---------------------------------------------|-----------------------------------------------------------------|
| Myers            | NP-385-H          | H <sub>2</sub> | Stepwise               | -0.269                             | -0.280                                                    | 0.050 to 0.070                              | 51                                                              |
|                  | NP-327-H          | H <sub>2</sub> | Stepwise               | -0.266                             | -0.271                                                    | 0.060 to 0.080                              | 67                                                              |
| Martin           | NP-385-H          | H <sub>2</sub> | Scan (- to +)          | -0.267                             | -0.293                                                    | 0.050                                       | 190                                                             |
|                  | NP-385-H          | H <sub>2</sub> | Scan (+ to -)          | -0.267                             | -0.300                                                    | 0.080                                       | 38.12                                                           |
| Riggs            | NP-385-H          | H <sub>2</sub> | Scan                   | -0.245                             | -0.263                                                    | -                                           | 60                                                              |
|                  | NP-385-H          | H <sub>2</sub> | Stepwise               | -0.245                             | -0.263                                                    | 0.054                                       | 29                                                              |
| Porte            | NP-327-H          | H <sub>2</sub> | Scan                   | -                                  | -0.263                                                    | -                                           | -                                                               |
| Steigerwald      | NP-385-H          | H <sub>2</sub> | Stepwise               | -0.263                             | -0.262                                                    | 0.05                                        | 8.37                                                            |
| Vaeth            | NP-327-H          | H <sub>2</sub> | Stepwise               | -                                  | -0.260                                                    | 0.089                                       | 140                                                             |
| Hatfield         | NP-327-H          | H <sub>2</sub> | Scan                   | -0.262                             | -0.265                                                    | 0.06                                        | 27                                                              |
| Economy & DiBari | NP-385-H          | H <sub>2</sub> | Stepwise               | -0.253                             | -0.253                                                    | 0.044                                       | 34                                                              |
| Wiene            | NP-385-H          | H <sub>2</sub> | Stepwise               | -0.264                             | -0.200                                                    | -                                           | 140                                                             |
| Saltzman         | NP-327-H          | H <sub>2</sub> | Scan                   | -0.259                             | -0.272                                                    | 0.063                                       | 77.5                                                            |
| Locke            | NP-385-H          | H <sub>2</sub> | Stepwise               | -0.240                             | -0.220                                                    | 0.050                                       | 28                                                              |
| Walker           | NP-385-H          | H <sub>2</sub> | Slow Scan              | -                                  | -0.22                                                     | 0.050                                       | 24                                                              |
|                  | NP-385-H          | H <sub>2</sub> | Fast Scan              | -                                  | -0.22                                                     | Not Linear                                  | 18                                                              |
| Bieffer          | NP-327-H          | H <sub>2</sub> | Scan                   | -                                  | -0.280                                                    | 0.054                                       | 6.8                                                             |
| Prazak           | NP-327-H          | Air            | Scan                   | -                                  | -                                                         | -                                           | 14.5                                                            |

Table IIb  
Comparison of Data Reported by Various Investigators for  
Potentiostatic Anodic Polarization Behavior of Nickel 270 in 1N H<sub>2</sub>SO<sub>4</sub>.

| Investigator     | Specimen Heat No. | Sat. Gas       | Polarization Technique | Critical Potential (E <sub>cr</sub> ), Volt vs. S.C.E. | Passive Current Density (i <sub>p</sub> ), ma/cm <sup>2</sup> | Early Transpassive Tafel Slope, volt/decade | Oxygen Evolution Tafel Slope, volt/decade |
|------------------|-------------------|----------------|------------------------|--------------------------------------------------------|---------------------------------------------------------------|---------------------------------------------|-------------------------------------------|
| Myers            | NP-385-H          | H <sub>2</sub> | Stepwise               | +0.100 (+0.100 to +0.160)                              | 0.019                                                         | 0.14 to 0.15                                | 0.09 to 0.10                              |
| Martin           | NP-327-H          | H <sub>2</sub> | Stepwise               | +0.120 (+0.120 to +0.200)                              | 0.015                                                         | 0.13 to 0.14                                | 0.08 to 0.09                              |
|                  | NP-385-H          | H <sub>2</sub> | Scan (- to +)          | +0.400                                                 | 0.016                                                         | 0.040                                       | -                                         |
|                  | NP-335-H          | H <sub>2</sub> | Scan (+ to -)          | -0.040                                                 | 0.0022                                                        | 0.040                                       | -                                         |
|                  | NP-385-H          | H <sub>2</sub> | Scan                   | +0.250                                                 | 0.30                                                          | -                                           | -                                         |
| Riggs            | NP-385-H          | H <sub>2</sub> | Stepwise               | +0.150                                                 | 0.019                                                         | 0.107                                       | 0.485                                     |
|                  | NP-327-H          | H <sub>2</sub> | Scan                   | -                                                      | -                                                             | -                                           | -                                         |
| Porte            | NP-385-H          | H <sub>2</sub> | Stepwise               | -0.050                                                 | 0.005                                                         | 0.140                                       | -                                         |
| Steigerwald      | NP-327-H          | H <sub>2</sub> | Stepwise               | +0.300                                                 | 0.0198                                                        | 0.182                                       | -                                         |
| Vaeth            | NP-327-H          | H <sub>2</sub> | Scan                   | -0.025                                                 | 0.05 to 0.18                                                  | 0.17                                        | 0.37                                      |
| Hatfield         | NP-327-H          | H <sub>2</sub> | Stepwise               | +0.140 (+0.088 at i <sub>cr</sub> )                    | 0.005                                                         | 0.160                                       | -                                         |
| Economy & Gajari | NP-385-H          | H <sub>2</sub> | Stepwise               | -0.050                                                 | 0.003                                                         | -                                           | -                                         |
| Wiene            | NP-385-H          | H <sub>2</sub> | Scan                   | 0.055                                                  | 0.003                                                         | -                                           | -                                         |
| Saltzman         | NP-327-H          | H <sub>2</sub> | Stepwise               | -0.100                                                 | 0.06                                                          | 0.140                                       | -                                         |
| Locke            | NP-385-H          | None           | Slow Scan              | +0.11                                                  | 0.02 to 0.2                                                   | 0.185                                       | -                                         |
| Walker           | NP-385-H          | H <sub>2</sub> | Fast Scan              | -0.05                                                  | about 0.1                                                     | Not Linear                                  | -                                         |
|                  | NP-327-H          | N <sub>2</sub> | Scan                   | +0.185                                                 | 0.032                                                         | 0.111                                       | -                                         |
| Bieffer          | NP-327-H          | Air            | Scan                   | -0.041                                                 | -                                                             | -                                           | -                                         |
| Prazak           | NP-327-H          | Air            | Scan                   | -                                                      | -                                                             | -                                           | -                                         |

## Appendix A

Data Sheets and Anodic Polarization Curves for the Fifteen  
Active Participants in T-3L Round Robin Test Program.

James R. Myers

Corrosion Research Laboratory

Air Force Institute of Technology

Wright-Patterson AFB, Ohio 45433

T-3L ROUND-ROBIN ANODIC POLARIZATION  
TEST PROGRAM DATA SHEET

- A. Specimen..... Nickel 270 (inP-385-II)
- B. Electrolyte..... 1N H<sub>2</sub>SO<sub>4</sub>
- C. Temperature, °C..... 22 ± 1 °C
- D. Saturating Gas..... Purified Hydrogen
- E. Specimen Preparation.... Ground through 4/0 emery paper, cleaned  
in boiling benzene, and rinsed in distilled water.
- F. Specimen Activation Treatment..... Cathodically activated at -1.5  
volts for 5 minutes.
- G. Reference Electrode..... Saturated Calomel (S.C.E.)
- H. Cathode Potential..... -0.269 volt vs. S.C.E.
- I. Corrosion Potential..... -0.280 volt vs. S.C.E.
- J. Anodic Potential Sweep Rate (if continuous)... 20 mv in active region, 40 mv
- K. Anodic Potential Increment (if stepwise)..... in passive and transpassive
- L. Time at Each Anodic Potential (if stepwise)... 3 minutes
- M. Critical Current Density ( $i_{cr}$ )..... 51 ma/cm<sup>2</sup>
- N. Critical Potential ( $E_{cr}$ )..... +0.100 volt vs. S.C.E.
- O. Passive Current Density ( $i_p$ )..... 0.019 ma/cm<sup>2</sup>
- P. Anodic Dissolution Tafel Slope... 0.050 to 0.070 volt/decade

Q. Transpassive Tafel Slope(s)..... a. Early transpassive: 0.140 to 0.150 volt/decade  
(identify each) b. Oxygen evolution: 0.090 to 0.100 volt/decade

R. Additional Comments..... Critical potential reported was  
potential associated with the critical current density. Passi-  
vation actually occurred over the potential range +0.100 to +0.160  
volt vs. S.C.E.

Name James R. Myers

Address Corrosion Research Laboratory

Air Force Institute of Technology

Wright-Patterson AFB, Ohio 45433

T-3L ROUND-ROBIN ANODIC POLARIZATION  
TEST PROGRAM DATA SHEET

- A. Specimen..... Nickel 270 (NP-327-II)
- B. Electrolyte..... 1N H<sub>2</sub>SO<sub>4</sub>
- C. Temperature, °C..... 22 ± 1 °C
- D. Saturating Gas..... Purified Hydrogen
- E. Specimen Preparation.... Ground through 4/0 emery paper, cleaned in  
boiling benzene, and rinsed in distilled water.
- F. Specimen Activation Treatment.... Cathodically activated at -1.5  
volts for 5 minutes.
- G. Reference Electrode..... Saturated Calomel (S.C.E.)
- H. Cathode Potential..... -0.266 volt vs. S.C.E.
- I. Corrosion Potential..... -0.271 volt vs. S.C.E.
- J. Anodic Potential Sweep Rate (if continuous)... 10 mv in active region, 40 mv in  
K. Anodic Potential Increment (if stepwise)..... passive and 20 mv in transpassive
- L. Time at Each Anodic Potential (if stepwise)... 3 minutes
- M. Critical Current Density ( $i_{cr}$ )..... 67 ma/cm<sup>2</sup>
- N. Critical Potential ( $E_{cr}$ )..... +0.120 volt vs. S.C.E.
- O. Passive Current Density ( $i_p$ )..... 0.015 ma/cm<sup>2</sup>
- P. Anodic Dissolution Tafel Slope... 0.060 to 0.080 volt/decade

Q. Transpassive Tafel Slope(s)..... a. Early transpassive: 0.130 to 0.140 volt/decade  
(identify each) b. Oxygen evolution: 0.080 to 0.090 volt/decade

