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Objective: To calculate the equilibrium phase fraction vs. temperature diagram calculation for Alloy 22 base metal and Alloy 686 weld filler metal at their nominal compositions.

Software: THERMOCALC Version N

Database: Thermotech Ni-Data Version 5

Alloy Composition (in Wt%):

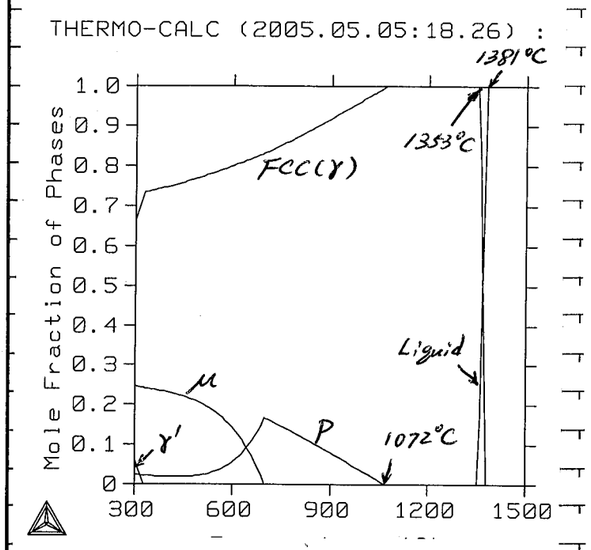
Alloy 22 – Ni – 21.25 Cr – 13.5 Mo – 3 W – 4 Fe – 0.01 Co – 0.03 Si – 0.004 C

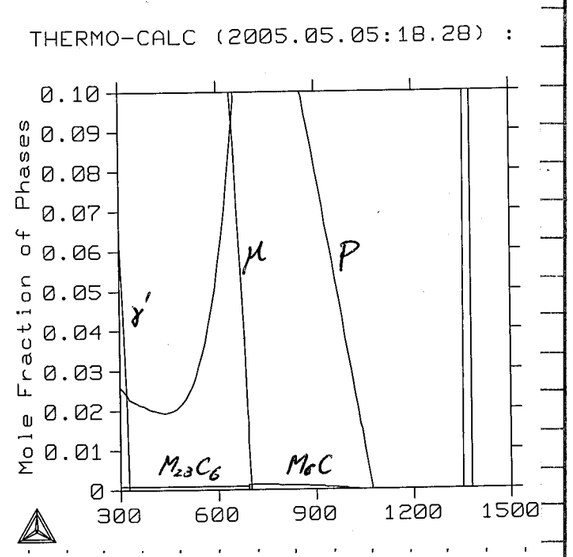
Alloy 686 – Ni – 21 Cr – 16 Mo – 3.7 W – 4 Fe – 0.01 Co – 0.03 Si – 0.004 C

Note that the mean values of the major alloy elements (Cr, Mo, W), as specified in ASTM B575, are assumed whereas the contents of other elements are based on the nominal values from typical commercial product.

Results:

a. Phase fraction vs. temperature diagrams for Alloy 22





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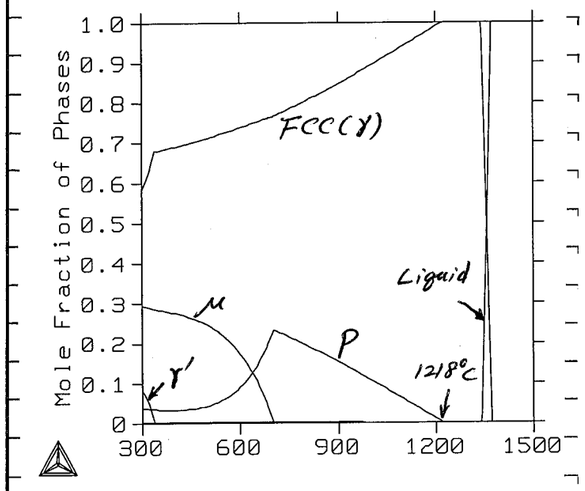
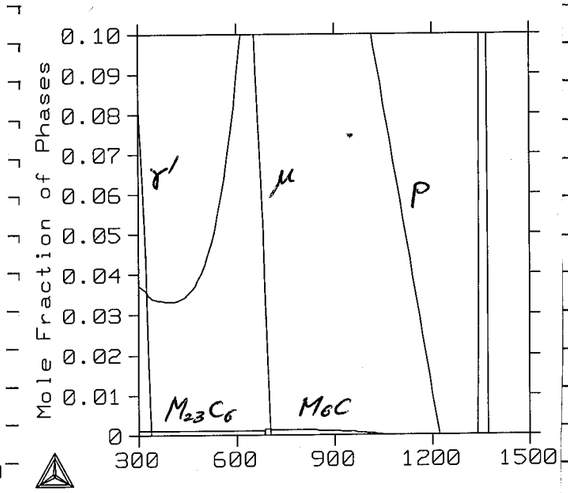
b. Phase fraction vs. temperature diagrams for Alloy 686





c. Phase contents and compositions in Alloy 22 at 870°C

Calculated Phase Contents and Compositions in Alloy 22 at 870 °C

Phase	Amount		Chemical Content (wt%)							
	wt%	mole%	Ni	Cr	Mo	W	Fe	Co	Si	C
γ	88.43	90.48	62.13	21.55	10.07	1.78	4.42	0.011	0.034	0.001
P	11.46	9.42	28.28	18.99	39.56	12.39	0.78	0.005	—	—
M_6C	0.11	0.10	24.75	14.25	52.27	4.92	1.21	0.002	0.001	2.58

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THERMALLY AGED PROCEDURE

Solution Annealing Treatments of Alloy 22 Welds

Quanity/Specimens = (6) Specimens total (3) from GTAW Labeled TL
(3) from GMAW Labeled ML

OVEN= Lindberg Model # 909172 SN# 51333

OVEN SETPOINT= 1326 °C

OVEN TEMPERATURE= 1306.7 °C

Measurement taken with OMEGA MICROPROCESSOR THEMOMETER MODEL# HH22
SN#= T94140 CAL= 11/4/04 DUE= 5/4/05
Thermocouple=
SN#= 326 Cal = 2/6/05 Due = 8/6/05

AMOUNT OF TIME = 1 hr. - 2 hr - 4 hr.

DETAILS=

	GTAW	GMAW
1 hr. Specimens - Sample ID	TL1	& ML1
2 hr. Specimens - Sample ID	TL2	& ML2
4 hr. Specimens - Sample ID	TL3	& ML3

* Note: Specimens In 4 hr. Test Are Nonexistant they Desinagnates To Powder Foam

water Quenches

GTAW HT# 2277-3-3292 filler WN813
GMAW HT# 2277-3-3292 filler WN813 XX1977B611

5/3/05

See NB# 636 pg# 18-56 for material Info

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THERMALLY AGED PROCEDURE

Solution Annealing Treatment of Alloy 22 Welds

Quanity/Specimens = (6) Specimens (3) from GTAW Labeled TL #10
(3) from GMAW Labeled ML

OVEN= Lindberg Model # 909172 SN# 51333

OVEN SETPOINT= 1289 °C

OVEN TEMPERATURE= 1276.1 °C

Measurement taken with OMEGA MICROPROCESSOR THEMOMETER MODEL# HH22
SN#= T94140 CAL= 11/4/04 DUE= 5/4/05
Thermocouple=
SN#= 326 Cal = 2/6/05 Due = 8/6/05

AMOUNT OF TIME = 1 hr. - 2hr - 4 hr.

DETAILS=

	GTAW	GMAW
1 hr Specimens - Sample ID	TL4	& ML4
2 hr. Specimens - Sample ID	TL5	& ML5
4 hr. Specimens - Sample ID	TL6	& ML6 #10

* Note: Added Larger Crevice Specimen #10 from GTAW (bottom of the welded plate)

water Quenches

GTAW HT# 2277-3-3292 filler WN813
GMAW HT# 2277-3-3292 filler WN813 XX1977B611

5/3/05

See NB# 636 pg# 18-56 for Material Info

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THERMALLY AGED PROCEDURE

Solution Annealing Treatments Alloy 22 Welds

Quanity/Specimens = (6) Specimens Plus (3) Block Welded Crevice Blanks GTAW #7 #8 #11 (bottom of the welded plate)

OVEN= Lindberg Model #909172 SN# 51333

OVEN SETPOINT= See Details

OVEN TEMPERATURE= See Details

Measurement taken with OMEGA MICROPROCESSOR THEMOMETER MODEL# HH22
SN#= T94140 CAL= 11/4/04 DUE= 5/4/05

Thermocouple=
SN#= 326 Cal = 2/6/05 Due = 8/6/05

AMOUNT OF TIME = See Details

DETAILS=

	Test Temperature set point	Oven Temp.	Time/Duration	Specimen GTAW GMAW GTAW
1.)	1247°C	1226.3°C	4 hrs	TR1-MR1 #7
2.)	1198°C	1177.2°C	4 hrs	TR2-MR2 #8
3.)	1149°C	1124.8°C	4 hrs.	TR3-MR3 #11

Water Quenched

GTAW : HT 2277-3-3292 WN 813 filler
GMAW = HT 2277-3-3292 WN 813 filler X1977B611

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See NB# 636 Pg# 18-56 for material Info

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THERMALLY AGED PROCEDURE

Solution Annealing Treatments Alloy 22 welds

Quanity/Specimens = (4) Specimens GTAW #5, #6, #9, #12 (bottom of the welded plate)

OVEN= Lindberg Model #909172 SN# 51333

OVEN SETPOINT= 1171°C

OVEN TEMPERATURE= 1126.6°C

Measurement taken with OMEGA MICROPROCESSOR THEMOMETER MODEL# HH22
SN#= T-94140 CAL= 5/12/05 DUE= 11/11/05

Thermocouple=
SN#= 326 Cal = 2/6/05 Due = 8/6/05

AMOUNT OF TIME = See Details

DETAILS= All Specimens At Same Temperature Placed All Into Oven took 4 min To Return to oven Setpoint. Started Procedure

Specimen #	Time/Duration
#5	15 min
#6	30 min
#9	1 hrs.
#12	2 hrs.

H_2O Quenched

5/13/05

GTAW = HT# 2277-3-3292 . WN 813 filler

See NB# 636 Pg# ~~18-56~~ for Material Info

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Project No.
Book No.
TITLE Microstructure Analysis of Alloy 22 Welds for SSRT Testing

From Page No.

1. Alloy 22 Weld materials (see notebook # 685, pages 7 & 25)

GTAW material (14B/C, 15B/C)

Alloy 22 base metal heat 2277-3-3292

Filler heat WN813

GMAW material (10 A/B, 16 A/B)

Alloy 22 base metal heat 2277-3-3292

Filler heat WN813 / XX1977 BG 11

2. Precipitate volume fraction measurements

Metallurgical samples were prepared using standard polishing techniques and etched in a solution of 5g Oxalic acid in 95 ml of 37% HCl solution for a few seconds.

Amount of precipitates was measured from optical micrographs using imaging analysis software along the centerline of the fusion zone.

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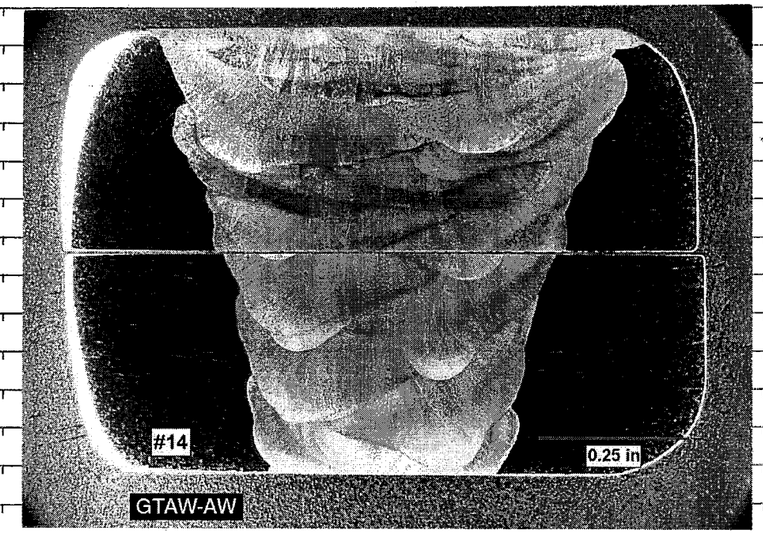
3. Results

a. GTAW As-Welded



GTAW(As-Welded)
(#14B&C)

Image	% Precip
M5405	0.53
M5406	0.53
M5407	0.6
M5408	0.4
M5409	0.33
M5410	0.36
M5411	0.45
M5412	0.28
M5413	0.18
M5414	0.34
M5415	0.24
M5416	0.37
M5417	0.18
M5418	1.21
M5419	0.15
M5420	0.37
M5421	0.15
M5422	0.45
M5423	0.26
M5424	0.21
M5425	0.45
M5426	0.27
M5427	0.29

Summary Statistics	
Mean	0.37
Standard Deviation	0.22
Minimum	0.15
Maximum	1.21
Sum	8.60
Count	23

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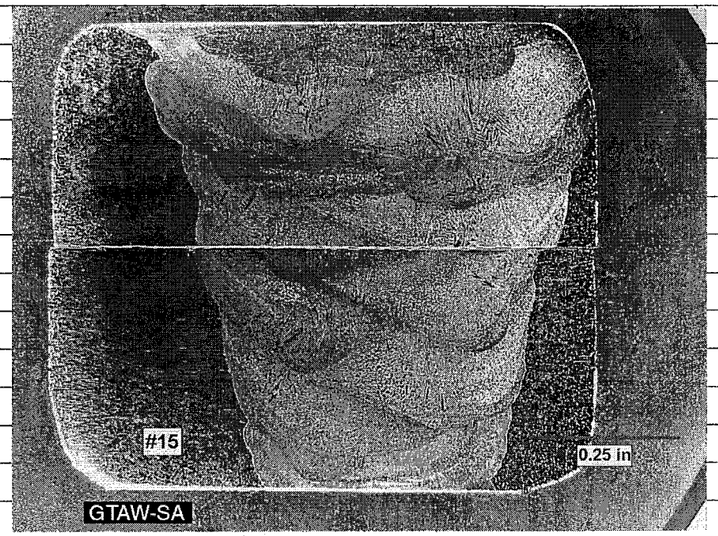
b. GTAW Solution-Annealed at 1125°C /20 min



GTAW(1125C/20min)
(#15B&C)

Image	% Precip
M5428	0.3
M5429	0.38
M5430	0.43
M5431	0.36
M5432	0.12
M5433	0.11
M5434	0.21
M5435	0.13
M5436	0.33
M5437	0.29
M5438	0.2
M5439	0.24
M5440	0.27
M5441	0.18
M5442	0.17
M5443	0.08
M5444	0.15
M5445	0.18
M5446	0.16
M5447	0.71
M5448	0.21
M5449	1.06

Summary Statistics	
Mean	0.28
Standard Deviation	0.22
Minimum	0.08
Maximum	1.06
Sum	6.27
Count	22

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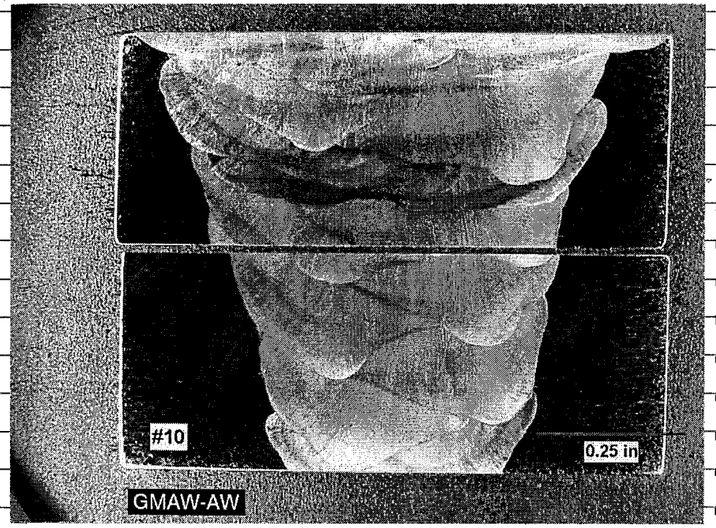
c. GMAW As-Welded



GMAW(As-Welded)
(#10A&B)

Image	% Precip
M5379	0.59
M5380	0.79
M5381	0.5
M5382	0.56
M5383	0.32
M5384	0.56
M5385	1.45
M5386	0.28
M5387	0.7
M5388	0.57
M5389	0.64
M5390	1.08
M5391	1.44
M5392	1.71
M5393	0.53
M5394	0.57
M5395	0.91
M5396	1.08
M5397	0.45
M5398	1.19
M5399	0.52
M5400	1.33
M5401	0.84
M5402	0.55
M5403	0.18
M5404	0.34

Summary Statistics	
Mean	0.76
Standard Deviation	0.40
Minimum	0.18
Maximum	1.71
Sum	19.68
Count	26

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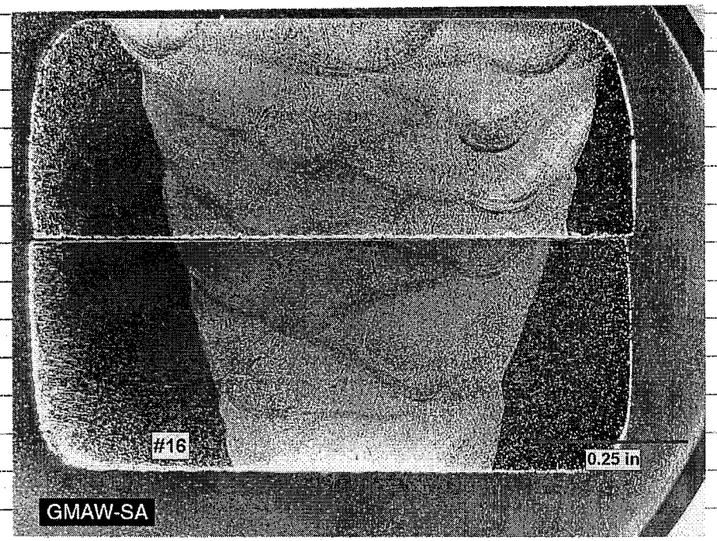
d. GMAW Solution-Annealed at 1125°C / 20 min



GMAW(1125C/20min)
(#16A&B)

Image	% Precip
M5508	1.35
M5509	0.65
M5510	0.47
M5511	0.28
M5512	0.25
M5513	0.38
M5514	0.27
M5515	0.15
M5516	0.4
M5517	0.31
M5518	0.63
M5519	0.49
M5520	0.25
M5521	0.3
M5522	0.23
M5523	0.17
M5524	0.24
M5525	0.28
M5526	0.49
M5527	0.57
M5528	1.1
M5529	1.02

Summary Statistics	
Mean	0.47
Standard Deviation	0.32
Minimum	0.15
Maximum	1.35
Sum	10.28
Count	22

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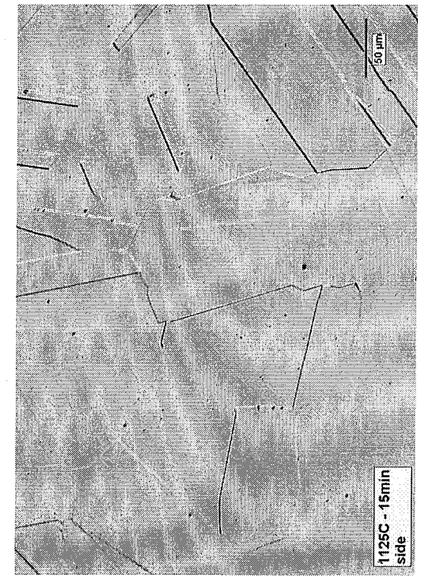
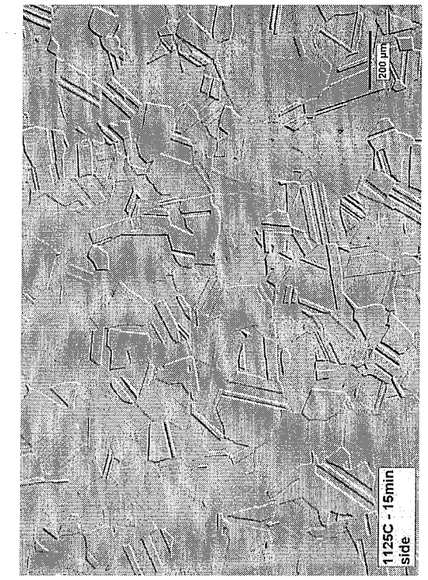
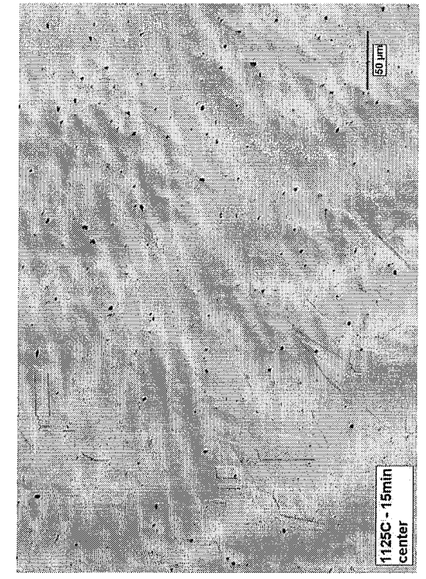
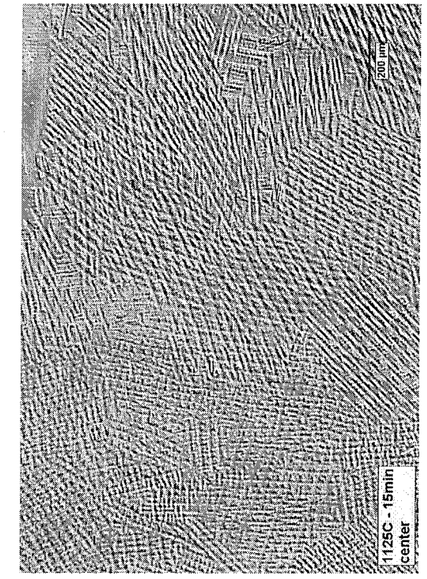
From Page No. (See notebook #636, pages 18-56 for material info.)

1. General microstructure from representative optical photographs showing changes inside weld fusion zone (center) and in the base metal (side)









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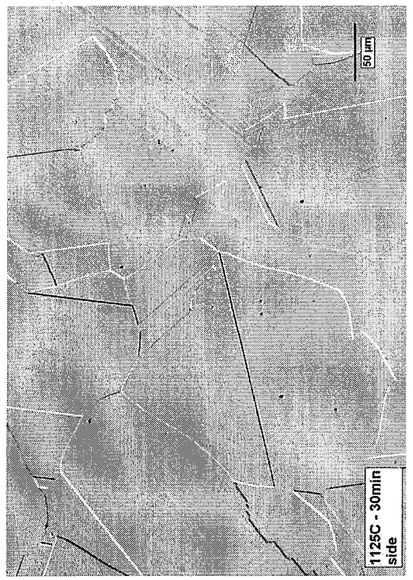

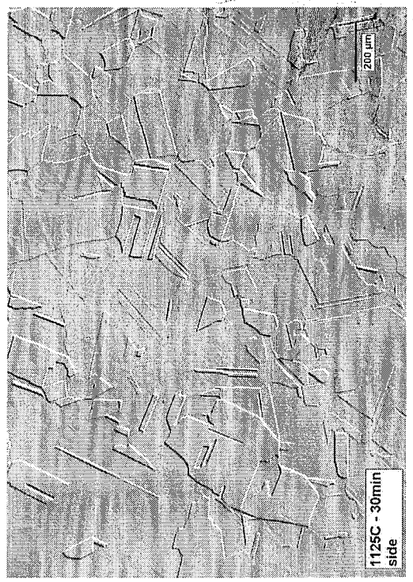

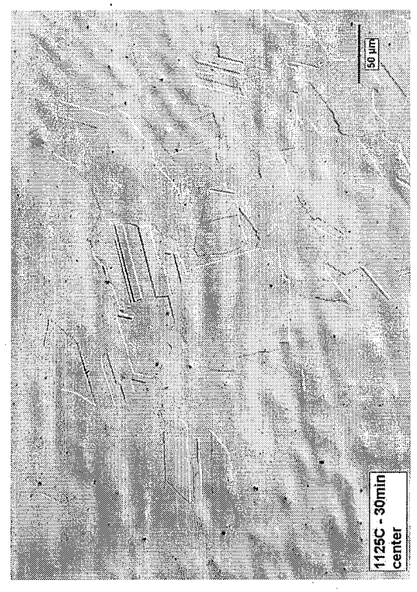

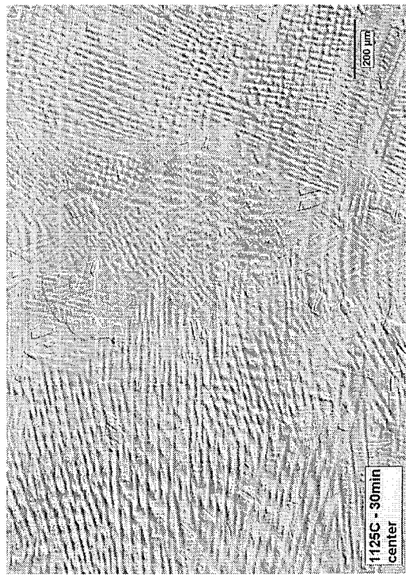

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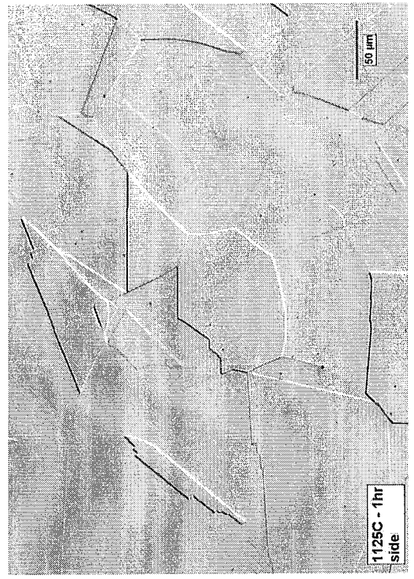