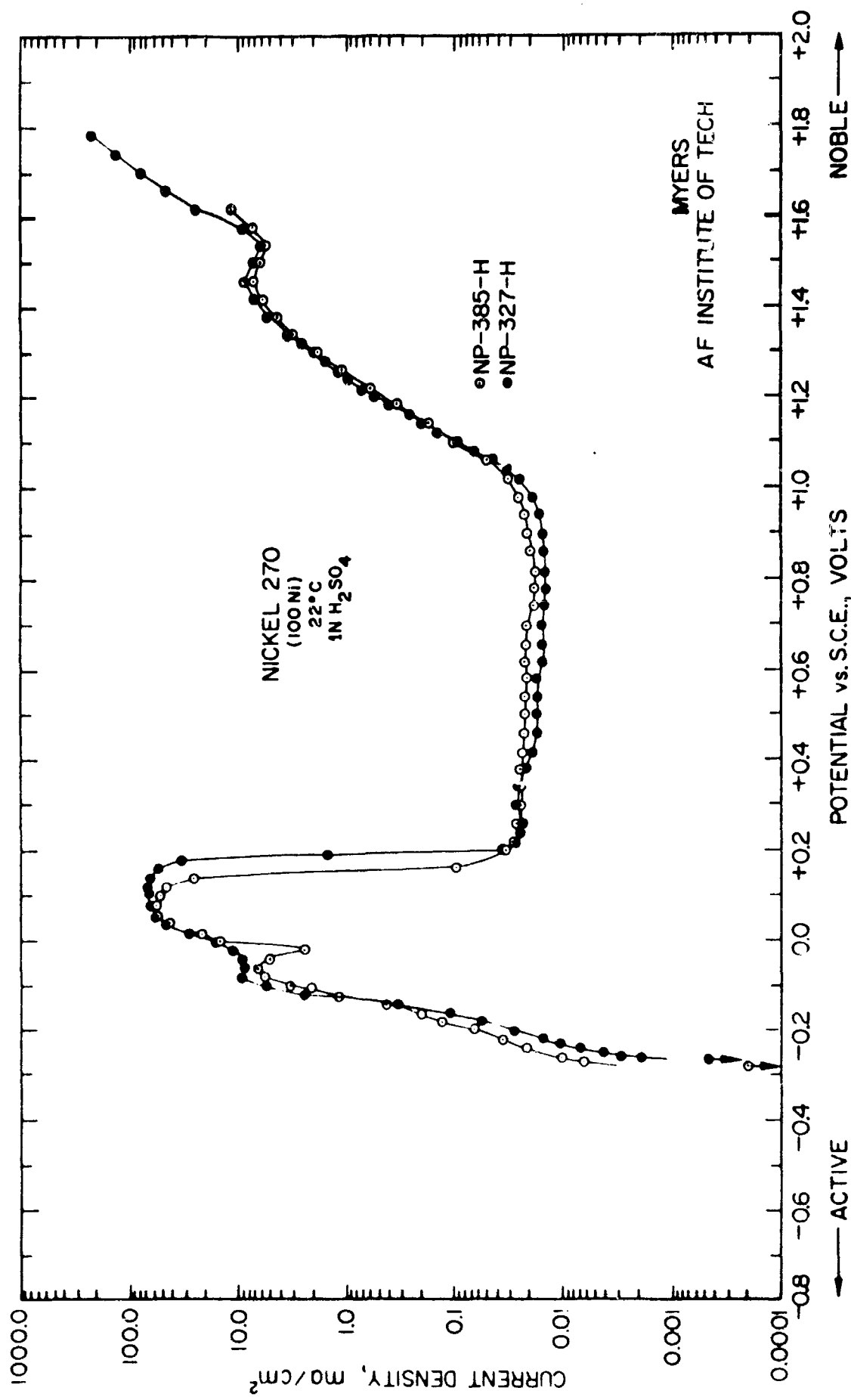
R. Additional Comments..... Critical potential reported was  
potential associated with the critical current density. Passi-  
vation actually occurred over the potential range +0.120 to +0.200  
volt vs. S.C.E.

Name James R. Myers

Address Corrosion Research Laboratory

Air Force Institute of Technology

Wright-Patterson AFB, Ohio 45433



Potentiostatic Anodic Polarization Curves for Nickel 270 (Heats NP-385-H and NP-327-H) in H<sub>2</sub>-Saturated, 1N H<sub>2</sub>SO<sub>4</sub> at 22 ± 1 °C.

Richard L. Martin

Monsanto Company

800 North Lindberg Boulevard

St. Louis, Missouri 63166

CURVE NO. 1

T-3L ROUND-ROBIN ANODIC POLARIZATION  
TEST PROGRAM DATA SHEET

- A. Specimen..... Nickel 270 (NP-385-H)
- B. Electrolyte..... 1N H<sub>2</sub>SO<sub>4</sub>
- C. Temperature, °C..... 25°C
- D. Saturating Gas..... Ultrapure Hydrogen
- E. Specimen Preparation.... Polished through 0000 emery paper, washed  
with soap and water, degreased with hot benzene, washed three times  
with distilled water, dried at 65°C for 15 minutes and cooled to  
room temperature (25°C) in desiccator.
- F. Specimen Activation Treatment..... -0.300 volt cathodic for 15  
minutes.
- G. Reference Electrode..... Saturated calomel (S.C.E.)
- H. Cathode Potential..... -0.267 volt vs. S.C.E.
- I. Corrosion Potential..... -0.293 volt vs. S.C.E.
- J. Anodic Potential Sweep Rate (if continuous)... 0.4 volt/hour
- K. Anodic Potential Increment (if stepwise).....
- L. Time at Each Anodic Potential (if stepwise)...
- M. Critical Current Density ( $i_{cr}$ )..... 190.0 ma/cm<sup>2</sup>
- N. Critical Potential ( $E_{cr}$ )..... +0.400 volt
- O. Passive Current Density ( $i_p$ )..... 0.016 ma/cm<sup>2</sup>
- P. Anodic Dissolution Tafel Slope... 0.050 volt/decade

Q. Transpassive Tafel Slope(s)..... 0.040 volt/decade  
(identify each)

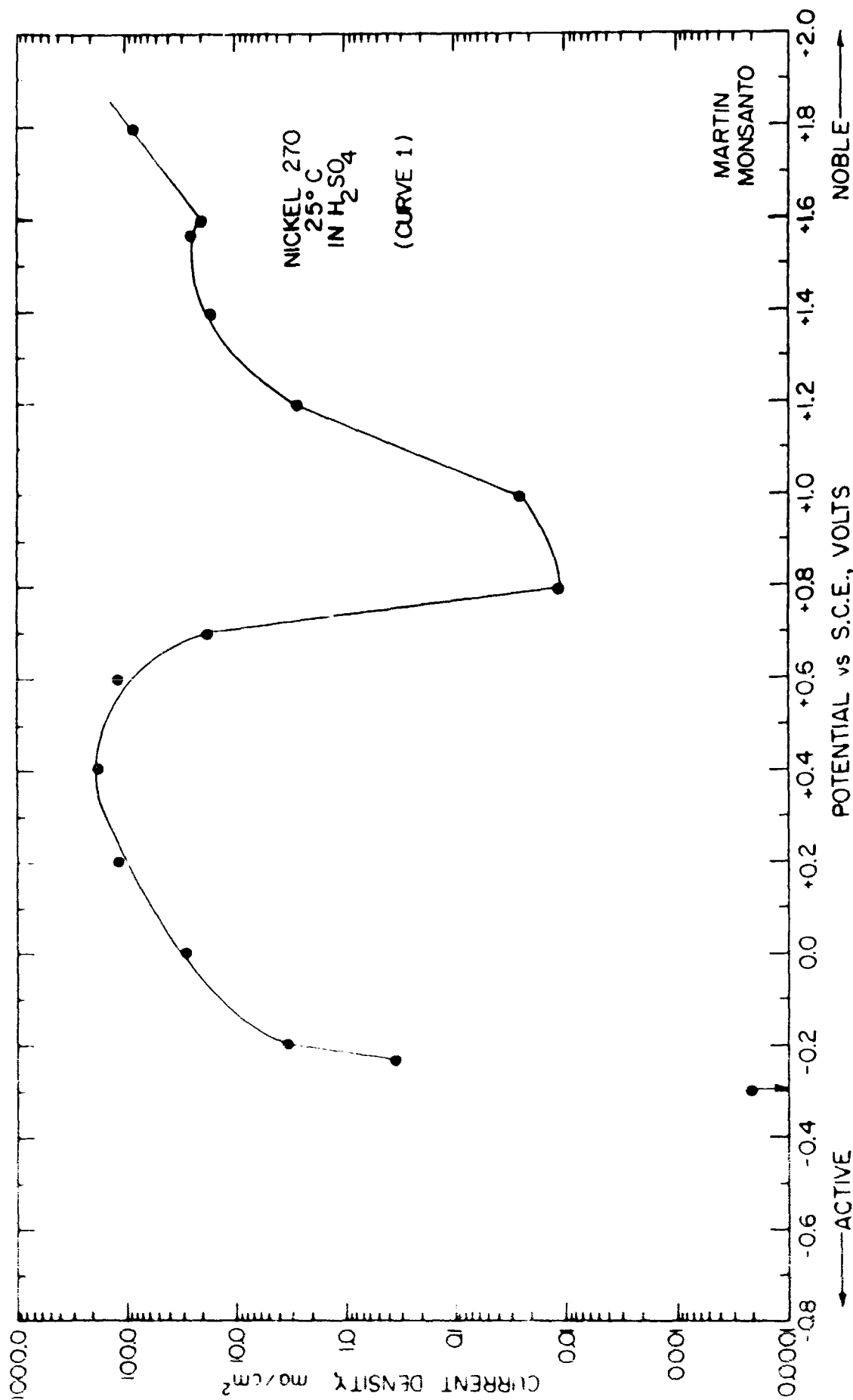
R. Additional Comments..... Curve No. 1 was obtained by  
traversing at 0.40 volt/hour from -0.30 volt to +1.40 volts.

Name Richard L. Martin

Address Monsanto Company

800 North Lindberg Boulevard

St. Louis, Missouri 63166



Potentiostatic Anodic Polarization Curve for Nickel 270  
(Heat NP-385-H) in H<sub>2</sub>-Saturated, IN H<sub>2</sub>SO<sub>4</sub> at 25 °C.

## CURVE NO. 2

T-3L ROUND-ROBIN ANODIC POLARIZATION  
TEST PROGRAM DATA SHEET

- A. Specimen..... Nickel 270 (NP-385-H)
- B. Electrolyte..... 1N H<sub>2</sub>SO<sub>4</sub>
- C. Temperature, °C..... 25°C
- D. Saturating Gas..... Ultrapure Hydrogen
- E. Specimen Preparation.... Polished through 0000 emery paper,  
washed with soap and water, degreased with hot benzene, washed  
three times with distilled water, dried at 65°C for 15 minutes  
and cooled to room temperature (25°C) in desiccator.
- F. Specimen Activation Treatment..... none
- G. Reference Electrode..... Saturated calomel (S.C.E.)
- H. Cathode Potential..... -0.267 volt vs. S.C.E.
- I. Corrosion Potential..... -0.300 volt vs. S.C.E.
- J. Anodic Potential Sweep Rate (if continuous)... 0.4 volt/hour
- K. Anodic Potential Increment (if stepwise).....
- L. Time at Each Anodic Potential (if stepwise)...
- M. Critical Current Density ( $i_{cr}$ )..... 38.12 ma/cm<sup>2</sup>
- N. Critical Potential ( $E_{cr}$ )..... -0.040 volt
- O. Passive Current Density ( $i_p$ ) .... 0.0022 ma/cm<sup>2</sup>
- P. Anodic Dissolution Tafel Slope... 0.080 volt/decade

Q. Transpassive Tafel Slope(s)..... 0.040 volt/decade  
(identify each) \_\_\_\_\_  
\_\_\_\_\_

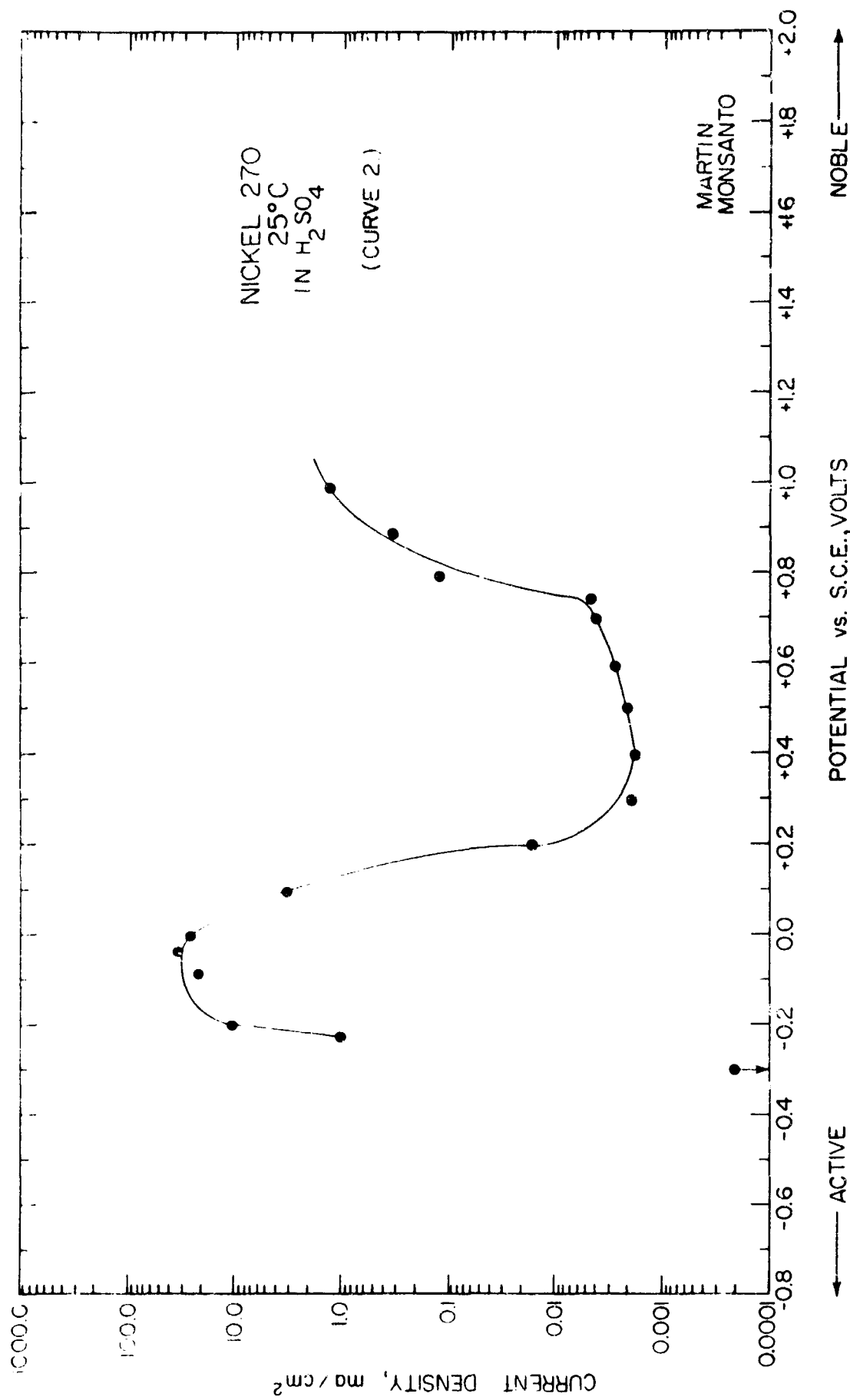
R. Additional Comments..... Curve No. 2 was obtained by  
traversing 0.40 volt/hour from 1.0 volt noble to -0.350 volt active.  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
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\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Name Richard L. Martin

Address Monsanto Company

800 North Lindberg Boulevard

St. Louis, Missouri 63166  
\_\_\_\_\_



Potentiostatic Anodic Polarization Curve for Nickel 270  
(Heat NP-385-H) in H<sub>2</sub>SO<sub>4</sub> at 25 °C.

Olen L. Riggs  
Continental Oil Company  
P. O. Drawer 1267  
Ponca City, Oklahoma 74601

T-3L ROUND-ROBIN ANODIC POLARIZATION  
TEST PROGRAM DATA SHEET

- A. Specimen..... Nickel 270 (NP-385-H)
- B. Electrolyte..... 1N H<sub>2</sub>SO<sub>4</sub>
- C. Temperature, °C..... 25°C
- D. Saturating Gas..... H<sub>2</sub>
- E. Specimen Preparation.... Machine polished; the exposed portion  
of the specimen remained cylindrical (1/2" diameter, 1" length).  
A long (1 1/2") flat handle extended from center of top for  
electrical connection. The approximate surface area was calculated  
to be 10.7 cm<sup>2</sup>.
- F. Specimen Activation Treatment..... Cathodically activated at 50 ma/cm<sup>2</sup>  
for 30 minutes.
- \_\_\_\_\_
- \_\_\_\_\_
- G. Reference Electrode..... Saturated calomel (S.C.E.)
- H. Cathode Potential..... -0.245 ± .001 volt (active)
- I. Corrosion Potential..... -0.263 ± .003 volt (active)
- J. Anodic Potential Sweep Rate (if continuous)... 20 second scan
- K. Anodic Potential Increment (if stepwise)..... 50 mv
- L. Time at Each Anodic Potential (if stepwise)... 2 minutes
- M. Critical Current Density ( $i_{cr}$ )..... 60.2 ma/cm<sup>2</sup> (scan) 29.0 ma/cm<sup>2</sup> (stepwise)
- N. Critical Potential ( $E_{cr}$ )..... +0.250 volt (scan) +0.150 volt (stepwise)
- O. Passive Current Density ( $i_p$ )..... 0.30 ma/cm<sup>2</sup> (scan) 0.019 ma/cm<sup>2</sup> (stepwise)
- P. Anodic Dissolution Tafel Slope... 0.054 volt/decade

Q. Transpassive Tafel Slope(s).....1. Prior to secondary passivation:  
(identify each)

0.107 volt/decade

2. After secondary passivation:

R. Additional Comments..... 0.485 volt/decade

(1) In my opinion, tafel slopes should traverse a minimum of 2 log  
decades preferably 3 or 4 to render the researcher meaningful  
information.

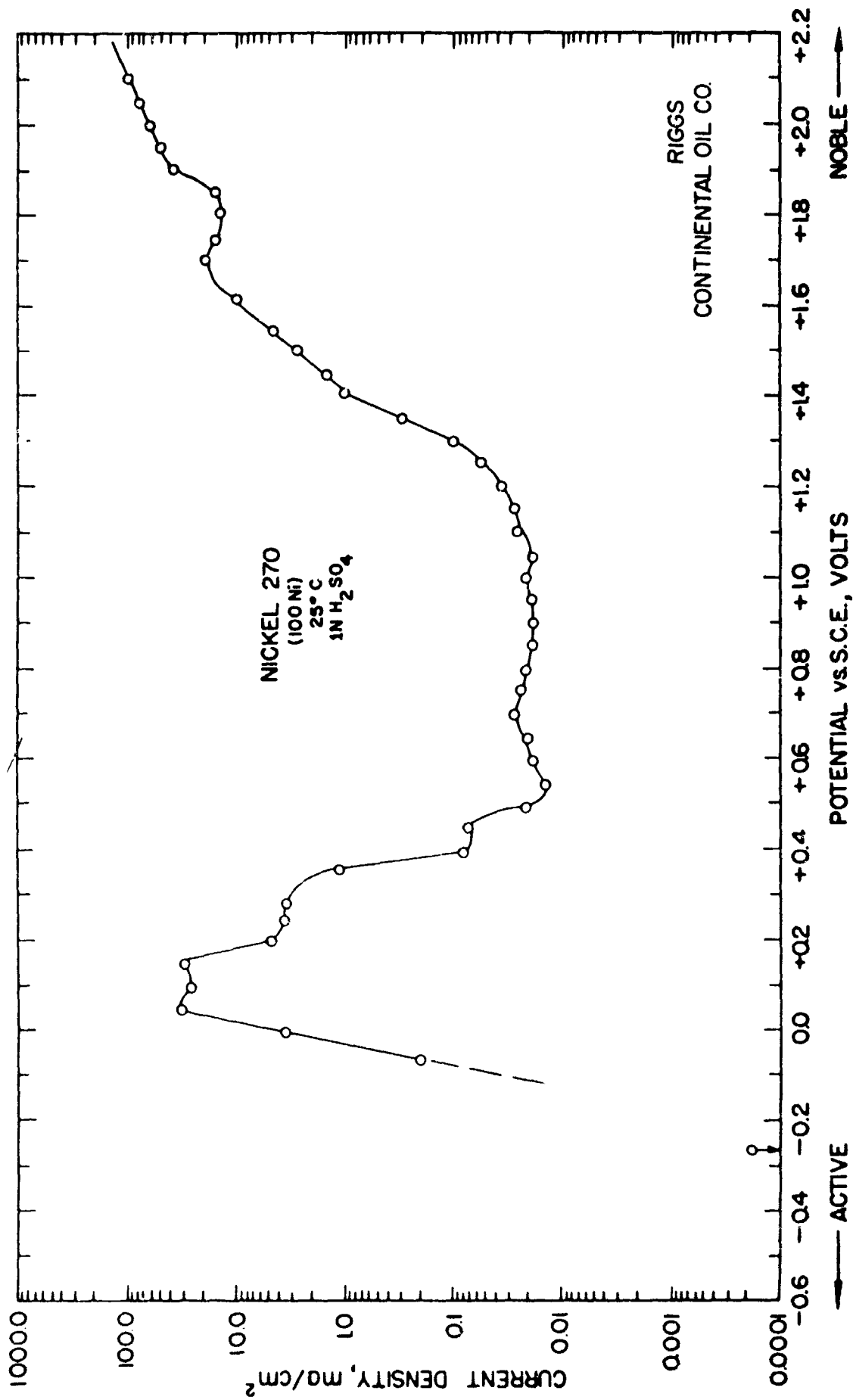
(2) Curve submitted was obtained stepwise.

Name Olen L. Riggs

Address Continental Oil Company

P. O. Drawer 1267

Ponca City, Oklahoma 74601



Potentiostatic Anodic Polarization Curve for Nickel 270  
(Heat NP-385-H) in H<sub>2</sub>-Saturated, 1N H<sub>2</sub>SO<sub>4</sub> at 25°C.

Howard A. Porte  
Chemistry Division  
U. S. Naval Civil Engineering Laboratory  
Port Hueneme, California 93041

T-3L ROUND-ROBIN ANODIC POLARIZATION  
TEST PROGRAM DATA SHEET

- A. Specimen..... Nickel 270 (NP-327-H)
- B. Electrolyte..... 1N H<sub>2</sub>SO<sub>4</sub>
- C. Temperature, °C..... 25°C
- D. Saturating Gas..... H<sub>2</sub>
- E. Specimen Preparation.... Electrode was wet-polished (demineralized  
water as lubricant) with succeeding finer grades of silicon-carbide  
paper through No. 400, rinsed with demineralized water and inserted  
in cell.
- F. Specimen Activation Treatment.... Left in solution overnight prior  
to polarization.
- G. Reference Electrode..... Saturated calomel (S.C.E.)
- H. Cathode Potential.....
- I. Corrosion Potential..... -0.263 volt vs. S.C.E.
- J. Anodic Potential Sweep Rate (if continuous)... 2 volts/hour
- K. Anodic Potential Increment (if stepwise).....
- L. Time at Each Anodic Potential (if stepwise)...
- M. Critical Current Density ( $i_{cr}$ ).....
- N. Critical Potential ( $E_{cr}$ ).....
- O. Passive Current Density ( $i_p$ ).....
- P. Anodic Dissolution Tafel Slope...

Q. Transpassive Tafel Slope(s).....  
(identify each)

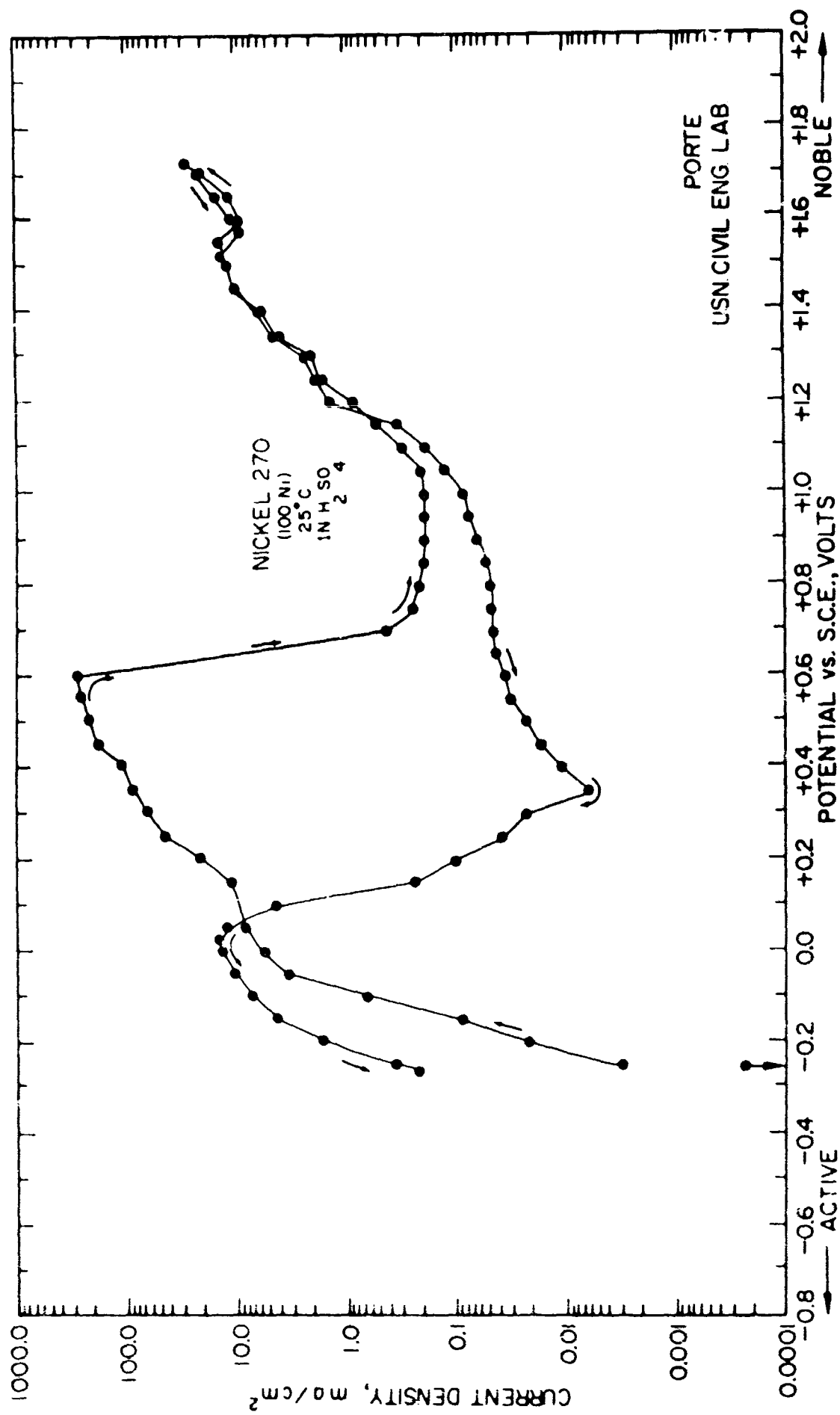
R. Additional Comments..... Polarization was conducted from  
corrosion potential in noble direction. After the transpassive  
region was reached, the potential sweep was reversed and polariza-  
tion was conducted in the active direction.