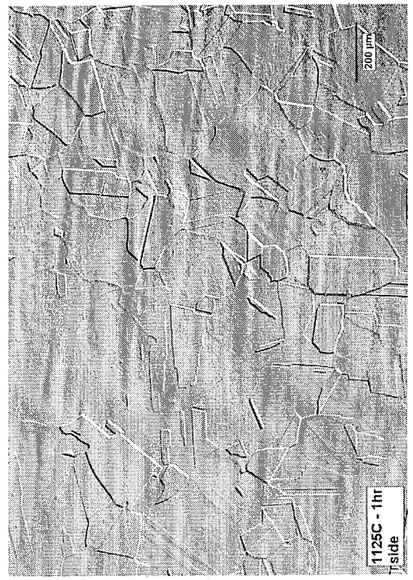

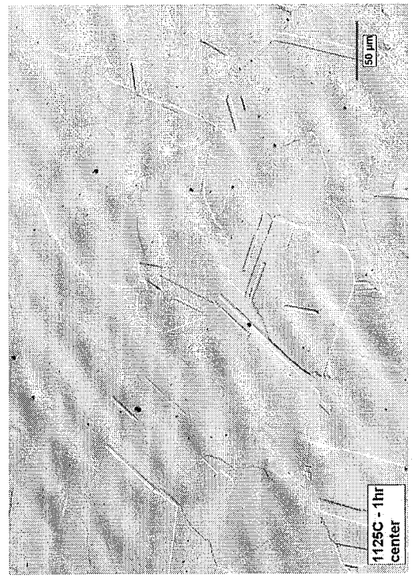

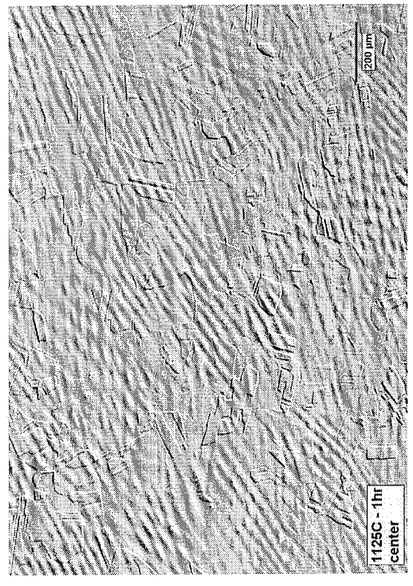

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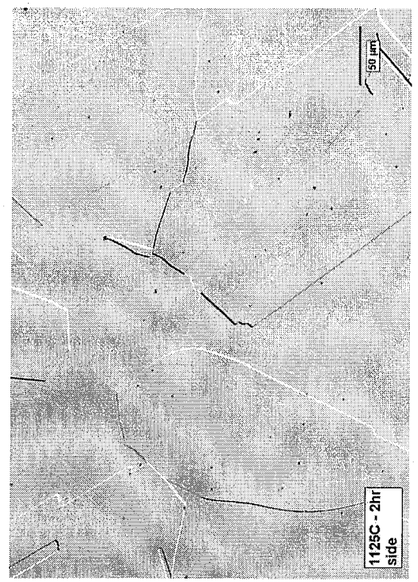

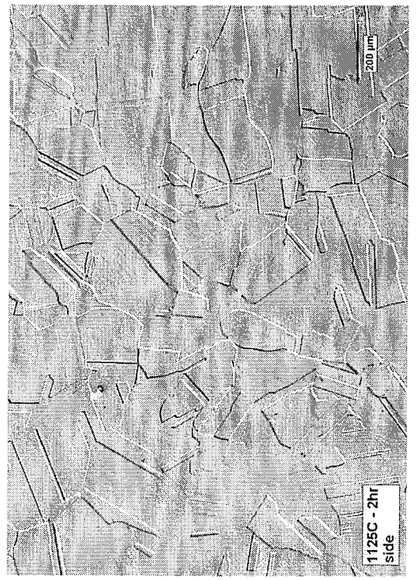

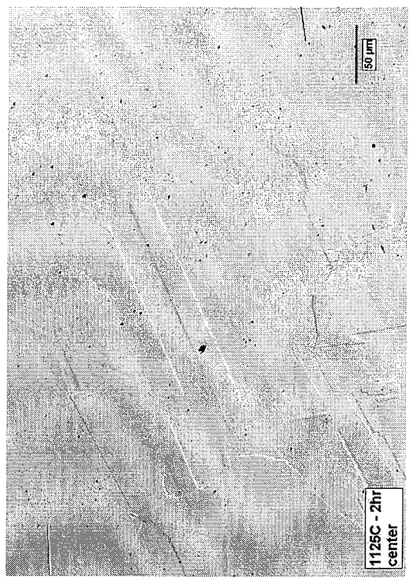

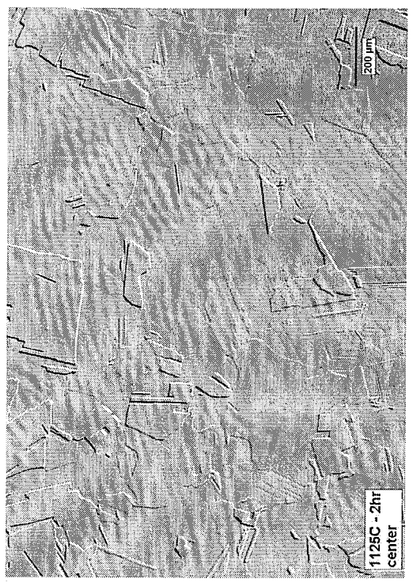

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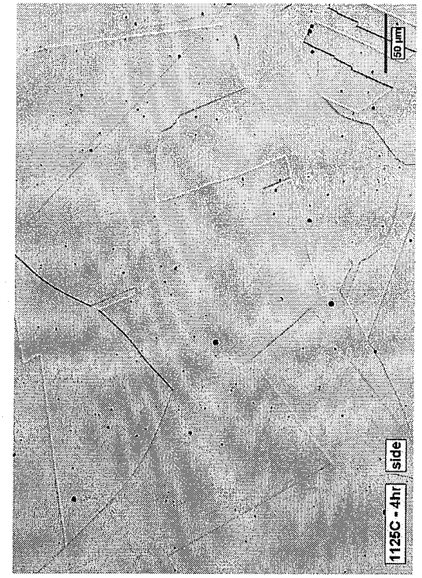

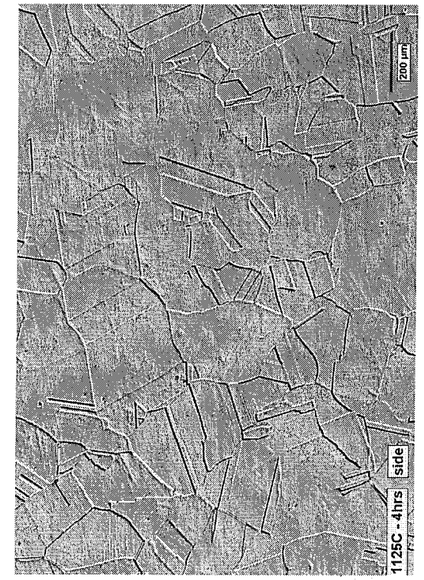

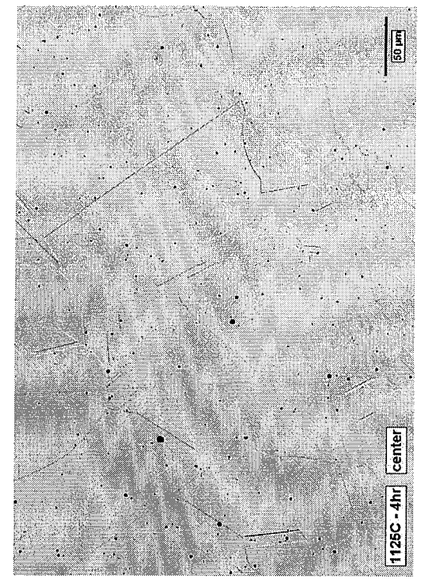

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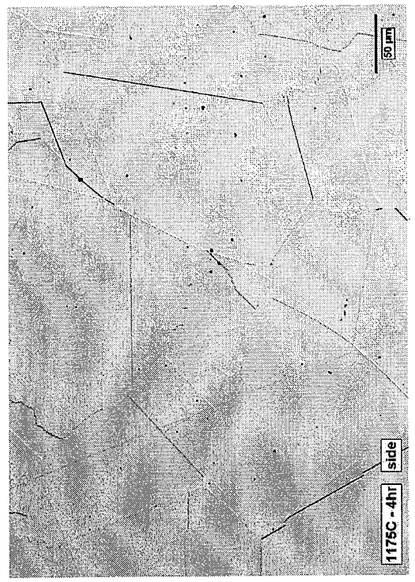

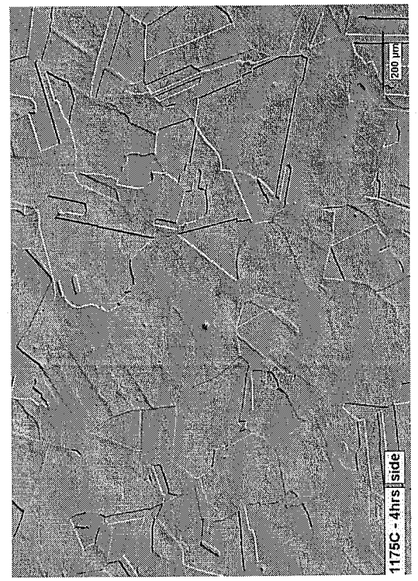

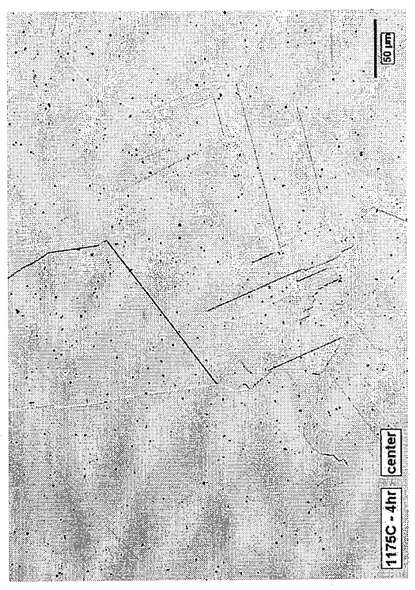

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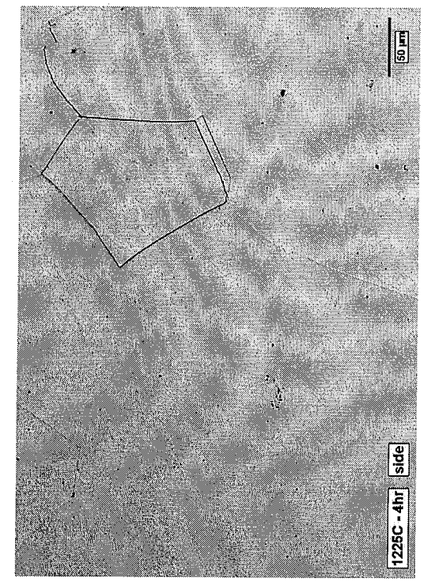

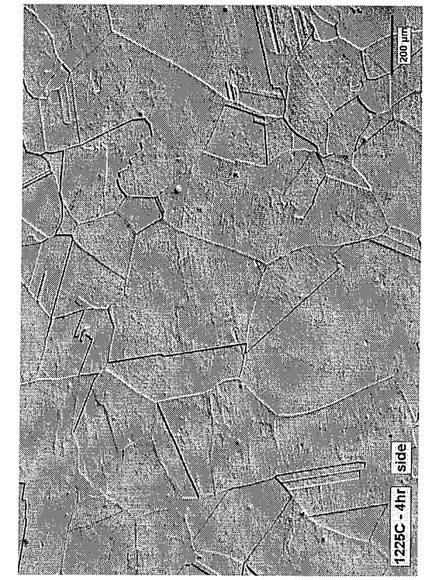

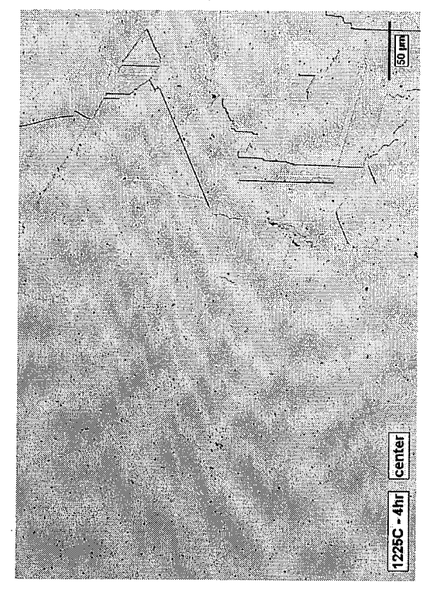

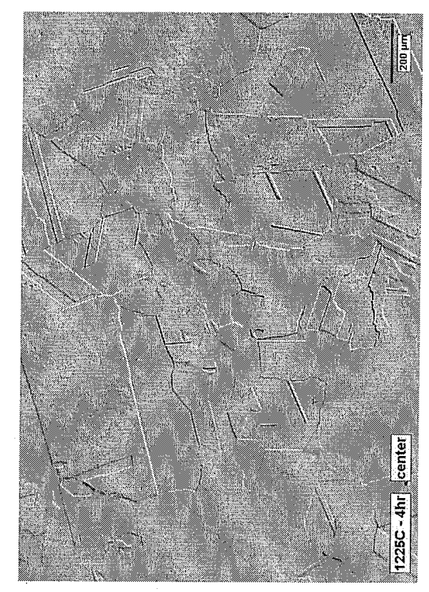

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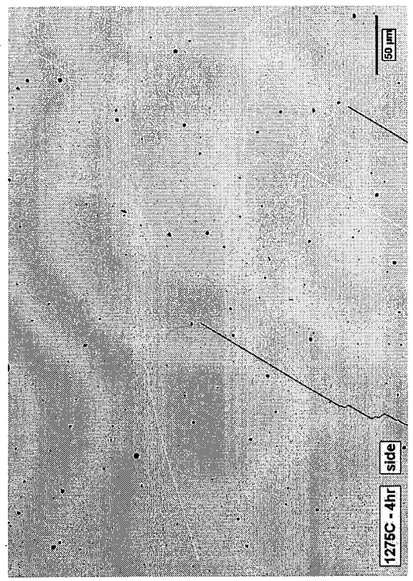

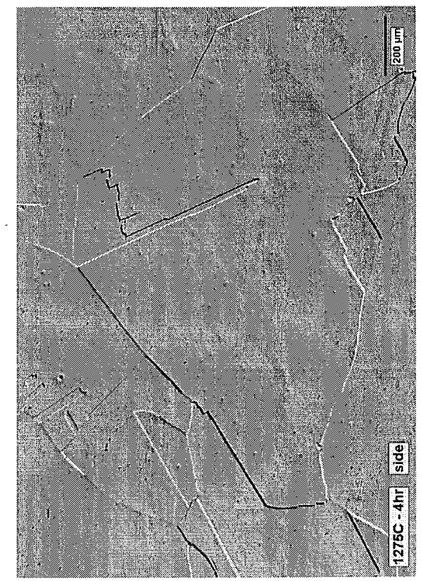

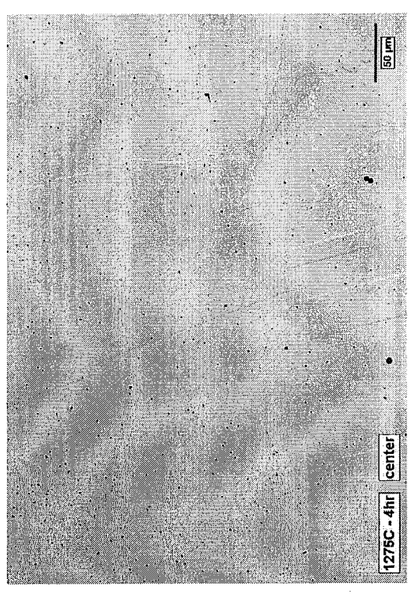

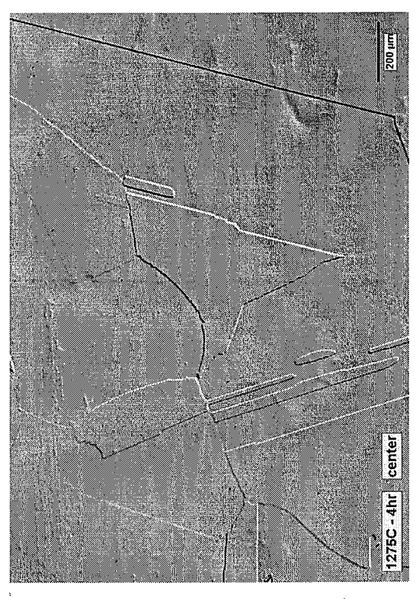

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2. Precipitate volume fraction measurements using imaging analysis software along the centerline of fusion zone

15min @ 1125C

M5634	0.56
M5635	0.47
M5636	0.64
M5637	0.83
M5638	0.46
M5639	0.54
M5640	0.64
M5641	0.25
M5642	1
M5682	0.31
M5683	0.62
M5684	0.53
M5685	1.07
M5686	1.2

Summary Statistics	
Mean	0.65
Standard Deviation	0.28
Minimum	0.25
Maximum	1.20
Sum	9.12
Count	14

30min @ 1125C

M5643	0.83
M5644	0.5
M5645	0.42
M5646	0.34
M5647	0.45
M5648	0.23
M5649	0.39
M5650	0.36
M5651	0.31
M5652	0.39
M5653	0.33
M5654	0.39
M5655	1.18

Summary Statistics	
Mean	0.47
Standard Deviation	0.26
Minimum	0.23
Maximum	1.18
Sum	6.12
Count	13

1hr @ 1125C

M5656	0.6
M5657	0.69
M5658	0.68
M5659	0.41
M5660	0.54
M5661	0.56
M5662	0.54
M5663	0.57
M5664	0.45
M5665	0.57
M5666	0.42
M5667	0.48
M5668	3.61

Summary Statistics	
Mean	0.54
Standard Deviation	0.09
Minimum	0.41
Maximum	0.69
Sum	6.51
Count	12

Note: The value for image M5668 is excluded for a number of void like features near the bottom of the cross section.

2hrs @ 1125C

M5669	0.71
M5670	0.57
M5671	0.4
M5672	0.3
M5673	0.29
M5674	0.27
M5675	0.39
M5676	0.55
M5677	0.26
M5678	0.32
M5679	0.25
M5680	0.34
M5681	0.66

Summary Statistics	
Mean	0.41
Standard Deviation	0.16
Minimum	0.25
Maximum	0.71
Sum	5.31
Count	13

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4hrs @ 1125C

M5687	1.02
M5688	0.21
M5689	0.4
M5690	0.34
M5691	0.32
M5692	0.25
M5693	0.21
M5694	0.14
M5695	0.33
M5696	0.31
M5697	0.26
M5698	0.33
M5699	0.83

Summary Statistics	
Mean	0.38
Standard Deviation	0.25
Minimum	0.14
Maximum	1.02
Sum	4.95
Count	13

4hrs @ 1175C

M5700	1.03
M5701	0.35
M5702	1.01
M5703	0.4
M5704	0.33
M5705	0.4
M5706	0.67
M5707	0.55
M5708	0.21
M5709	0.26
M5710	0.27
M5711	0.21
M5712	0.31

Summary Statistics	
Mean	0.46
Standard Deviation	0.28
Minimum	0.21
Maximum	1.03
Sum	6.00
Count	13

4hrs @ 1225C

M5713	0.28
M5714	0.11
M5715	0.11
M5716	0.08
M5717	0.1
M5718	0.14
M5719	0.1
M5720	0.31
M5721	0.19
M5722	0.18
M5723	0.22
M5724	0.25
M5725	0.41

Summary Statistics	
Mean	0.19
Standard Deviation	0.10
Minimum	0.08
Maximum	0.41
Sum	2.48
Count	13

4hrs @ 1275C

M5726	5
M5727	0.67
M5728	0.5
M5729	0.29
M5730	0.52
M5731	0.47
M5732	0.36
M5733	0.24
M5734	0.46
M5735	1.07
M5736	0.96

Summary Statistics	
Mean	0.55
Standard Deviation	0.27
Minimum	0.24
Maximum	1.07
Sum	5.54
Count	10

Note: The value for image M5726 is excluded for a large number of void like features near the top of the cross section.

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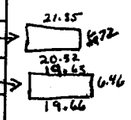
Project No.
Book No.

TITLE ASTM G28 B Immersion Corrosion Tests ~~of Solution Annealed Alloy 22 welds~~

From Page No. (see notebook # 636, pages 18-56 for materials/info)

1. Test Specimens and Procedures

Specimen	Start wt.(g)	Final wt.(g)	LxWxT (mm)
1125°C/15min	10.60793	10.60520	19.6 x 8.47 x 7.66
1125°C/30min	10.55761	10.55390	19.82 x 7.95 x 8.10
1125°C/1h	10.79150	10.78789	19.94 x 7.94 x 8.17
1125°C/2h	10.95220	10.94431	19.08 x 8.05 x 8.5
1125°C/4h	9.84040	9.82452	w = 8.32
1175°C/4h	10.06443	10.05453	w = 8.25
1225°C/4h	11.71310	11.70208	19.50 x 8.83 x 8.07
1275°C/4h	11.59295	11.55274	18.86 x 9.96 x 7.57
As Received	11.59789	11.59591	19.33 x 8.44 x 8.52



I. Test Procedures

a. All tests will be run using ASTM G28 method B for 24 hours.
b. Test specimens will be polished to 120 grit finish except one surface that contains the weld fusion zone cross section to be polished to 600 grit followed by 6 and 1 µm diamond paste and then 0.3 µm alumina paste.

II. Calibration Information:

a. Weight measurements taken with
Model# Sartorious Genius SN# 12809099 Cal= 5/11/05 Due= 11/11/05

b. Dimensions taken with
Model# 721 Starrett SN# 03031512 Cal= 3/24/05 Due= 3/24/06

c) Astm G28 Reagents
Measurements Taken with Ohaus Precision Standard scale SN# 2883 Cal 1/14/05 Due 7/14/05

$FeCl_3 \cdot 6H_2O$ Lot # 005437
$CuCl_2 \cdot 2H_2O$ Lot # 897713
Sulfuric Acid Lot # 946710
HCl Lot # 040174

* New Solution for Each Specimen

* Test specimens include both weld fusion zone and heat affected zone

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2. Results

Corrosion Rate Calculations After ASTM G28B Testing

	As-Welded	1125 C/15 min	1125 C/30 min	1125 C/1 h	1125 C/2 h
K	8.76E+04	8.76E+04	8.76E+04	8.76E+04	8.76E+04
W(g)	0.00198	0.00273	0.00371	0.00361	0.00789
A(cm^2)	7.99	7.62	7.65	7.72	7.68
T(h)	24	24	24	24	24
D(g/cm^3)	8.69	8.69	8.69	8.69	8.69
R(mm/y)	0.1040	0.1505	0.2037	0.1964	0.4313
R(mpy)	4.0968	5.9260	8.0222	7.7332	16.9855
Depth(um)	0.28	0.41	0.56	0.54	1.18
Test Surface Inspection	No Pit, Surface Etching	No Pit, Little Surface Attack	No Pit, Little Surface Attack	No Pit, Little Surface Attack	No Pit, Shallow Surface Attack Particulary on the Top and Bottom Weld Surfaces

	1125 C/4 h	1175 C/4 h	1225 C/4 h	1275 C/4 h
K	8.76E+04	8.76E+04	8.76E+04	8.76E+04
W(g)	0.01588	0.0099	0.01102	0.04021
A(cm^2)	7.48	7.39	8.02	8.12
T(h)	24	24	24	24
D(g/cm^3)	8.69	8.69	8.69	8.69
R(mm/y)	0.8922	0.5627	0.5774	2.0799
R(mpy)	35.1361	22.1606	22.7407	81.9129
Depth(um)	2.44	1.54	1.58	5.70
Test Surface Inspection	No Pit, Shallow Surface Attack Particulary on the Top and Bottom Weld Surfaces	No Pit, Shallow Surface Attack Particulary on the Top and Bottom Weld Surfaces	Multiple Pits on the Top and Bottom Weld Surfaces	Multiple Pits with Severe Surface Attack on the Top and Bottom Weld Surfaces

R(mm/y)=(K*W)/(A*T*D)
R(mpy)=R(mm/y)*(3.45E6/8.76E4)
Depth(um)=(W*10000)/(A*D)

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Revised Initial Entry for Phase Stability and Passive Film Study of Alloy 22

Title: Phase stability and passive film study of Alloy 22

Tests Performed by: Yi-Ming Pan (Div 20); Darrell Dunn and Brian Derby (Div 18)

Objectives: Evaluate the effect of fabrication processes on the microstructure of Alloy 22 and changes in the oxide film composition and structure as a function of the solution chemistry, applied potential, time, and temperature of electrochemical treatments. Aging of test specimens at 600-900 °C and solution annealing at 1100-1350 °C. Phase transformation modeling using Thermo-Calc Version N and DICTRA Version 21computer codes under CNWRA configuration control, as documented in the Software Validation Report (Pan, 2004).*

Equipments: Laboratory ovens calibrated with thermocouple and thermocouple meter; optical microscopy and image analysis system owned by Div 18 and calibrated for dimension with Clemex micrometer CL-04-114-0517; scanning electron microscopy and energy dispersive x-ray spectrometry system owned by Div 18 and calibrated for magnification and composition with NIST standard reference materials 484F and 482, respectively; X-ray photoelectron spectroscopy from outside vendor and calibrated for energy scale with pure gold and copper samples and for sputtering rate with SiO_2 layer on Si substrate.

Materials: Alloy 22, heat to be identified in each test, under mill-annealed, welded, and heat-treated conditions, and after various electrochemical treatments

Measurement Parameters: precipitate identification and volume fraction, temperature, and thickness, composition, and chemical state of the oxide films

Required Level of Accuracy: Temperature ± 5 °C, time of exposure ± 1 minute.

Uncertainty and Sources of Error: Several precipitate phases with similar compositions and structures form in Alloy 22. The presence of oxide film that formed after air exposure may influence characterization of the passive film arising from electrochemical treatments.

* Pan, Y.-M. Software Validation Report for Thermo-Calc Version N and DICTRA Version 21. San Antonio, Texas: CNWRA, 2004.

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Project No.
Book No.
TITLE Cover Letter for Shipping Alloy 22 Specimens POF01 and POF02A for XPS Analysis

From Page No.

CNWRA *A center of excellence in earth sciences and engineering*
6220 Culebra Road · San Antonio · Texas, U.S.A. 78228-5166

May 18, 2005

Mr. Carl Steinke
RBD Enterprises
2437 NE Twin Knolls Drive, Suite 2
Bend, OR 97701

Reference: Requisition # 05021257

Dear Carl:

Enclosed please find two Alloy 22 specimens (POF01 and POF02A) submitted for surface analyses with x-ray photoelectron spectroscopy. The objective of this investigation is to characterize the passive surface films for determination of the thickness, composition, and oxidation state of the films. For each specimen, a wide-energy survey will be conducted on the as-received surface to determine surface elemental composition. The survey will be followed by high resolution scans combined with in-depth ion sputtering to determine concentration depth profile. The high-resolution spectra will be curve fitted to determine the oxidation state of nickel, chromium, and molybdenum, as well as the chemical-bonding environment for oxygen. Since the thickness of the films is expected to be 10-20 nm, a 9-second sputtering cycle used previously is appropriate. Note that the instrument needs to be calibrated for binding energy and sputtering rate. The calibration information will be provided to me along with the results from the passive film analysis.

Please call me if you have any questions. Thank you for your assistance.

Sincerely,

Yi Pan

Yi-Ming Pan
Center for Nuclear Waste Regulatory Analyses
Southwest Research Institute
Tel: 210-522-6640
Fax: 210-522-5184
e-mail: ypan@swri.org

Note: see detailed electrochemical treatment info in notebook # 637 pages 38-39 for POF01 and pages 42-43 for POF02A. POF01 was electrochemically treated in simulated concentrated water at 100 mVSCE and POF02A at 400 mVSCE.