Name Howard A. Porte

Address Chemistry Division

U. S. Naval Civil Engineering Laboratory

Port Hueneme, California 93041



Potentiostatic Anodic Polarization Curve for Nickel 270  
(Heat NP-327-H) in H<sub>2</sub>SO<sub>4</sub> at 25 °C.

R. F. Steigerwald  
Engineering Materials Laboratory  
E. I. du Pont de Nemours & Co.  
Experimental Station  
Wilmington, Delaware 19898

T-3L ROUND-ROBIN ANODIC POLARIZATION  
TEST PROGRAM DATA SHEET

- A. Specimen..... Nickel 270 (NP-385-H)
- B. Electrolyte..... 1N H<sub>2</sub>SO<sub>4</sub>
- C. Temperature, °C..... 26°C
- D. Saturating Gas..... H<sub>2</sub>
- E. Specimen Preparation.... Ground on 400 grit emery; rinsed;  
etched in 10 parts formic acid - 10 parts hydrogen peroxide  
(30%) - 80 parts water at 80°C for 2 minutes; rinsed in distilled  
water.
- F. Specimen Activation Treatment..... ~ 1 min at -0.6 volt vs. S.C.E.
- G. Reference Electrode..... Saturated Calomel (S.C.E.)
- H. Cathode Potential..... E = -0.2630 volt vs. S.C.E.
- I. Corrosion Potential..... -0.2615 volt vs. S.C.E.
- J. Anodic Potential Sweep Rate (if continuous)... \_\_\_\_\_
- K. Anodic Potential Increment (if stepwise)..... Variable.
- L. Time at Each Anodic Potential (if stepwise)... "steady-state" or 5 min.
- M. Critical Current Density ( $i_{cr}$ )..... 8.37 ma/cm<sup>2</sup>
- N. Critical Potential ( $E_{cr}$ )..... -0.05 volt vs. S.C.E.
- O. Passive Current Density ( $i_p$ )..... minimum  $i_p = 0.005$  ma/cm<sup>2</sup>
- P. Anodic Dissolution Tafel Slope... 0.05 volt/decade

Q. Transpassive Tafel Slope(s)..... 0.14 volt/decade  
(identify each)

\_\_\_\_\_  
\_\_\_\_\_

R. Additional Comments.....

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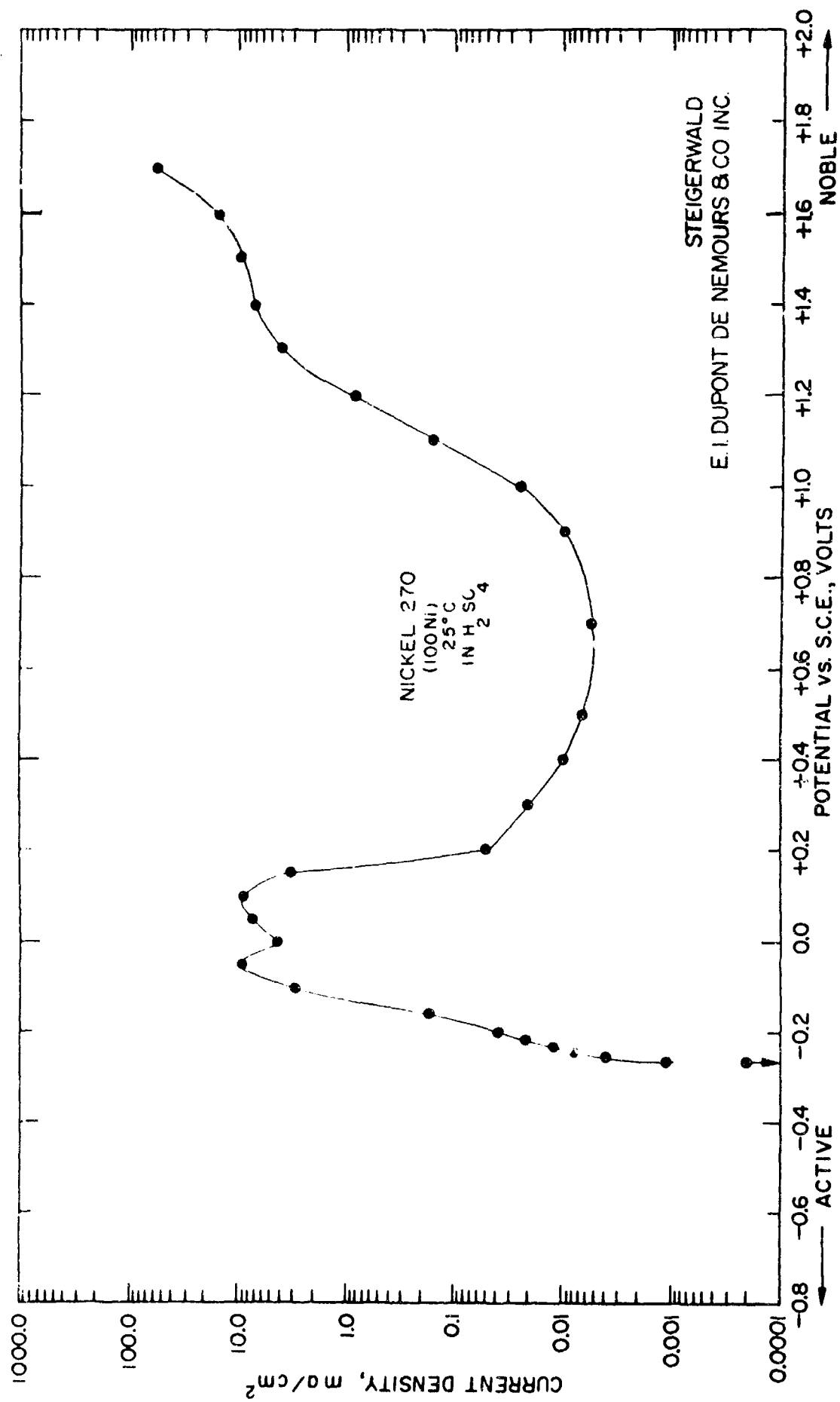
Name R. F. Steigerwald

Address Engineering Materials Laboratory

E. I. du Pont de Nemours & Co.

Experimental Station

Wilmington, Delaware 19898



Potentiostatic Anodic Polarization Curve for Nickel 270  
(Heat NP-385-H) in H<sub>2</sub>-Saturated, 1N H<sub>2</sub>SO<sub>4</sub> at 26 °C.

Howard Vaeth  
Republic Steel Corporation  
Research Center  
6801 Brecksville Road  
Independence, Ohio 44131

T-3L ROUND-ROBIN ANODIC POLARIZATION  
TEST PROGRAM DATA SHEET

- A. Specimen..... Nickel 270 (NP-327-H)
- B. Electrolyte.....
- C. Temperature, °C..... 24 + 1 °C
- D. Saturating Gas..... Hydrogen
- E. Specimen Preparation.... Cross section of sample mounted in plastic  
(Quickmount) and polished metallographically, finishing with 0.05  
micron alumina.
- F. Specimen Activation Treatment..... One hour age in electrolyte  
followed by one minute at -0.500 volt followed by a one minute  
period after which the polarization run was started.
- G. Reference Electrode..... Saturated Calomel (S.C.E.)
- H. Cathode Potential.....
- I. Corrosion Potential..... -0.260 volt vs. S.C.E.
- J. Anodic Potential Sweep Rate (if continuous)...
- K. Anodic Potential Increment (if stepwise)..... 20 mv
- L. Time at Each Anodic Potential (if stepwise)... 2 minutes
- M. Critical Current Density ( $i_{cr}$ )..... 140 ma/cm<sup>2</sup>
- N. Critical Potential ( $E_{cr}$ )..... 0.3 volt vs. S.C.E. See reverse side
- O. Passive Current Density ( $i_p$ )..... 19.8  $\mu$  a/sq cm
- P. Anodic Dissolution Tafel Slope... 0.089 volt/decade

Q. Transpassive Tafel Slope(s)..... 0.182 volt/decade  
(identify each)

This is before the transpassive  
inflection.

R. Additional Comments.....

1. Critical Potential. No distinct "nose" was observed. Rather a  
range of potentials over which the current remained at a con-  
stant maximum value was observed. The approximate middle of this  
potential range is at 0.3 volt and is the value reported on the  
reverse side. The current density through this range is taken  
as the critical current density.

2. General. Four runs were made using four cross sections cut from  
the original sample.

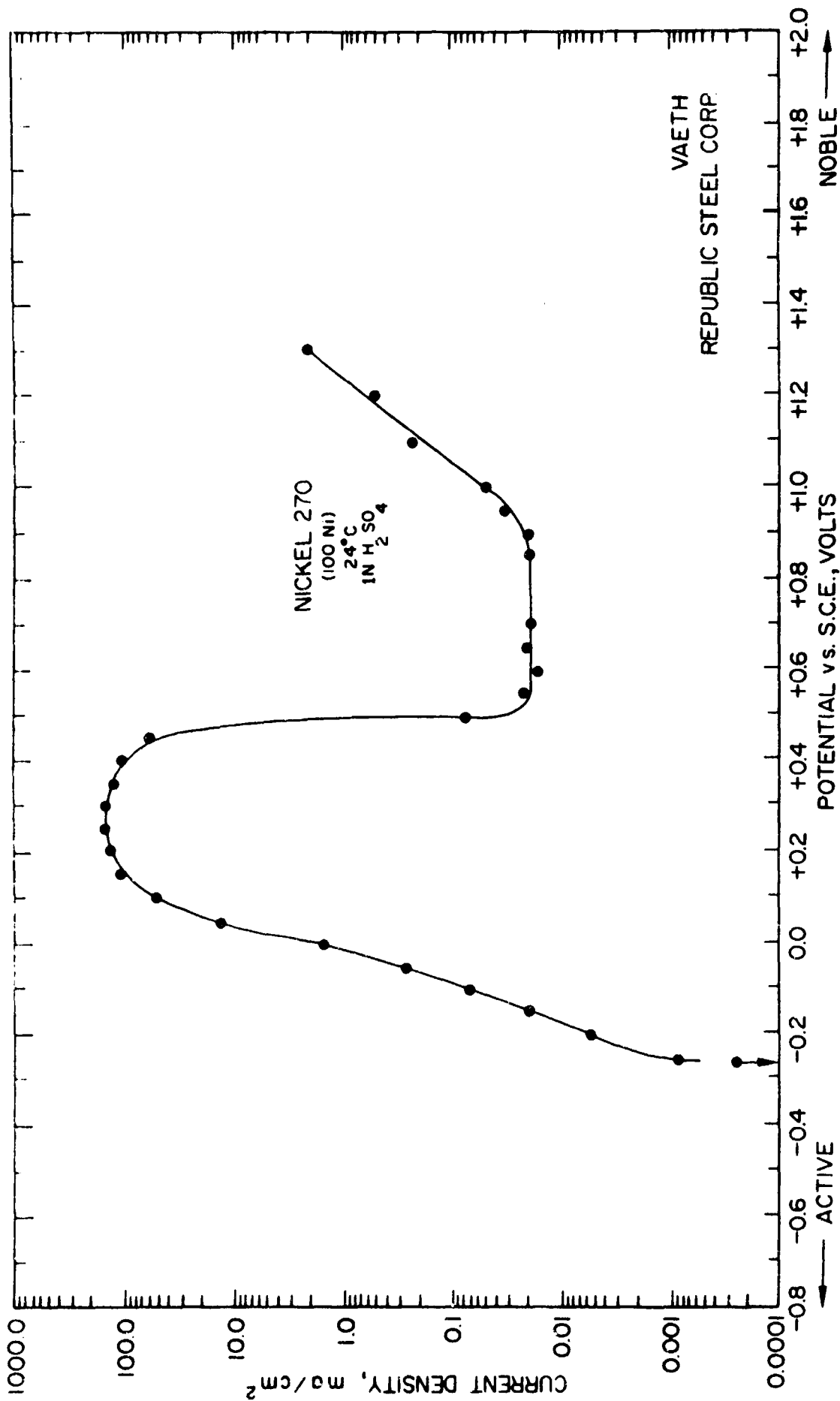
Name Howard Vaeth

Address Republic Steel Corporation

Research Center

6801 Brecksville Road

Independence, Ohio 44131



Potentiostatic Anodic Polarization Curve for Nickel 270  
(Heat NP-327-H) in H<sub>2</sub>-Saturated, 1N H<sub>2</sub>SO<sub>4</sub> at 24 ± 1 °C.