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TITLE XPS Calibration
Project No.
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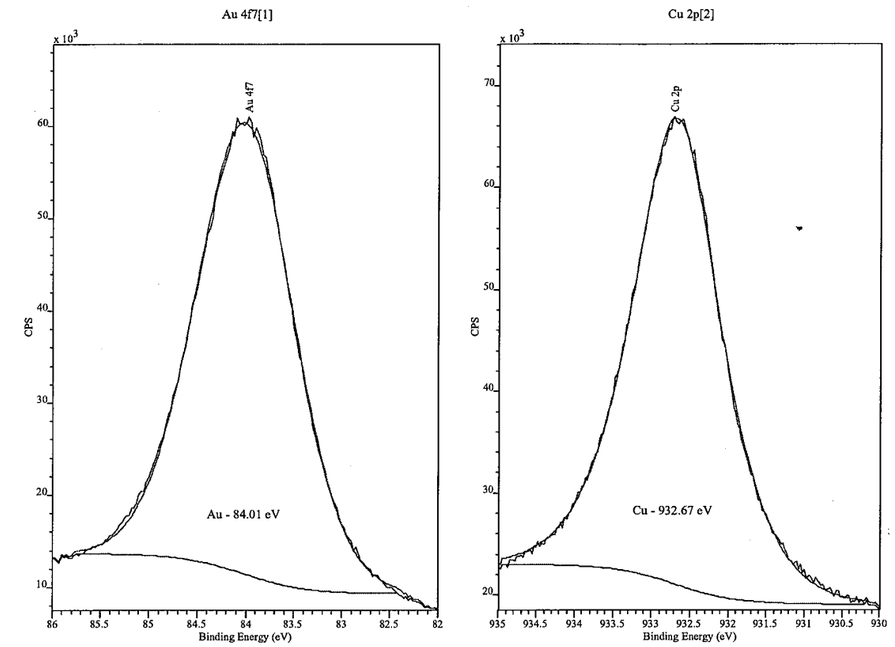
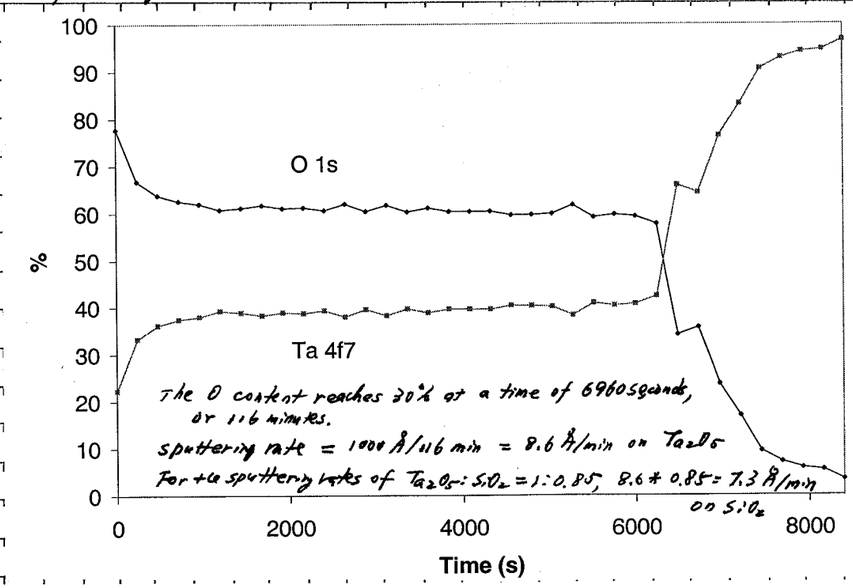
From Page No. 1. Binding energy



2. Sputtering rate



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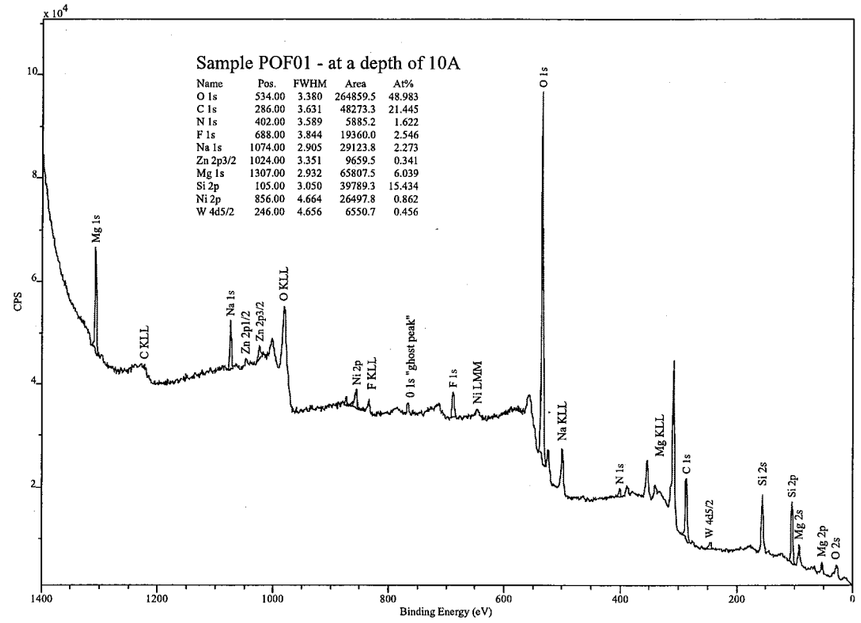
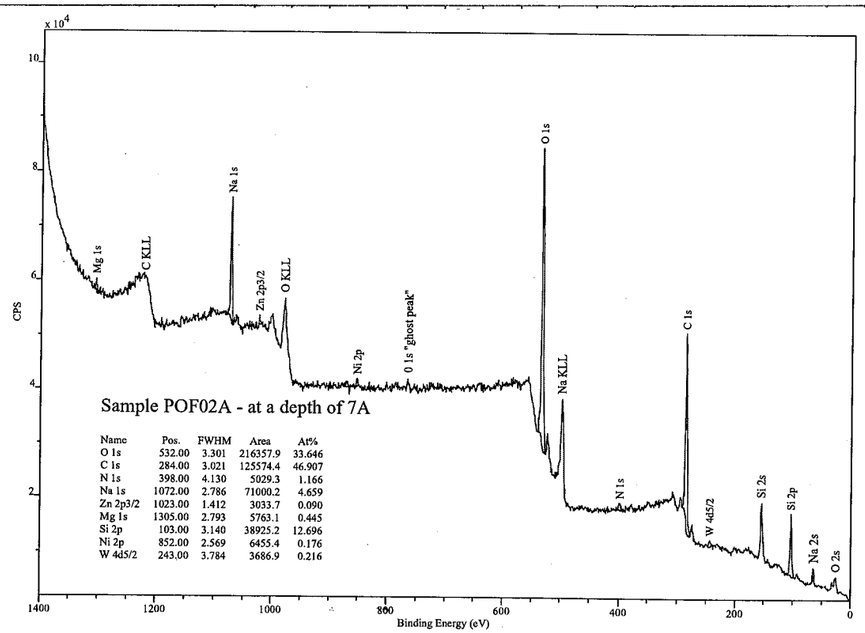
Book No.

TITLE XPS Analysis of Alloy 22 Specimens POF01 and POF02A

From Page No.

1. Wide-energy survey of the initial surfaces





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2. Elemental concentration data for POF02A

Etch Time (s)	Depth (Å)	C 1s %	Cr 2p %	Mg 1s %	Mo 3d %	Na 1s %	Ni 2p %	O 1s %	Si 2p3 %	W 4d5 %
0	0.0	64.24	0.00	0.39	0.00	4.60	0.46	23.38	6.84	0.08
60	7.3	51.27	0.00	0.53	0.00	5.03	0.22	31.48	10.93	0.54
120	14.6	41.00	0.00	0.47	0.00	5.49	0.35	38.42	13.77	0.50
180	21.9	33.87	0.25	0.82	0.00	5.17	0.45	43.74	15.21	0.49
240	29.2	30.03	0.60	0.40	0.00	5.21	0.24	46.42	16.63	0.46
300	36.5	27.40	0.50	0.49	0.00	4.89	0.42	48.38	17.44	0.47
360	43.8	24.45	0.80	0.44	0.00	5.24	0.33	50.05	18.20	0.49
420	51.1	23.13	0.90	0.45	0.00	5.40	0.30	51.07	18.16	0.59
480	58.4	23.14	0.86	0.55	0.00	5.42	0.44	50.78	18.36	0.45
540	65.7	20.07	0.76	0.46	0.17	5.56	0.60	53.39	18.45	0.54
600	73.0	19.59	0.94	0.66	0.16	5.93	0.61	53.20	18.44	0.47
660	80.3	17.91	1.14	0.67	0.16	6.15	0.73	53.63	19.14	0.49
720	87.6	17.89	1.09	0.57	0.18	6.39	0.87	54.60	17.84	0.57
780	94.9	16.68	1.61	0.59	0.31	6.62	1.02	54.65	17.97	0.55
840	102.2	16.33	1.53	0.53	0.34	6.38	1.43	55.28	17.65	0.54
900	109.5	16.46	1.94	0.37	0.33	6.55	1.34	55.34	17.18	0.50
960	116.8	14.88	2.13	0.57	0.43	7.05	1.60	54.94	17.89	0.49
1020	124.1	15.35	2.31	0.74	0.54	7.27	2.10	54.14	16.99	0.56
1080	131.4	15.07	2.55	0.48	0.58	7.34	2.38	54.33	16.68	0.59
1140	138.7	14.63	2.85	0.52	0.79	7.66	2.76	53.63	16.51	0.65
1200	146.0	13.21	2.92	0.78	0.80	7.69	3.56	53.74	16.60	0.71
1260	153.3	13.51	2.78	0.77	0.86	7.46	4.48	53.83	15.70	0.61
1320	160.6	12.95	3.60	0.41	1.05	7.65	4.77	52.73	16.11	0.72
1380	167.9	12.36	4.21	0.54	1.24	7.96	5.85	51.64	15.46	0.74
1440	175.2	12.07	4.48	0.43	1.20	8.03	6.42	52.04	14.54	0.79
1500	182.5	12.17	4.80	0.57	1.47	7.91	7.16	50.55	14.47	0.89
1560	189.8	11.83	5.46	0.57	1.68	7.39	8.09	50.50	13.58	0.89
1620	197.1	10.88	5.44	0.60	1.84	7.44	8.96	50.46	13.43	0.95
1680	204.4	10.81	5.91	0.55	2.07	7.02	9.35	49.26	14.06	0.97
1740	211.7	10.47	6.45	0.48	2.30	6.87	10.85	49.08	12.71	0.78
1800	219.0	11.02	6.77	0.52	2.64	6.86	11.48	47.34	12.32	1.04
1860	226.3	11.07	6.45	0.57	2.64	7.30	13.20	46.18	11.51	1.09
1920	233.6	11.19	6.77	0.33	2.64	6.86	13.02	45.96	12.13	1.09
1980	240.9	9.69	7.00	0.56	3.11	6.67	15.85	44.96	11.03	1.14
2040	248.2	9.46	7.62	0.69	3.41	6.72	16.69	43.28	10.74	1.37
2100	255.5	10.58	7.75	0.62	3.45	6.49	17.48	41.68	10.65	1.30
2160	262.8	9.44	8.45	0.00	3.65	6.77	18.91	41.50	9.97	1.31
2220	270.1	9.31	8.64	0.00	4.04	5.99	19.95	40.52	10.06	1.49
2280	277.4	9.11	8.78	0.00	4.09	5.64	20.47	40.58	9.63	1.69
2340	284.7	10.28	9.33	0.00	4.38	5.48	21.49	38.42	9.00	1.61
2400	292.0	9.44	9.46	0.00	4.61	5.53	23.02	38.06	8.15	1.73
2460	299.3	10.14	9.96	0.00	4.82	5.52	23.27	36.18	8.41	1.70
2520	306.6	10.10	9.89	0.00	5.09	5.42	25.35	34.10	8.30	1.74
2580	313.9	8.13	10.16	0.00	5.22	5.55	26.68	34.02	8.54	1.71
2640	321.2	8.62	10.86	0.00	5.31	4.82	28.02	33.03	7.61	1.73
2700	328.5	8.70	10.57	0.00	5.85	5.13	28.08	32.99	6.79	1.89
2760	335.8	8.29	11.02	0.00	6.03	4.36	29.77	32.11	6.54	1.89
2820	343.1	8.48	11.38	0.00	6.18	4.37	31.23	30.29	5.94	2.13
2880	350.4	7.14	12.09	0.00	6.61	4.39	31.56	29.81	6.12	2.28
2940	357.7	7.99	12.07	0.00	6.88	4.30	32.48	29.36	4.54	2.38
3000	365.0	6.78	12.01	0.00	6.89	4.33	33.31	28.95	5.49	2.24
3060	372.3	8.51	12.86	0.00	7.20	4.28	33.83	26.07	4.88	2.36
3120	379.6	7.48	12.37	0.00	7.34	4.36	36.48	25.69	4.02	2.28
3180	386.9	7.94	13.03	0.00	7.34	3.62	37.42	24.74	3.69	2.20
3240	394.2	7.67	13.26	0.00	7.55	3.73	36.94	24.84	3.59	2.42
3300	401.5	7.39	13.25	0.00	7.66	3.19	37.92	24.35	3.52	2.73
3360	408.8	6.88	13.46	0.00	8.15	3.55	39.75	22.39	3.26	2.54
3420	416.1	7.45	14.23	0.00	8.00	3.21	38.94	23.21	2.49	2.46
3480	423.4	7.91	13.72	0.00	8.56	3.18	39.76	22.02	2.31	2.54
3540	430.7	6.47	13.75	0.00	8.40	3.38	40.03	21.46	3.52	3.00
3600	438.0	7.09	14.66	0.00	8.60	3.18	41.15	20.14	2.60	2.57
3660	445.3	8.28	13.38	0.00	8.17	2.98	41.25	19.95	3.52	2.47
3720	452.6	6.30	14.48	0.00	8.93	3.00	41.31	19.87	3.44	2.66
3780	459.9	8.04	14.58	0.00	9.10	2.80	42.15	18.89	1.74	2.71
3840	467.2	8.12	14.58	0.00	9.34	2.65	43.04	18.39	1.24	2.64
3900	474.5	6.35	15.42	0.00	9.37	2.52	43.75	18.27	1.64	2.68
3960	481.8	6.36	15.33	0.00	9.22	2.72	44.51	17.21	1.77	2.87
4020	489.1	6.72	15.80	0.00	9.29	2.31	43.43	17.48	1.75	3.22
4080	496.4	5.98	15.64	0.00	9.24	1.75	44.24	17.63	2.21	3.31