John D. Katfield  
Fundamental Research Branch  
TVA National Fertilizer Development Center  
Muscle Shoals, Alabama 35660

T-3L ROUND-ROBIN ANODIC POLARIZATION  
TEST PROGRAM DATA SHEET

- A. Specimen..... Nickel 270 (NP-327-H)
- B. Electrolyte..... 1.0N H<sub>2</sub>SO<sub>4</sub>
- C. Temperature, °C..... 25.0 °C
- D. Saturating Gas..... Hydrogen
- E. Specimen Preparation.... Ground with Nos. 2, 1, 0, 2/0, 3/0 and 4/0  
emery paper in kerosene. Washed at 25 °C in acetone. Dried 20 minutes  
at 60 °C and desiccated overnight at room temperature.
- F. Specimen Activation Treatment.... Cathodized in 1N H<sub>2</sub>SO<sub>4</sub> immediately  
prior to measurements at approximately 1 ampere for 5 minutes.
- G. Reference Electrode..... Saturated calomel (S.C.E.)
- H. Cathode Potential..... Initially -0.262 volt vs. S.C.E.
- I. Corrosion Potential..... -0.265 volt vs. S.C.E.
- J. Anodic Potential Sweep Rate (if continuous)... 2.50 mv/min
- K. Anodic Potential Increment (if stepwise).....
- L. Time at Each Anodic Potential (if stepwise)...
- M. Critical Current Density ( $i_{cr}$ )..... 27 ma/cm<sup>2</sup>
- N. Critical Potential ( $E_{cr}$ )..... -0.025 volt vs. S.C.E.
- O. Passive Current Density ( $i_p$ )..... 0.05 to 0.18 ma/cm<sup>2</sup>
- P. Anodic Dissolution Tafel Slope... 0.06 volt/decade

Q. Transpassive Tafel Slope(s)..... No oxygen evolution: 0.17 volt/decade  
(identify each)

With oxygen evolution: 0.37 volt/decade

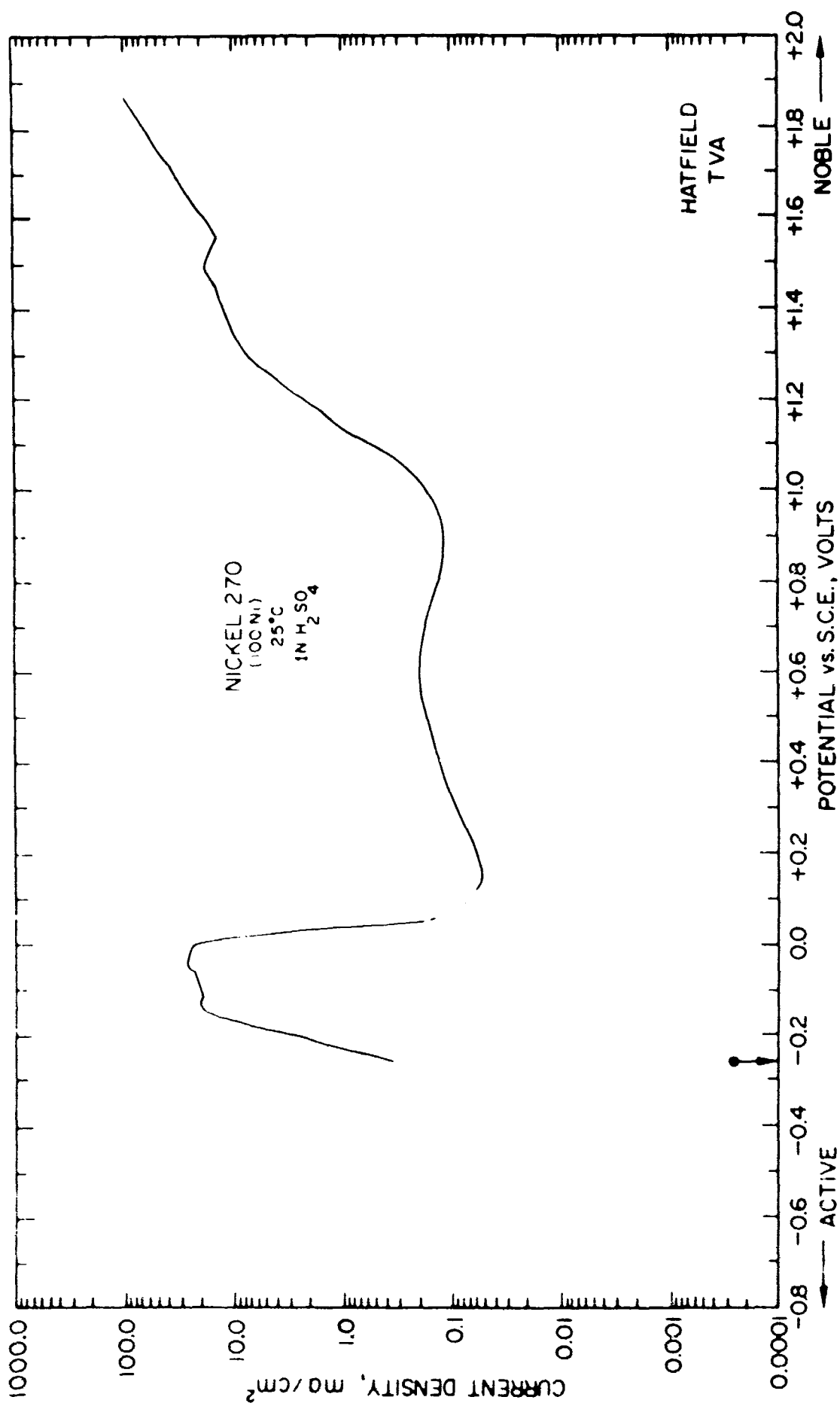
R. Additional Comments..... The attached curve is a composite of  
two runs. Although anodic dissolution and transpassive dissolution  
slopes, as well as passivation currents of each run, were essentially  
identical, the first specimen (not subjected to an activation treat-  
ment) failed to passivate until a current density of 150 ma/cm<sup>2</sup> at a  
potential of +0.32 volt vs. SCE had been attained.

Name John D. Hatfield

Address Fundamental Research Branch

TVA National Fertilizer Development Center

Muscle Shoals, Alabama 35660



Potentiostatic Anodic Polarization Curves for Nickel 270  
(Heat NP-327-H) in H<sub>2</sub>-Saturated, 1N H<sub>2</sub>SO<sub>4</sub> at 25 °C.

George Economy & C. A. Mihari

Paul J. Perica Research Laboratory

The International Nickel Company, Inc.

Sterling Forest

Suffern, New York 10901

T-3L ROUND-ROBIN ANODIC POLARIZATION  
TEST PROGRAM DATA SHEET

- A. Specimen..... Nickel 270 (WP-385-II)
- B. Electrolyte..... 1.0005N  $H_2SO_4$
- C. Temperature, °C..... 25 ± 0.5 °C
- D. Saturating Gas..... hydrogen (Oxoxo Purified)
- E. Specimen Preparation.... exposed surface given mirror polish.
- .....
- .....
- .....
- F. Specimen Activation Treatment..... cleaned in acetone, rinsed in distilled water, immersed in 1 to 1 nitric-acetic acid solution, rinsed in distilled water, and held in  $H_2SO_4$  until placed in cell.
- .....
- G. Reference Electrode..... Saturated Calomel
- H. Cathode Potential..... +0.10 volt vs. S.C.E.
- I. Corrosion Potential..... +0.253 ± 0.01 volt vs. S.C.E.
- J. Anodic Potential Sweep Rate (if continuous)... ..
- K. Anodic Potential Increment (if stepwise)..... Irregular
- L. Time at Each Anodic Potential (if stepwise)... .. 5 minutes to 16 hours
- M. Critical Current Density ( $i_{CR}$ )..... 31  $mA/cm^2$
- N. Critical Potential ( $E_{CR}$ )..... +0.140 volt vs. S.C.E.
- O. Passive Current Density ( $i_P$ )..... 0.002  $mA/cm^2$
- P. Anodic Dissolution Tafel Slope... .. 0.014 volt/decade

Q. Transpassive Tafel Slope(s)..... 0.150 volt/decade  
(identify each) \_\_\_\_\_  
\_\_\_\_\_

R. Additional Comments..... E<sub>cr</sub> would be +0.088 volt vs. S.C.E.  
if taken at i<sub>cr</sub>.  
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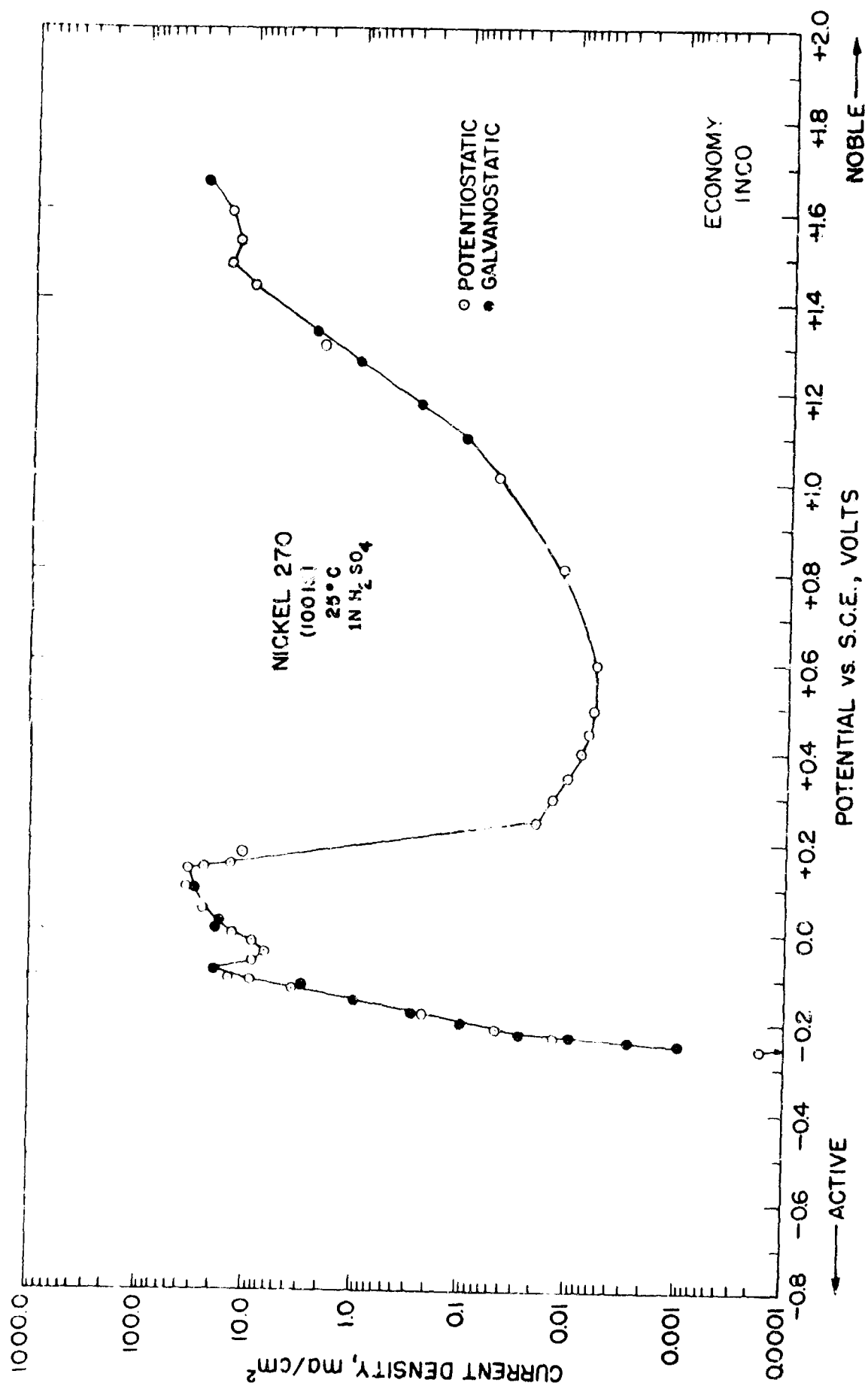
Name Paul J. Ferreira, Ph.D., A. (Chari)

Address Paul J. Ferreira Research Laboratory

The International Nickel Company, Inc.