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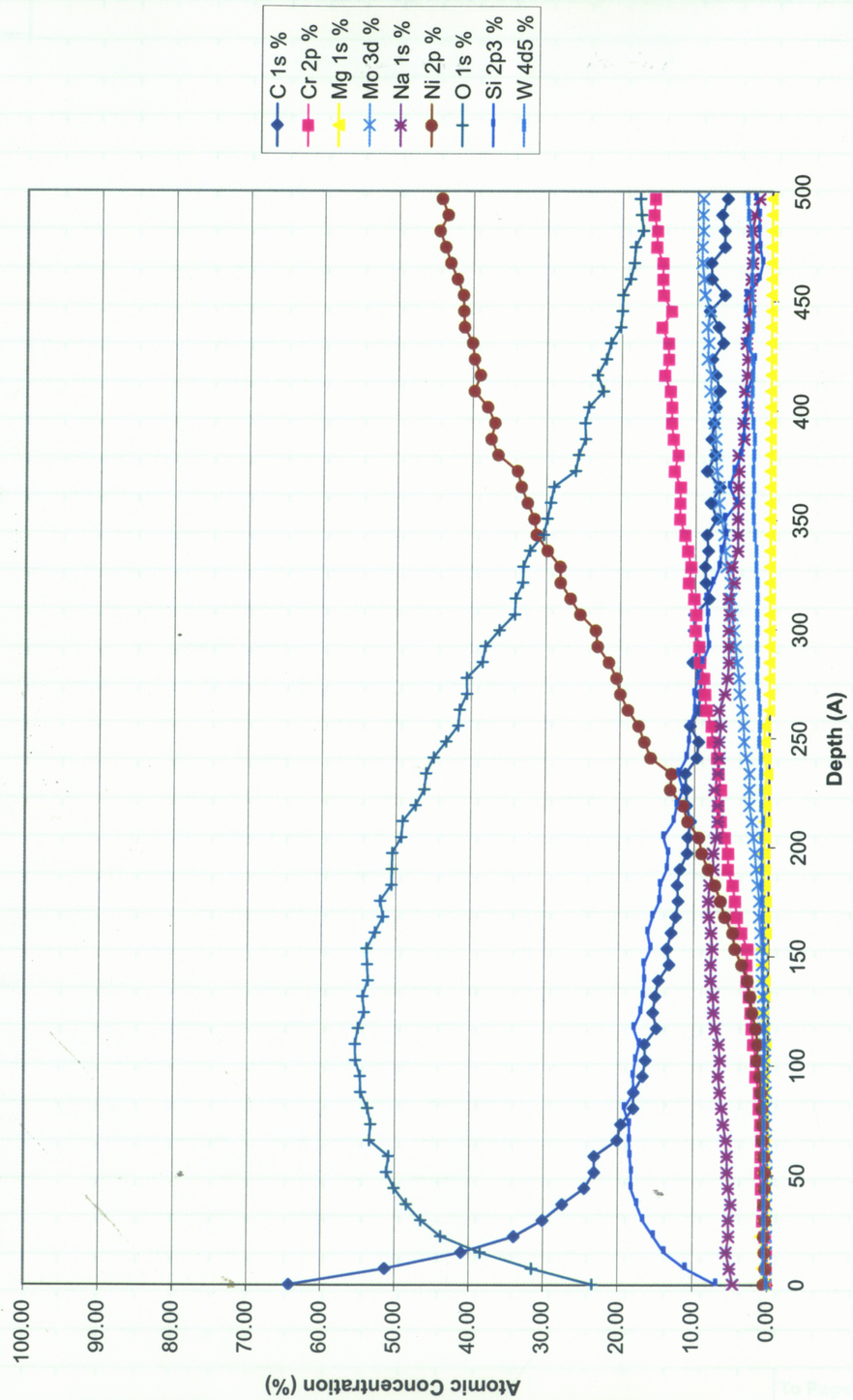

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3. Chemical state data for POF02A

Etch Time (sec)	Depth (Å)	C 1s %	Cr metal %	Cr2O3 %	Mg 1s %	Mo IV %	Mo O2 %	Mo V %	Mo VI %	Mo metal %	Na 1s %	Ni metal %	Ni2O3 %	NiO %	H2O %	O2- %	OH- %	Si 2p3 %	W 4d5 %
0	0	64.95	0.12	0.31	0.39	0.05	0.03	0.04	0.02	0.03	4.65	0.07	0.31	0.12	7.77	0.00	14.13	6.92	0.08
60	7	51.11	0.06	0.24	0.53	0.04	0.05	0.04	0.01	0.04	5.02	0.01	0.18	0.16	9.12	0.04	21.70	10.90	0.53
120	15	40.89	0.11	0.21	0.47	0.01	0.04	0.03	0.04	0.07	5.48	0.08	0.12	0.19	13.20	0.00	24.82	13.74	0.50
180	22	34.42	0.16	0.28	0.83	0.01	0.04	0.04	0.03	0.07	5.26	0.09	0.13	0.10	20.87	0.00	21.76	15.45	0.49
240	29	30.14	0.14	0.32	0.40	0.00	0.03	0.04	0.04	0.02	5.23	0.06	0.15	0.12	26.17	0.19	19.80	16.69	0.46
300	37	27.83	0.21	0.27	0.50	0.01	0.04	0.03	0.03	0.06	4.97	0.07	0.16	0.18	28.64	0.00	18.82	17.71	0.48
360	44	24.43	0.23	0.31	0.44	0.02	0.02	0.04	0.02	0.06	5.24	0.10	0.15	0.16	31.15	0.00	18.94	18.19	0.49
420	51	23.29	0.33	0.54	0.46	0.02	0.02	0.00	0.04	0.05	5.44	0.09	0.10	0.09	32.47	0.00	18.18	18.29	0.59
480	58	23.26	0.31	0.53	0.55	0.00	0.03	0.03	0.04	0.07	5.45	0.15	0.10	0.14	31.98	0.00	18.44	18.45	0.45
540	66	20.28	0.31	0.44	0.47	0.01	0.05	0.02	0.04	0.08	5.62	0.22	0.07	0.15	35.31	0.00	17.75	18.64	0.54
600	73	19.76	0.38	0.55	0.66	0.00	0.03	0.05	0.05	0.06	5.98	0.15	0.00	0.20	34.21	0.44	18.39	18.60	0.48
660	80	18.22	0.53	0.57	0.68	0.03	0.03	0.01	0.04	0.10	6.26	0.18	0.05	0.23	33.54	0.00	19.55	18.26	0.50
720	88	18.31	0.43	0.59	0.59	0.00	0.06	0.05	0.05	0.10	6.54	0.24	0.07	0.25	34.67	0.57	18.65	18.57	0.57
780	95	17.24	0.61	0.77	0.61	0.00	0.08	0.04	0.06	0.12	6.84	0.50	0.10	0.21	33.87	0.00	19.84	18.26	0.55
840	102	16.89	0.68	0.78	0.55	0.01	0.07	0.03	0.04	0.14	6.60	0.54	0.11	0.29	35.35	0.85	18.24	18.26	0.55
900	110	16.84	0.75	0.98	0.38	0.01	0.10	0.05	0.04	0.19	6.70	0.70	0.19	0.39	33.40	0.98	20.20	17.57	0.51
960	117	15.14	0.92	1.10	0.58	0.01	0.10	0.05	0.04	0.24	7.18	0.72	0.06	0.48	32.91	1.20	20.57	18.20	0.50
1020	124	15.61	1.09	1.24	0.75	0.05	0.12	0.02	0.04	0.30	7.40	0.93	0.21	0.51	32.00	0.87	21.01	17.28	0.57
1080	131	15.39	1.15	1.30	0.49	0.00	0.12	0.06	0.06	0.35	7.49	1.16	0.19	0.50	32.05	1.16	20.90	17.03	0.60
1140	139	15.00	1.44	1.53	0.53	0.02	0.16	0.07	0.04	0.38	7.86	1.43	0.06	0.69	29.65	0.82	22.71	16.93	0.67
1200	146	13.40	1.53	1.52	0.79	0.02	0.16	0.01	0.04	0.49	7.80	1.76	0.47	0.80	29.38	1.11	23.16	16.85	0.72
1260	153	13.97	1.56	1.50	0.80	0.04	0.19	0.05	0.05	0.53	7.71	2.00	0.36	0.93	31.40	0.29	21.79	16.23	0.63
1320	161	13.34	1.85	1.84	0.42	0.00	0.27	0.05	0.06	0.66	7.88	2.28	0.37	1.15	28.82	1.46	22.22	16.60	0.74
1380	168	12.64	2.08	2.00	0.55	0.02	0.24	0.04	0.04	0.75	8.14	2.65	0.20	1.11	30.66	0.03	22.28	15.81	0.76
1440	175	12.49	2.28	1.98	0.44	0.04	0.28	0.06	0.04	0.85	8.31	3.01	0.35	1.43	27.07	1.53	23.97	15.05	0.81
1500	183	12.50	2.48	2.05	0.58	0.02	0.36	0.07	0.02	0.95	8.12	3.46	0.66	1.63	26.42	1.49	23.42	14.86	0.92
1560	190	12.24	2.77	2.19	0.59	0.00	0.44	0.04	0.07	1.07	7.65	3.85	0.72	1.89	25.08	1.97	24.46	14.05	0.92
1620	197	11.29	3.11	2.36	0.63	0.00	0.44	0.08	0.14	1.25	7.72	4.32	0.34	2.14	26.56	2.13	22.56	13.94	0.99
1680	204	11.26	3.24	2.30	0.57	0.01	0.46	0.10	0.12	1.38	7.32	4.68	0.68	2.61	24.67	2.14	22.83	14.65	1.01
1740	212	10.95	3.56	2.26	0.51	0.00	0.53	0.05	0.12	1.58	7.19	5.45	1.31	2.35	23.47	2.05	24.52	13.28	0.82
1800	219	11.49	3.68	2.54	0.54	0.01	0.56	0.03	0.09	1.73	7.15	5.95	1.05	2.70	21.58	2.05	24.92	12.84	1.08
1860	226	11.58	4.15	2.58	0.59	0.00	0.64	0.09	0.07	1.89	7.64	6.09	1.10	3.19	23.17	1.78	22.27	12.04	1.14
1920	234	11.63	4.47	2.85	0.34	0.00	0.63	0.06	0.12	2.00	7.14	6.46	0.57	3.61	21.18	1.73	23.46	12.61	1.13
1980	241	10.28	4.68	2.77	0.59	0.01	0.68	0.08	0.08	2.23	7.08	7.39	1.46	3.73	20.70	1.88	23.42	11.71	1.21
2040	248	9.99	5.32	3.32	0.73	0.00	0.80	0.05	0.23	2.34	7.09	7.65	0.98	4.29	19.42	2.22	22.79	11.34	1.45
2100	256	11.35	5.30	2.70	0.66	0.01	0.87	0.03	0.08	2.45	6.97	8.16	0.81	4.56	17.57	2.26	23.45	11.42	1.40
2160	263	10.06	5.58	3.01	0.00	0.03	0.83	0.09	0.08	2.76	7.22	8.83	1.36	4.69	19.20	1.98	22.23	10.64	1.40
2220	270	9.94	6.02	3.21	0.00	0.00	0.93	0.07	0.09	2.97	6.40	9.74	1.76	4.01	18.38	2.09	22.05	10.74	1.59
2280	277	9.89	6.58	3.14	0.00	0.02	0.95	0.12	0.10	3.20	6.12	9.81	1.03	5.54	17.21	2.32	21.68	10.45	1.83
2340	285	11.20	6.79	3.26	0.00	0.04	1.09	0.09	0.09	3.32	5.97	10.09	0.81	5.94	15.92	1.87	21.96	9.81	1.76
2400	292	10.04	7.05	3.21	0.00	0.00	1.01	0.08	0.10	3.73	5.87	10.95	1.43	6.38	14.69	2.17	22.79	8.66	1.84
2460	299	10.82	7.04	2.91	0.00	0.00	1.01	0.23	0.02	3.70	5.87	11.14	1.74	6.10	15.96	1.85	20.82	8.97	1.82
2520	307	10.92	7.56	3.33	0.00	0.06	1.09	0.14	0.14	3.84	5.87	12.04	2.26	5.53	13.95	2.09	20.34	8.98	1.89
2580	314	8.98	7.77	3.25	0.00	0.00	1.13	0.17	0.17	4.11	6.14	12.02	1.37	7.59	13.16	1.45	21.41	9.43	1.88
2640	321	9.45	7.98	3.26	0.00	0.00	1.16	0.12	0.06	4.27	5.28	12.52	1.87	7.76	14.14	2.06	19.83	8.35	1.90
2700	329	9.33	8.59	3.36	0.00	0.00	1.32	0.03	0.11	4.61	5.50	13.18	1.67	7.39	13.76	2.44	19.40	7.28	2.03
2760	336	9.16	9.01	3.40	0.00	0.00	1.70	0.14	0.18	4.57	4.82	13.57	1.45	8.09	12.60	2.17	19.81	7.23	2.09
2820	343	9.30	8.93	3.35	0.00	0.03	1.42	0.07	0.11	4.92	4.79	14.18	1.28	8.61	12.82	2.36	18.97	6.52	2.34
2880	350	8.07	9.64	3.20	0.00	0.03	1.57	0.04	0.25	5.29	4.95	14.79	1.88	9.20	11.20	2.06	18.35	6.91	2.57
2940	358	8.92	9.74	3.27	0.00	0.00	1.69	0.07	0.21	5.30	4.80	15.43	1.75	9.37	10.85	2.03	18.86	5.07	2.66
3000	365	7.47	9.83	3.28	0.00	0.03	1.60	0.08	0.10	5.37	4.76	15.08	1.96	9.52	11.13	2.27	19.00	6.05	2.47
3060	372	9.37	10.25	3.00	0.00	0.00	1.75	0.16	0.07	5.49	4.71	15.63	1.55	9.95	9.59	1.96	18.55	5.39	2.60
3120	380	8.49	10.36	3.44	0.00	0.01	1.72	0.29	0.17	5.61	4.95	16.04	2.07	9.98	9.98	1.95	17.80	4.57	2.58
3180	387	9.13	10.77	2.80	0.00	0.00	1.63	0.28	0.00	5.89	4.16	16.93	2.80	9.68	9.45	2.14	17.56	4.24	2.53
3240	394	8.39	11.42	4.10	0.00	0.05	1.68	0.12	0.19	6.00	4.09	16.82	2.02	10.38	9.03	2.10	17.03	3.93	2.64
3300	402	8.38	11.62	3.88	0.00	0.00	1.92	0.02	0.00	6.12	3.61	17.53	1.70	10.16	8.25	2.68	17.05	3.99	3.09
3360	409	7.88	11.93	3.71	0.00	0.07	1.73	0.33	0.08	6.37	4.07	17.52	2.39	11.14	7.82	1.74	16.57	3.74	2.91
3420	416	8.38	11.87	4.22	0.00	0.05	1.91	0.07	0.13	6.36	3.62	18.02	2.15	11.45	8.15	2.16	15.88	2.80	2.77
3480	423	8.82	12.44	3.89	0.00	0.01	1.89	0.04	0.09	6.71	3.55	18.83	3.59	10.74	6.24	2.08	15.68	2.57	2.83
3540	431	7.30	12.15	3.39	0.00	0.13	1.96	0.09	0.22	6.82	3.82	18.16	1.92	11.80	7.62	2.58	14.65	3.98	3.38
3600	438	8.32	12.26	3.56	0.00	0.02	1.93	0.16	0.07	7.19	3.74	19.58	2.00	12.45	5.73	2.03	14.87	3.06	3.02
3660	445	9.62	12.28	3.09	0.00	0.03	2.01	0.11	0.20	6.80	3.46	18.59	2.38	12.01	5.74	2.26	14.45	4.09	2.87
3720	453	7.18	13.05	4.18	0.00	0.01	2.21	0.17	0.18	6.93	3.42	19.40	2.81	12.59	5.50	1.98	13.43	3.92	3.03
3780	460	9.07	12.90	3.64	0.00	0.13	1.97	0.07	0.23	7.25	3.15	19.99	3.98	11.69	5.97	2.25	12.72	1.96	3.05
3840	467	9.24	13.24	3.43	0.00	0.00	2.12	0.11	0.39	7.35	3.02	20.59	3.61	12.02	5.56	2.18	12.72	1.41	3.01
3900	475	7.25	13.82	3.95	0.00	0.01	2.03	0.16	0.07	7.72	2.87	20.79	3.55	12.52	6.02	2.20	12.10	1.88	3.06
3960	482	7.48	14.00	3.99	0.00	0.00	2.26	0.20	0.20	7.58	3.20	20.74	2.31	12.82	4.23	2.50	13.03	2.08	3.38
4020	489	7.80	13.98	4.12	0.00	0.07	2.21	0.13	0.07	7.73	2.69	20.91	3.35	12.24	3.10	2.67	13.16	2.04	3.74
4080	496	6.99	13.73	4.14	0.00	0.07	2.20	0.16	0.28	7.65	2.04	20.57	2.79	13.40	6.08	3.10	10.36	2.59	3.87