Sterling Forest

Suffern, New York 10981



Potentiostatic and Galvanostatic Anodic Polarization Curves for Nickel 270 (Heat NP-385-H) in H<sub>2</sub>-Saturated, 1N H<sub>2</sub>SO<sub>4</sub> at 25 ± 0.5 °C.

Edward L. Wiehe  
J & L Graham Research Laboratory  
900 Agnew Road  
Pittsburgh, Pennsylvania 15227

T-3L ROUND-ROBIN ANODIC POLARIZATION  
TEST PROGRAM DATA SHEET

- A. Specimen..... Nickel 270 (NP-385-H)
- B. Electrolyte..... 1N H<sub>2</sub>SO<sub>4</sub>
- C. Temperature, °C..... Start 23°C      Finish 24°C
- D. Saturating Gas..... H<sub>2</sub>
- E. Specimen Preparation.... Finished with 120 grit paper and then  
degreased in an ultrasonic cleaner.
- F. Specimen Activation Treatment.... Electrode immersed overnight in  
H<sub>2</sub> - saturated cell prior to polarization studies.
- G. Reference Electrode..... Saturated Calomel (S.C.E.)
- H. Cathode Potential..... -.2646 volt vs. S.C.E. (start);  
-.2640 volt vs. S.C.E. (finish)
- I. Corrosion Potential..... -.2000 volt vs. S.C.E. (time dependent)
- J. Anodic Potential Sweep Rate (if continuous)...
- K. Anodic Potential Increment (if stepwise)..... 25 mv to  $i_{cr}$  then 50 mv
- L. Time at Each Anodic Potential (if stepwise)... 5 minutes
- M. Critical Current Density ( $i_{cr}$ )..... 140,000  $\mu$  amp/cm<sup>2</sup>
- N. Critical Potential ( $E_{cr}$ )..... -.0500 volt
- O. Passive Current Density ( $i_p$ )..... 3  $\mu$  amp/cm<sup>2</sup>
- P. Anodic Dissolution Tafel Slope... not determined

Q. Transpassive Tafel Slope(s)..... Not determined.  
(identify each)

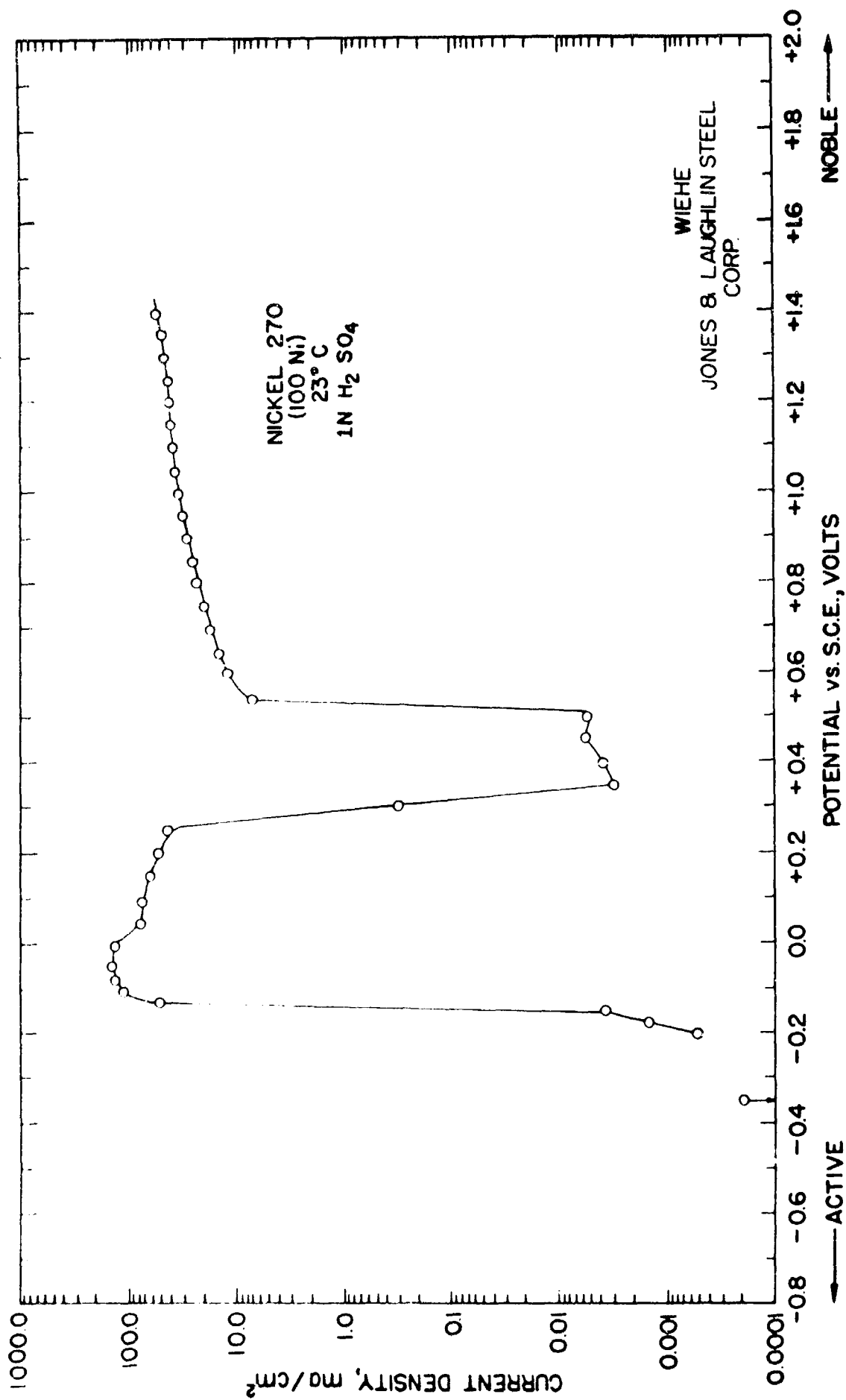
R. Additional Comments.....

Name Edward L. Wiehe

Address J & L Graham Research Laboratory

900 Anew Road

Pittsburgh, Pennsylvania 15227



Potentiostatic Anodic Polarization Curve for Nickel 270  
(Heat NP-385-H) in H<sub>2</sub>-Saturated, 1N H<sub>2</sub>SO<sub>4</sub> at 23-24 °C.

G. A. Saltzman  
Crucible Steel Co. of America  
Central Research Laboratory  
234 Atwood Street  
Pittsburgh, Pennsylvania 15213

T-3L ROUND-ROBIN ANODIC POLARIZATION  
TEST PROGRAM DATA SHEET

- A. Specimen..... Nickel 270 (NP-327-H)
- B. Electrolyte..... 1N H<sub>2</sub>SO<sub>4</sub>
- C. Temperature, °C..... 25 ± 1 °C
- D. Saturating Gas..... H<sub>2</sub>
- E. Specimen Preparation.... Surface abraded with 500 grit silicon car-  
bide paper, scrubbed with an alkaline cleaner, degreased in hot  
chloroform, rinsed with distilled water.
- F. Specimen Activation Treatment..... Pre-exposure to test solution  
for 1 hour prior to beginning potentiostatic polarization.
- G. Reference Electrode..... Saturated Calomel
- H. Cathode Potential..... -0.259 volt vs. S.C.E.
- I. Corrosion Potential..... -0.272 volt vs. S.C.E.
- J. Anodic Potential Sweep Rate (if continuous)... 0.64 volt/hour
- K. Anodic Potential Increment (if stepwise).....
- L. Time at Each Anodic Potential (if stepwise)...
- M. Critical Current Density ( $i_{cr}$ ).....  $7.75 \times 10^4 \mu \text{ a/cm}^2$
- N. Critical Potential ( $E_{cr}$ )..... 0.055 volt vs. S.C.E.
- O. Passive Current Density ( $i_p$ ).....  $3 \mu \text{ a/cm}^2$  (minimum)
- P. Anodic Dissolution Tafel Slope... 0.063 volt/decade

Q. Transpassive Tafel Slope(s)..... Not determined  
(identify each)

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R. Additional Comments.....

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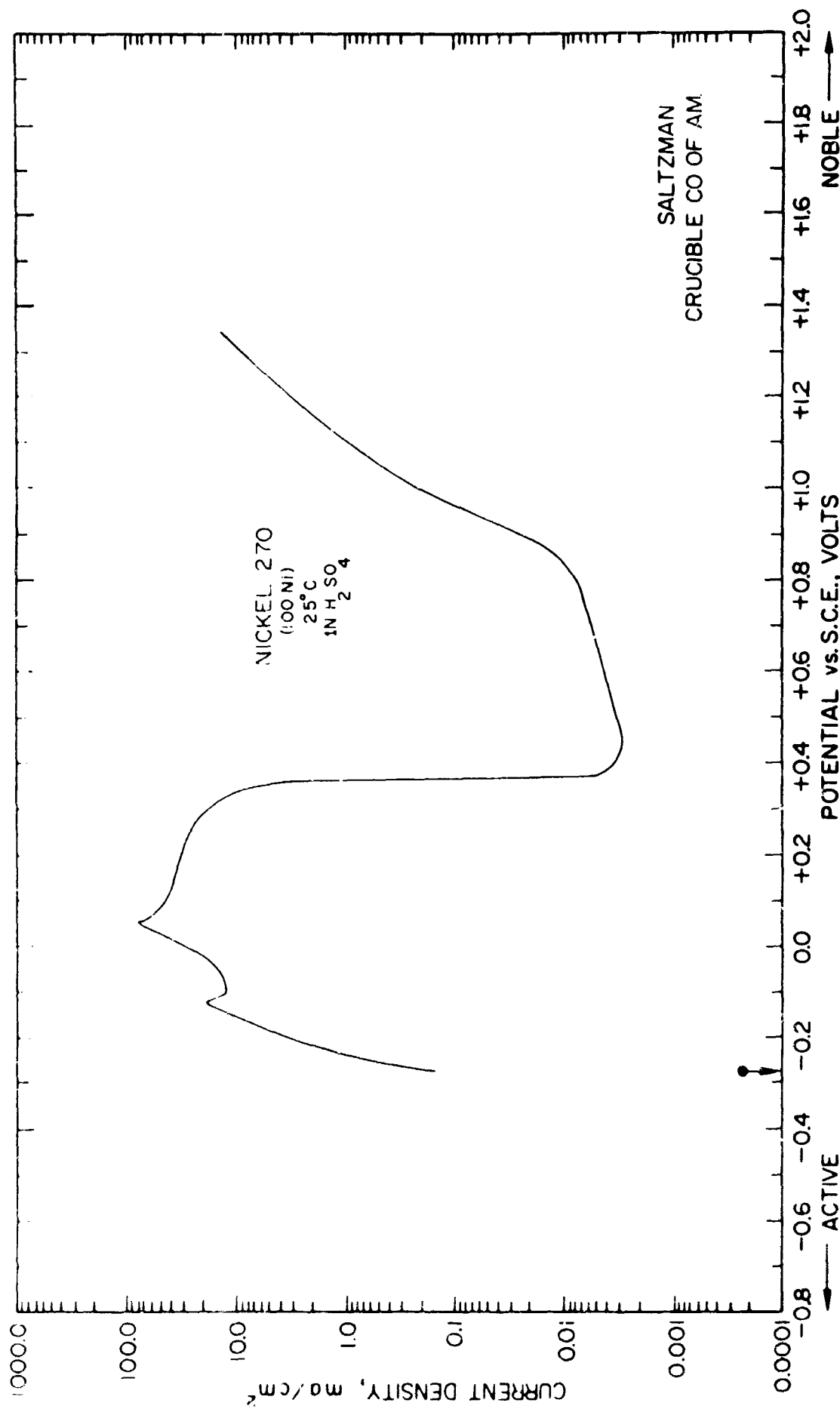
Name G. A. Saltzman

Address Crucible Steel Co. of America

Central Research Laboratory

234 Atwood Street

Pittsburgh, Pennsylvania 15213



Potentiostatic Anodic Polarization Curve for Nickel 270  
(Heat NP-327-H) in H<sub>2</sub>-Saturated, 1N H<sub>2</sub>SO<sub>4</sub> at 25 ± 1 °C.

C. E. Locke  
Anotrol Division  
Continental Oil Company  
P. O. Drawer 1267  
Ponca City, Oklahoma 74601

T-3L ROUND-ROBIN ANODIC POLARIZATION  
TEST PROGRAM DATA SHEET

- A. Specimen..... Nickel 270 (NP-385-H)
- B. Electrolyte..... 1N H<sub>2</sub>SO<sub>4</sub>
- C. Temperature, °C..... 25 °C
- D. Saturating Gas..... None
- E. Specimen Preparation.... Abraded on a disc sander (medium grit)  
followed by silicon carbide sanding disc. Washed with H<sub>2</sub>O, acetone,  
and dried.
- F. Specimen Activation Treatment..... Cathodically activated at 15 ma/in<sup>2</sup>  
for three minutes in test solution.
- G. Reference Electrode..... Saturated Calomel Electrode (S.C.E.)
- H. Cathode Potential..... -240 mv (active) vs. S.C.E.
- I. Corrosion Potential..... -220 mv (active) vs. S.C.E.
- J. Anodic Potential Sweep Rate (if continuous)....
- K. Anodic Potential Increment (if stepwise)..... 100 mv
- L. Time at Each Anodic Potential (if stepwise).... 3 minutes
- M. Critical Current Density ( $i_{cr}$ )..... 28 ma/in<sup>2</sup>
- N. Critical Potential ( $E_{cr}$ )..... -100 mv (active)
- O. Passive Current Density ( $i_p$ )..... 0.06 ma/in<sup>2</sup>
- P. Anodic Dissolution Tafel Slope... 50 mv/decade

Q. Transpassive Tafel Slope(s)..... 140 mv/decade  
(identify each)

R. Additional Comments.....

Name C. E. Locke

Address Anotrol Division

Continental Oil Company

P. O. Drawer 1267

Ponca City, Oklahoma 74601

Monte S. Walker  
General Motors Technical Center  
12 Mile and Mound Roads  
Warren, Michigan 48090

T-3L ROUND-ROBIN ANODIC POLARIZATION  
TEST PROGRAM DATA SHEET

SLOW SWEEP RATE

- A. Specimen..... Nickel 270 (NP-385-H)
- B. Electrolyte..... 1N H<sub>2</sub>SO<sub>4</sub>
- C. Temperature, °C..... 25°C
- D. Saturating Gas..... Nitrogen
- E. Specimen Preparation.... The specimen was polished with emery  
paper, finishing with a 0000 grade. It was then stored in a  
desiccator. Just prior to use, it was repolished with 0000 emery  
paper and rinsed in alcohol and distilled water.
- F. Specimen Activation Treatment..... Cathodically activated at -1.85 volt  
for 5 minutes.
- G. Reference Electrode..... Saturated calomel (S.C.E.)
- H. Cathode Potential.....
- I. Corrosion Potential..... -0.22 volt vs. S.C.E.
- J. Anodic Potential Sweep Rate (if continuous)... 1/3 volt hour
- K. Anodic Potential Increment (if stepwise).....
- L. Time at Each Anodic Potential (if stepwise)...
- M. Critical Current Density ( $i_{cr}$ )..... 24 ma/cm<sup>2</sup>
- N. Critical Potential ( $E_{cr}$ )..... +0.11 volt vs. S.C.E.
- O. Passive Current Density ( $i_p$ )..... 0.02 to 0.2 ma/cm<sup>2</sup>
- P. Anodic Dissolution Tafel Slope... 0.050 volt/decade

Q. Transpassive Tafel Slope(s)..... 0.185 volt/decade  
(identify each)

R. Additional Comments.....

- (1) The electrolyte was mechanically stirred at the rate of  
250 rpm.
- (2) Initially, the test specimen was prepared using the full  
1/2-inch bar of Inconel 270. This specimen would not passivate.  
Preferential attack of the outer edge of the specimen occurred  
during a controlled potential sweep. By machining the specimen  
down to 0.50 cm<sup>2</sup>, the edge suffering preferential attack was  
eliminated.

Name Monte S. Walker

Address General Motors Technical Center  
12 Mile and Mound Roads  
Warren, Michigan 48090

T-3L ROUND-ROBIN ANODIC POLARIZATION  
TEST PROGRAM DATA SHEET

FAST SWEEP RATE

- A. Specimen..... Nickel 270 (NP-385-H)
- B. Electrolyte..... 1N H<sub>2</sub>SO<sub>4</sub>
- C. Temperature, °C..... 25°C
- D. Saturating Gas..... Nitrogen
- E. Specimen Preparation.... The specimen was polished with emery  
paper, finishing with 0000 grade. It was then stored in a  
desiccator. Just prior to use, it was repolished with 0000  
emery paper and rinsed in alcohol and distilled water.
- F. Specimen Activation Treatment.... Cathodically activated at -1.85  
volt for 5 minutes
- G. Reference Electrode..... Saturated calomel (S.C.E.)
- H. Cathode Potential.....
- I. Corrosion Potential..... -0.22 volt vs. S.C.E.
- J. Anodic Potential Sweep Rate (if continuous)... 30 volts/hour
- K. Anodic Potential Increment (if stepwise).....
- L. Time at Each Anodic Potential (if stepwise)...
- M. Critical Current Density ( $i_{cr}$ )..... 18 ma/cm<sup>2</sup>
- N. Critical Potential ( $E_{cr}$ )..... -0.05 volt vs. S.C.E.
- O. Passive Current Density ( $i_p$ )..... ~ 1 ma/cm<sup>2</sup>
- P. Anodic Dissolution Tafel Slope... Not linear

Q. Transpassive Tafel Slope(s)..... Not linear  
(identify each)

R. Additional Comments.....

(1) The electrolyte was mechanically stirred at the rate of 250 rpm.

(2) At the fast scan rate (30 volt/hour), the second current maximum does not have time to develop.

Name Monte S. Walker

Address General Motors Technical Center

12 Mile and Mound Roads

Warren, Michigan 48090

G. J. Biefer  
Corrosion Section  
Physical Metallurgy Division  
Mines Branch of Canada  
568 Booth Street  
Ottawa, Ont, Canada

T-3L ROUND-ROBIN ANODIC POLARIZATION  
TEST PROGRAM DATA SHEET

- A. Specimen..... Nickel 270 (NP-327-H)
- B. Electrolyte..... 1N H<sub>2</sub>SO<sub>4</sub>
- C. Temperature, °C..... 23.5 °C
- D. Saturating Gas..... Purified Nitrogen
- E. Specimen Preparation.... Surface-ground by hand on 120 grit silicon  
carbide paper under water cooling, rinsed in water, cleaned in  
ultrasonically agitated carbon tetrachloride, then alcohol, then  
dried in a blast of hot air.
- F. Specimen Activation Treatment.... Specimen immersed in test solution  
(1.6 litres) for 1 hour prior to measurements.
- G. Reference Electrode..... Saturated Calomel (S.C.E.)
- H. Cathode Potential.....
- I. Corrosion Potential..... -280 mv vs S.C.E.
- J. Anodic Potential Sweep Rate (if continuous)... 7 volts/hour
- K. Anodic Potential Increment (if stepwise).....
- L. Time at Each Anodic Potential (if stepwise)...
- M. Critical Current Density ( $i_{cr}$ )..... 6.8 ma/cm<sup>2</sup>
- N. Critical Potential ( $E_{cr}$ )..... +185 mv vs S.C.E.
- O. Passive Current Density ( $i_p$ )..... 32  $\mu$  a/cm<sup>2</sup> (minimum)
- P. Anodic Dissolution Tafel Slope... .054 volt/decade  
(from  $\sim 0.2$  ma/cm<sup>2</sup> to  $\sim 2$  ma/cm<sup>2</sup>)

G. Transpassive Tafel Slope(s)..... 111 mv/decade (from ~ 0.2 ma/cm<sup>2</sup> to  
(identify each) ~ 2 ma/cm<sup>2</sup>)

R. Additional Comments..... H<sub>2</sub>- purifier at present under repair.  
N<sub>2</sub> has been used in the past, at this laboratory, for this kind of run.

Name G. J. Biefer

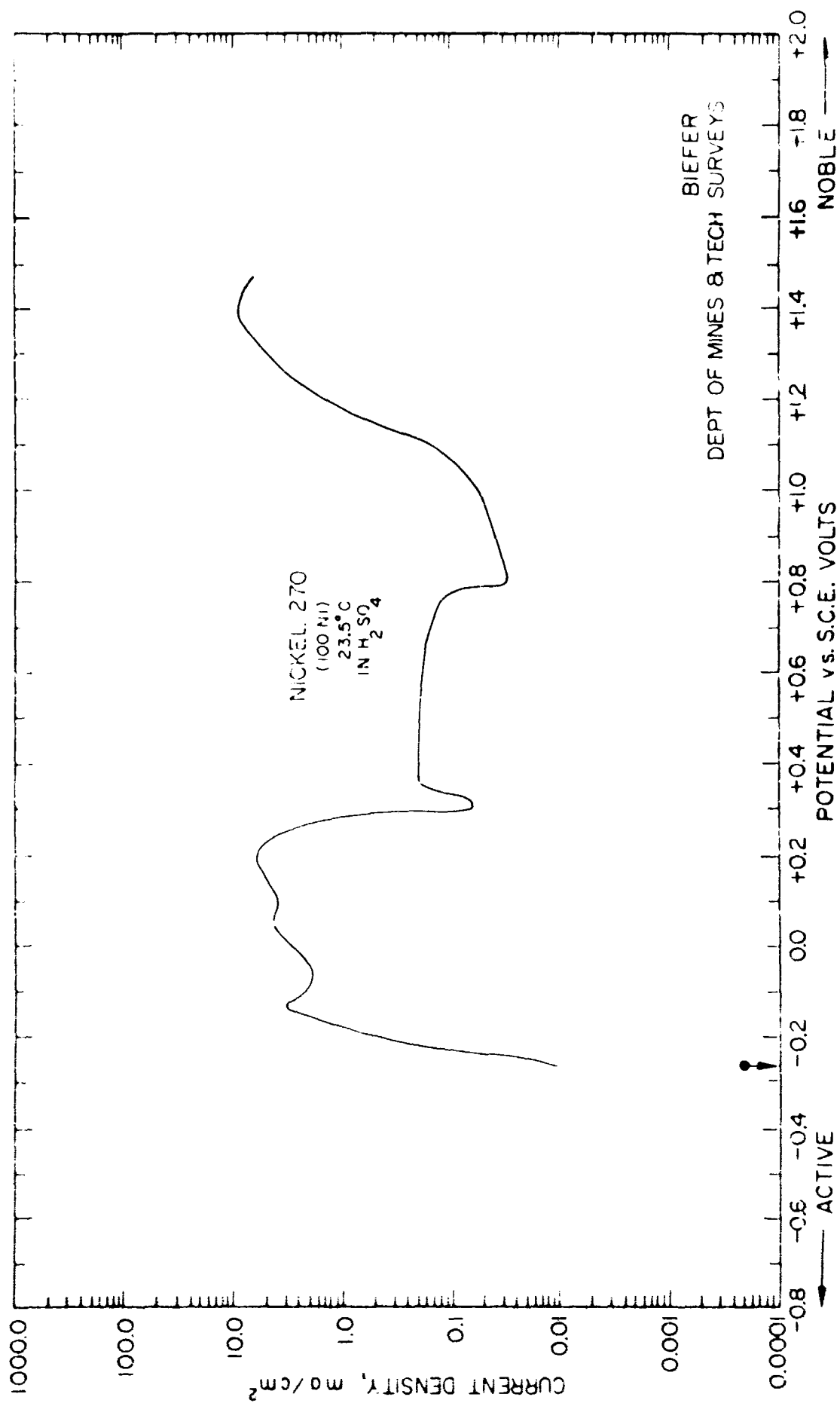
Address Corrosion Section

Physical Metallurgy Division

Mines Branch of Canada

553 Booth Street

Ottawa, Ont, Canada



Potentiostatic Anodic Polarization Curve for Nickel 270  
(Heat NP-327-H) in H<sub>2</sub>-Saturated, 1N H<sub>2</sub>SO<sub>4</sub> at 23.5 °C.