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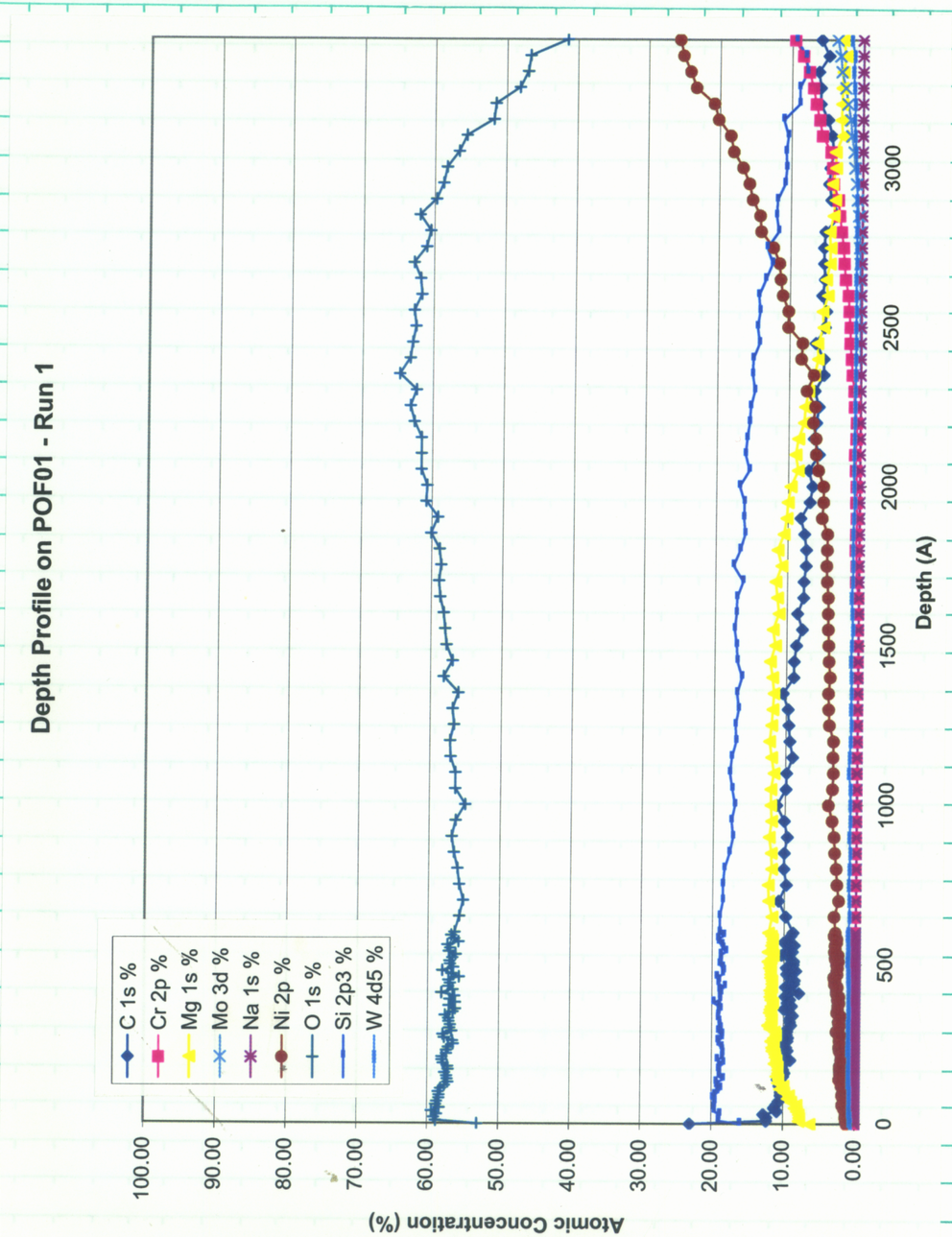
4. Elemental concentration depth profile for POF01



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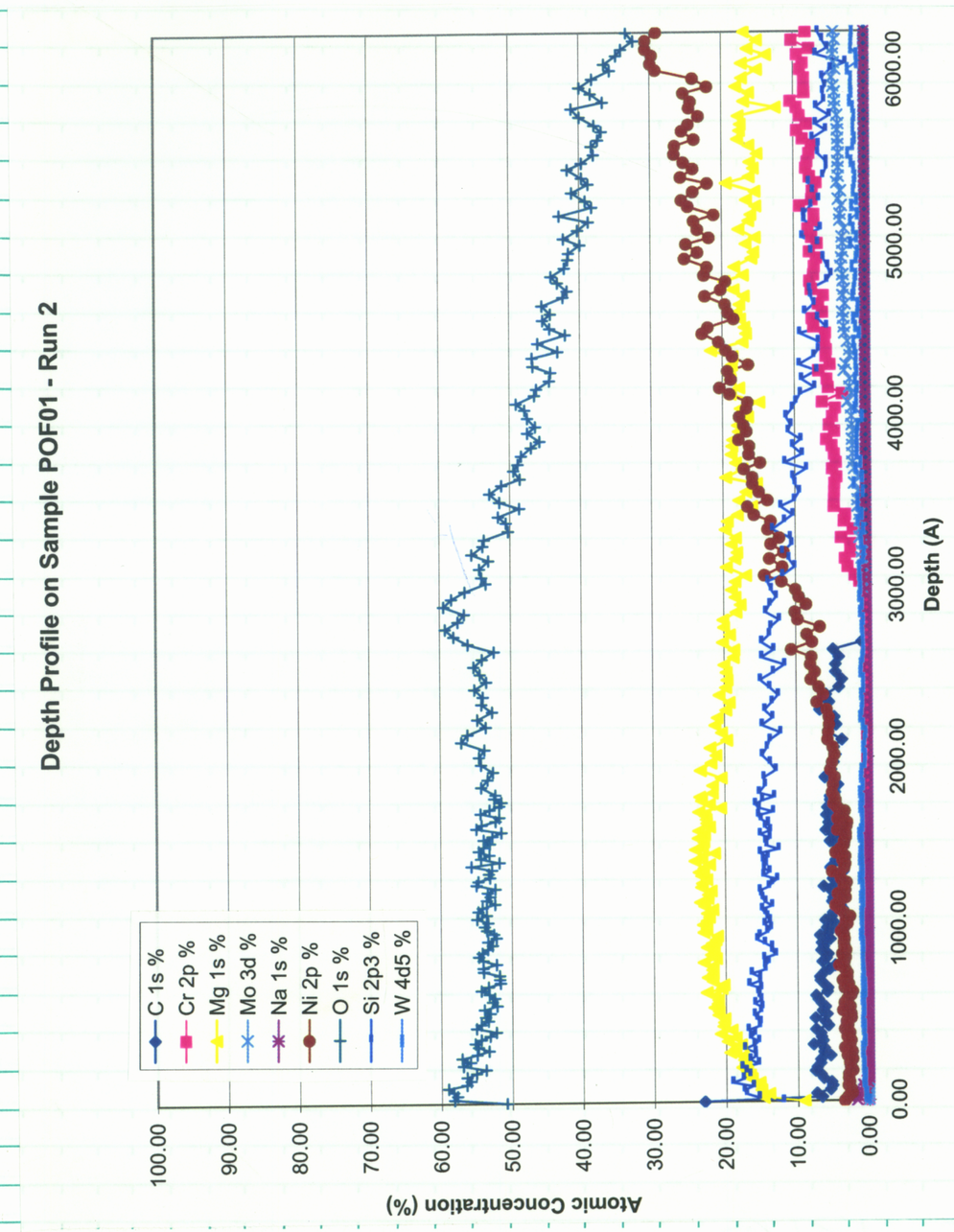

Note: The oxide film formed on POF01 is on the order of 5000-6000 Å and contains an unexpected amount of Mg. A repeated analysis is planned.

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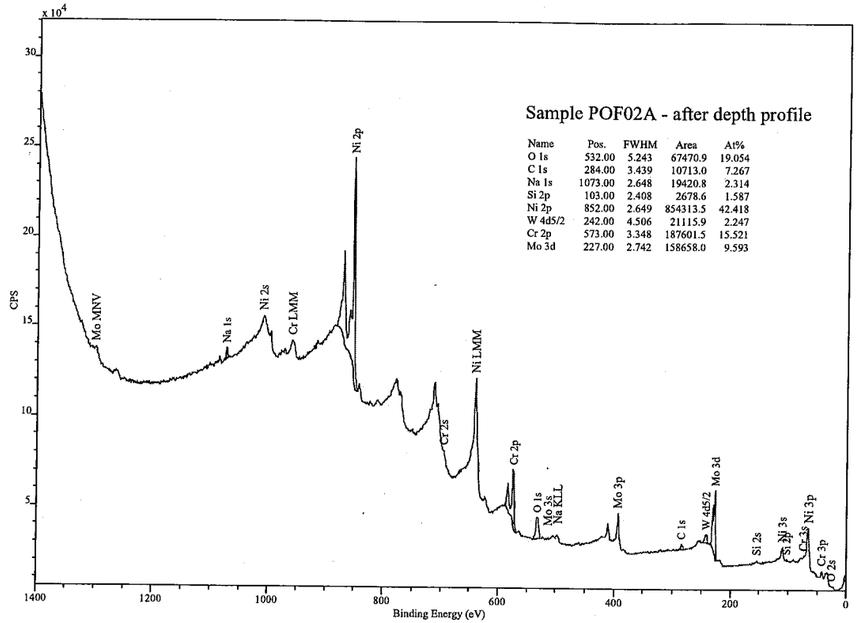
f. wide-energy survey after depth profiling



Sample POF02A - after depth profile

Name	Pos.	FWHM	Area	At%
O 1s	532.00	5.243	67470.9	19.054
C 1s	284.00	3.439	10713.0	7.267
Na 1s	1073.00	2.648	19420.8	2.314
Si 2p	103.00	2.408	2678.6	1.587
Ni 2p	852.00	2.649	854313.5	42.418
W 4d5/2	242.00	4.506	21115.9	2.247
Cr 2p	573.00	3.348	187601.5	15.521
Mo 3d	227.00	2.742	158658.0	9.593

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Project No.
Book No.
TITLE ASTM G28B Tests for Alloy 22 Weld Fusion Zone Samples

From Page No.

(See notebook #636, page 18-56 for material information)

1. Test Specimens and Procedures

ASTM G28 Method B Test Matrix for Alloy 22 Weld Fusion Zone

Specimen #	Start wt.(g)	Final wt.(g)	LxWxT (mm)
As-welded 1	4.43919	4.43801	19.11 X 5.35 X 5.07
As-welded 2	4.32671	4.32578	19.07 X 5.3 X 5.08
1125°C/20min 1	4.10150	4.10066	19.12 X 5.09 X 5.03
1125°C/20min 2	3.62533	3.62418	19.17 X 4.52 X 5.03
1125°C/1h 1	4.09022	4.08744	19.04 X 4.86 X 5.31
1125°C/1h 2	4.05133	4.04889	18.68 X 4.88 X 5.39
1125°C/4h 1	4.11439	4.11031	18.84 X 4.93 X 5.32
1125°C/4h 2	4.03599	4.03319	18.87 X 4.96 X 5.38

I. Test Procedures

a. All tests will be run using ASTM G28 method B for 24 hours.
b. Test specimens will be cut out from half of the flat crevice specimens and polished to 120 grit finish.