Ing. M. Pražák CSc.  
State Institute for Material  
Protection Research,  
Prague 7  
Czechoslovakia

Ing M. Pražák CSc.  
State Institute for Material  
Protection Research,  
Prague 7  
Czechoslovakia

T-3L ROUND-ROBIN ANODIC POLARIZATION  
TEST PROGRAM DATA SHEET

- A. Specimen..... Nickel 270 (NP-327-H)
- B. Electrolyte..... 1N H<sub>2</sub>SO<sub>4</sub>
- C. Temperature, °C..... 20°C
- D. Saturating Gas..... Air
- E. Specimen Preparation.... Mechanically polished, followed by  
registration of the curve 2 times from -0.6 to +1.6 volts vs. S.C.E.  
(i.e., electrochemically etched, before final registration; final  
registration = Curve No. 3.
- F. Specimen Activation Treatment..... at -0.6 volt (see above)
- G. Reference Electrode..... Saturated calomel (S.C.E.) with satd. NH<sub>4</sub>NO<sub>3</sub> junction
- H. Cathode Potential.....
- I. Corrosion Potential.....
- J. Anodic Potential Sweep Rate (if continuous)... +0.010 volt/sec.
- K. Anodic Potential Increment (if stepwise).....
- L. Time at Each Anodic Potential (if stepwise)...
- M. Critical Current Density ( $i_{cr}$ )..... 14.5 ma/cm<sup>2</sup>
- N. Critical Potential ( $E_{cr}$ )..... -0.041 volt vs. S.C.E.
- O. Passive Current Density ( $i_p$ )..... cannot be determined
- P. Anodic Dissolution Tafel Slope...

Q. Transpassive Tafel Slope(s).....  
(identify each)

R. Additional Comments.....

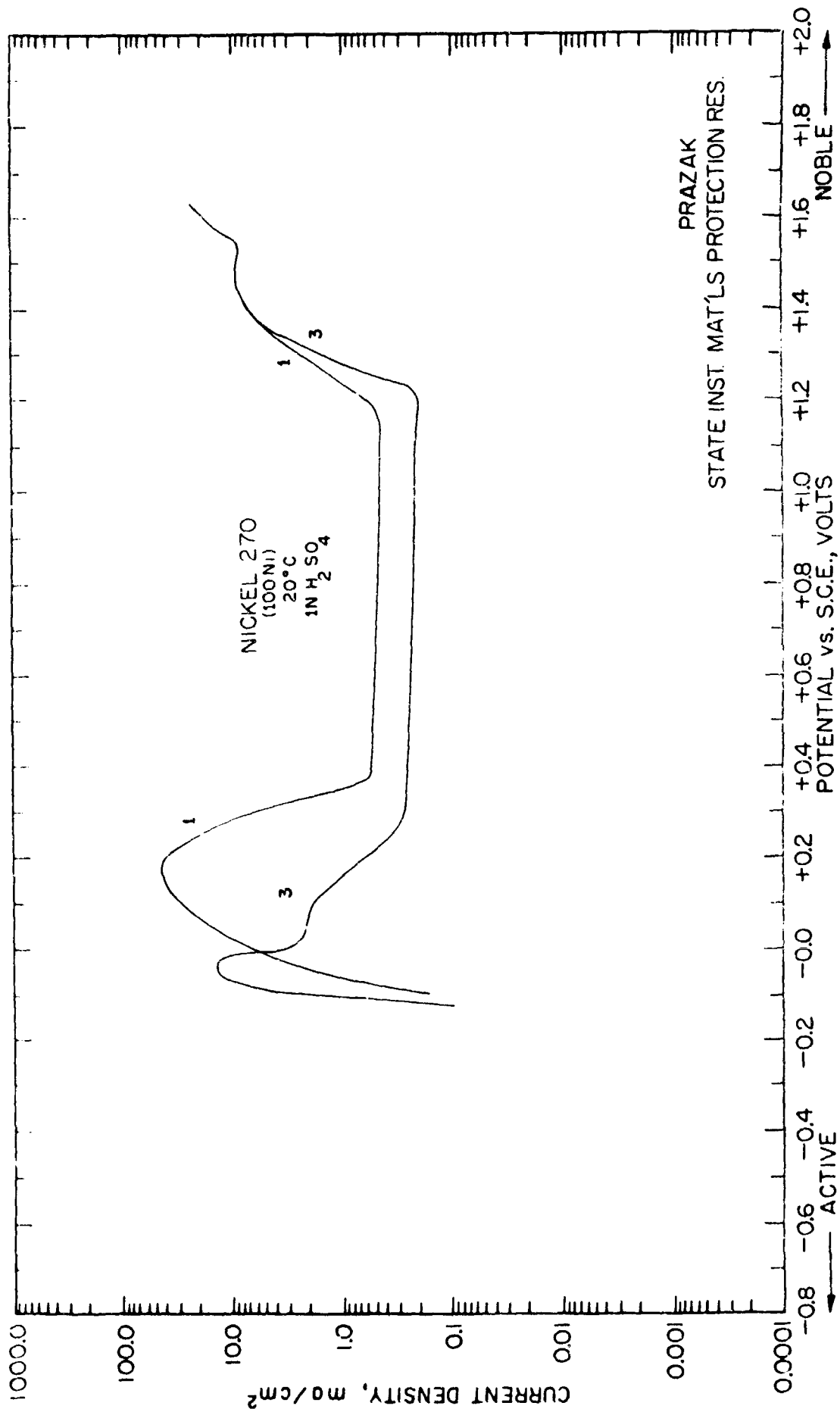
Name Ing. M. Pražák CSc.

Address State Institute for Material

Protection Research,

Prague 7

Czechoslovakia



Potentiostatic Anodic Polarization Curves for Nickel 270  
(Heat NP-327-H) Air-Saturated, 1N H<sub>2</sub>SO<sub>4</sub> at 20 °C.

James W. Johnson  
Department of Chemical Engineering  
University of Missouri at Rolla  
Rolla, Missouri 65401

T-3L ROUND-ROBIN ANODIC POLARIZATION  
TEST PROGRAM DATA SHEET

- A. Specimen..... Nickel 270 (NP-385-H)
- B. Electrolyte..... 1N H<sub>2</sub>SO<sub>4</sub>
- C. Temperature, °C..... 25°C
- D. Saturating Gas..... H<sub>2</sub>
- E. Specimen Preparation.... Mounted in Teflon holder, smoothed with  
belt sander (wet), final polished with No. 600 grit wet hand grinder.
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_
- F. Specimen Activation Treatment..... Etched 30 seconds in 1N H<sub>2</sub>SO<sub>4</sub>
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_
- G. Reference Electrode..... Mercurous sulfate (1N H<sub>2</sub>SO<sub>4</sub>)
- H. Cathode Potential..... -0.011 volt (rest pot. of Ni)
- I. Corrosion Potential..... <0.087 volt
- J. Anodic Potential Sweep Rate (if continuous)... \_\_\_\_\_
- K. Anodic Potential Increment (if stepwise)..... galvanostatic measurement
- L. Time at Each Anodic Potential (if stepwise)... 1 hour
- M. Critical Current Density ( $i_{cr}$ )..... 4 to 5 ma/cm<sup>2</sup>
- N. Critical Potential ( $E_{cr}$ )..... 0.2 volt (NHS)
- O. Passive Current Density ( $i_p$ )..... Not determined
- P. Anodic Dissolution Tafel Slope... 0.062 volt/decade

Q. Transpassive Tafel Slope(s)..... 1st: about 0.120 volt/decade  
(identify each)

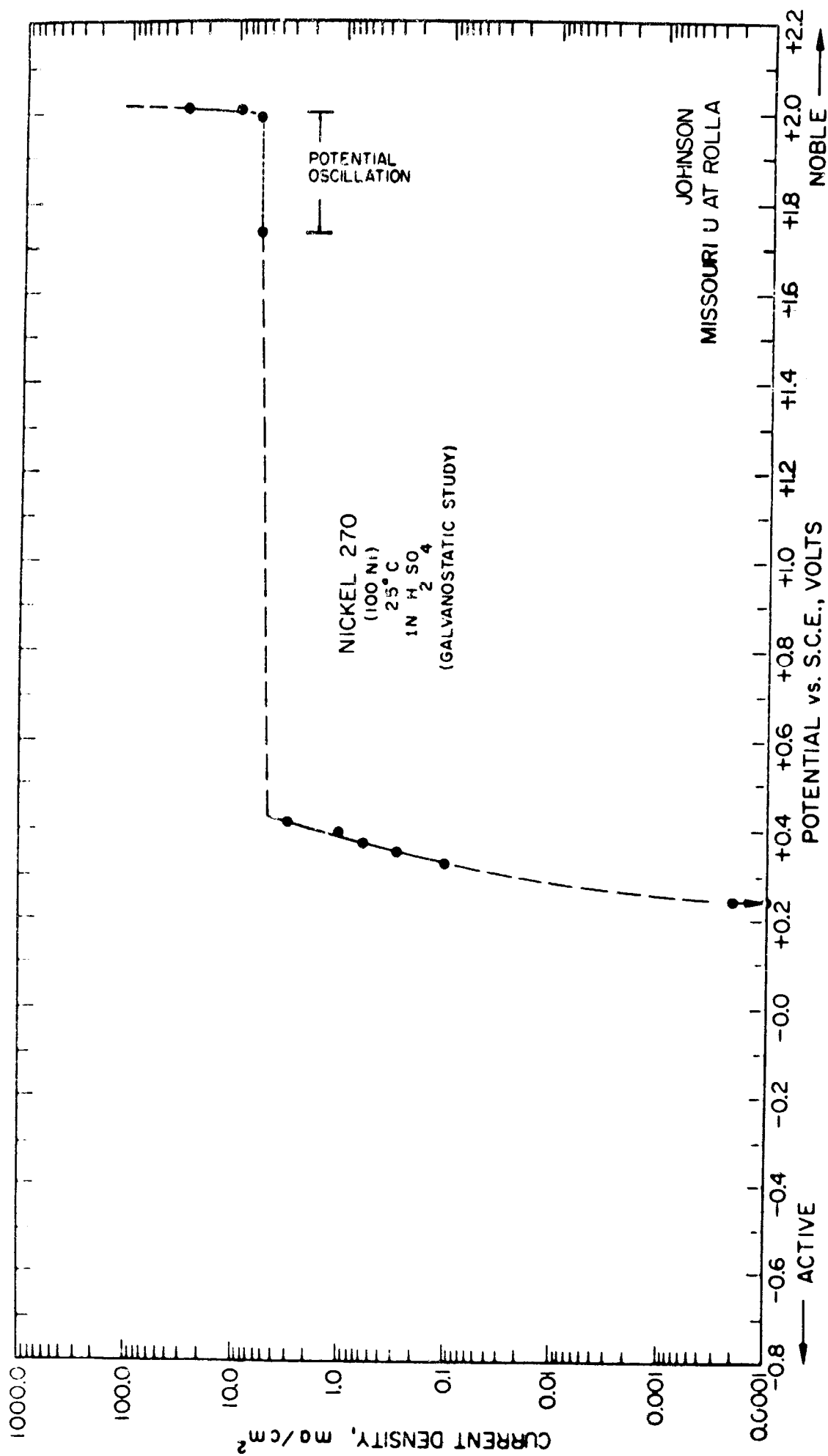
R. Additional Comments..... Experiments were made  
galvanostatically, so that "active-to-passive" and  
"passive" region could not be determined.

Name James W. Johnson

Address Department of Chemical Engineering

University of Missouri at Rolla

Rolla, Missouri 65401



Galvanostatic Anodic Polarization Curve for Nickel 270  
 (heat NP-385-H) in H<sub>2</sub>SO<sub>4</sub> at 25 °C.

Unclassified

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