II. Calibration Information:

a. Weight measurements taken with
Model# Sartorious Genius SN# 12809099 Cal= 5/11/05 Due= 11/11/05

b. Dimensions taken with
Model# Starrett 721 SN# 03031512 Cal= 3/24/05 Due= 3/24/06

Solution #1 (As-welded & 20min)

$FeCl_3 \cdot 6H_2O$ = 20.158g Lot# 020683
$CuCl_2 \cdot 2H_2O$ = 14.446g Lot# 897713
476 mls DI X2
H_2SO_4 = 180 mls Lot# 946710
HCl = 36 mls Lot# 040174

Solution #2 (1 hr & 4 hr.)

$FeCl_3 \cdot 6H_2O$ = 20.101g Lot# 020683
$CuCl_2 \cdot 2H_2O$ = 14.407g Lot# 897713
476 mls DI X2
H_2SO_4 = 180 mls Lot# 946710
HCl = 36 mls Lot# 040174

Brian K Derby
8/11/05

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2. Results

Corrosion Rate Calculations After ASTM G28B Testing

	As-Welded	As-Welded	1125 C/20 min	1125 C/20 min
K	8.76E+04	8.76E+04	8.76E+04	8.76E+04
W(g)	0.00118	0.00093	0.00084	0.00115
A(cm^2)	4.53	4.50	4.38	4.12
T(h)	24	24	24	24
D(g/cm^3)	8.69	8.69	8.69	8.69
R(mm/y)	0.1095	0.0869	0.0805	0.1173
R(mpy)	4.3137	3.4206	3.1710	4.6216
Depth(um)	0.30	0.24	0.22	0.32
Test Surface Inspection	Preferential attack that results in high density small, shallow pits	Preferential attack that results in high density small, shallow pits	No pit; Shallow, isolated surface attack and morphology of grain boundary etching	No pit; Shallow, isolated surface attack and morphology of grain boundary etching

	1125 C/1 h	1125 C/1 h	1125 C/4 h	1125 C/4 h
K	8.76E+04	8.76E+04	8.76E+04	8.76E+04
W(g)	0.00278	0.00244	0.00408	0.0028
A(cm^2)	4.31	4.36	4.39	4.44
T(h)	24	24	24	24
D(g/cm^3)	8.69	8.69	8.69	8.69
R(mm/y)	0.2708	0.2349	0.3907	0.2651
R(mpy)	10.6653	9.2512	15.3853	10.4413
Depth(um)	0.74	0.64	1.07	0.73
Test Surface Inspection	No pit; Extensive intergranular attack with deeper penetrations along grain boundaries	No pit; Extensive intergranular attack with deeper penetrations along grain boundaries	No pit; Extensive intergranular attack with deeper penetrations along grain boundaries	No pit; Extensive intergranular attack with deeper penetrations along grain boundaries

R(mm/y)=(K*W)/(A*T*D)
R(mpy)=R(mm/y)*(3.45E6/8.76E4)
Depth(um)=(W*10000)/(A*D)

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Cover letter for shipping Alloy 22 specimens
TITLE POF04, 06, 09, and 10 for XPS analysis
Project No.
Book No.

From Page No.

CNWRA A center of excellence in earth sciences and engineering
6220 Culebra Road · San Antonio · Texas, U.S.A. 78228-5166

August 1, 2005

Mr. Carl Steinke
RBD Enterprises
2437 NE Twin Knolls Drive, Suite 2
Bend, OR 97701

Reference: Requisition # 05028928

Dear Carl:

Enclosed please find four Alloy 22 specimens (POF04, POF06, POF09, and POF10), in which POF10 is a duplicate of POF01 from Requisition #05021257, submitted for surface analyses with x-ray photoelectron spectroscopy. The objective of this investigation is to characterize the passive surface films for determination of the thickness, composition, and oxidation state of the films. For each specimen, a wide-energy survey will be conducted on the as-received surface to determine surface elemental composition. The survey will be followed by high resolution scans combined with in-depth ion sputtering to determine concentration depth profile. The high-resolution spectra will be curve fitted to determine the oxidation state of nickel, chromium, and molybdenum, as well as the chemical-bonding environment for oxygen. Note that the instrument needs to be calibrated for binding energy and sputtering rate. The calibration information will be provided to me along with the results from the passive film analysis.

Please call me if you have any questions. Thank you for your assistance.

Sincerely,

Yi Pan

Yi-Ming Pan
Center for Nuclear Waste Regulatory Analyses
Southwest Research Institute
Tel: 210-522-6640
Fax: 210-522-5184
e-mail: ypan@swri.org

Note: Electrochemical treatments of the Alloy 22 specimens are documented in notebook #637. POF04 - pages 46-47, POF06 - pages 50-51, POF09 - pages 58-59, POF10 - pages 60-61.

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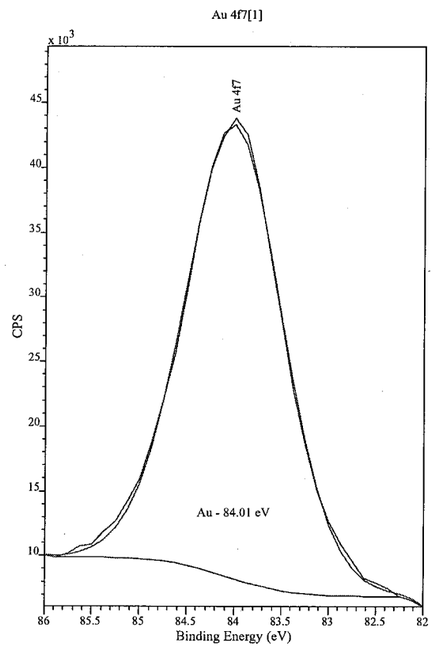
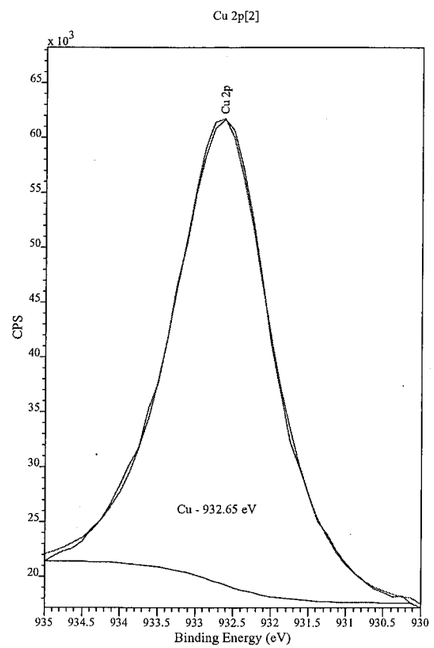
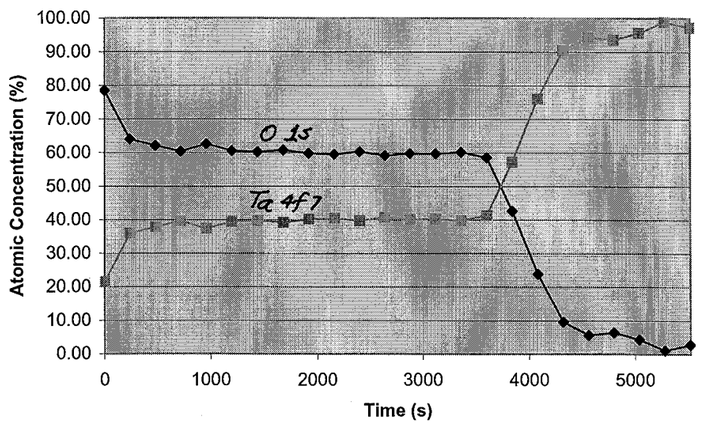
Project No.
Book No.
TITLE XPS Calibration

From Page No. 1. Binding energy





2. Sputtering rate



The O content reaches 30% at a time of 4000 seconds, or 66.67 minutes.

The sputtering rate is 1000Å/66.67 min = 15 Å/min on Ta_2O_5.

For the sputtering rate ratio of $Ta_2O_5 : SiO_2 = 1 : 0.85$, the sputtering rate on SiO_2 is 15 * 0.85 = 12.75 Å/min

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TITLE XPS Analysis Results of Alloy 22 Specimen POF04, 06, 09, and 10
Project No.
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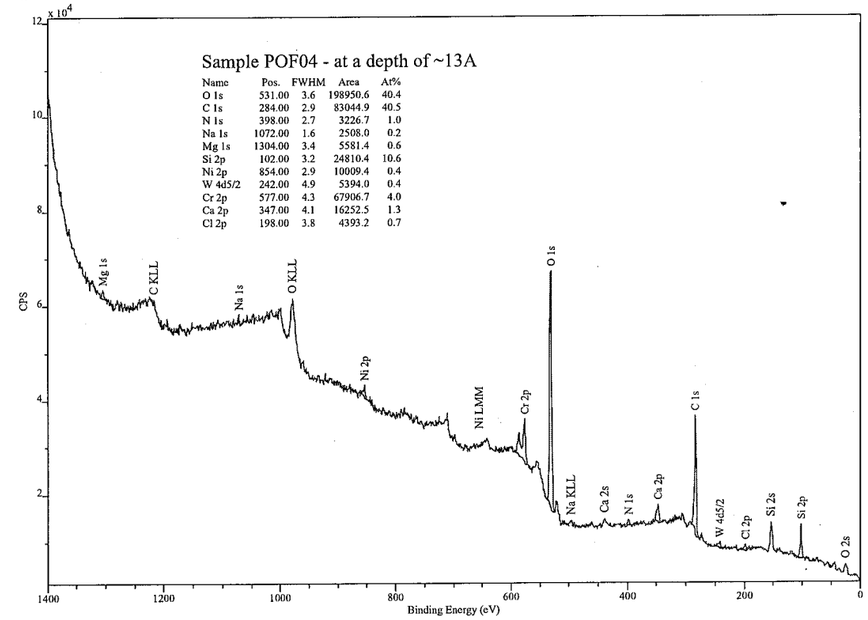
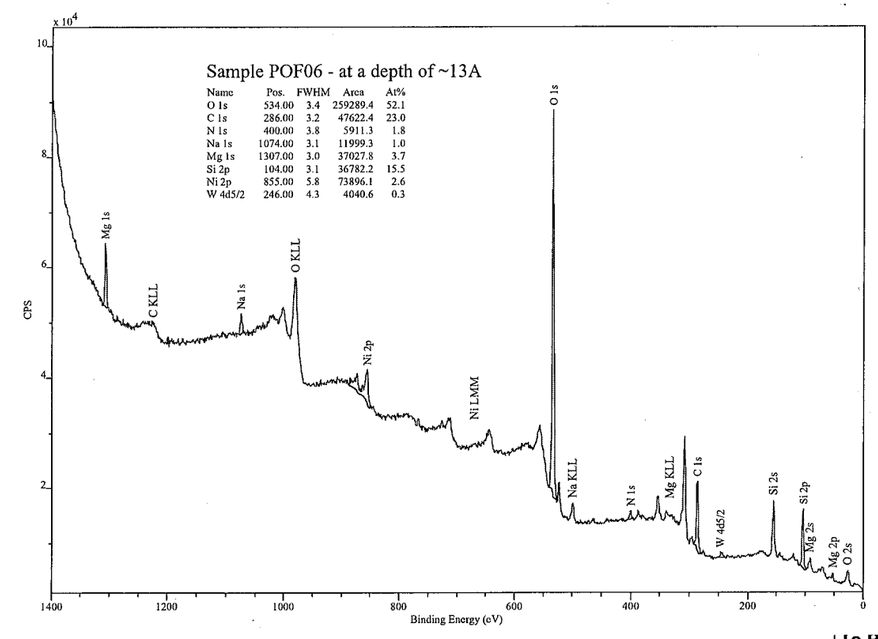
From Page No. 1. Wide-energy survey of the initial surfaces





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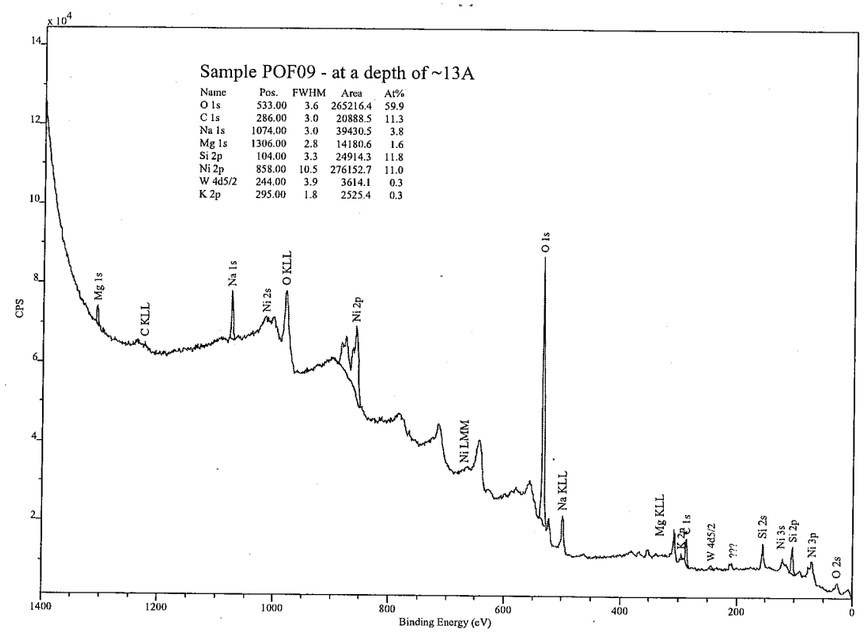

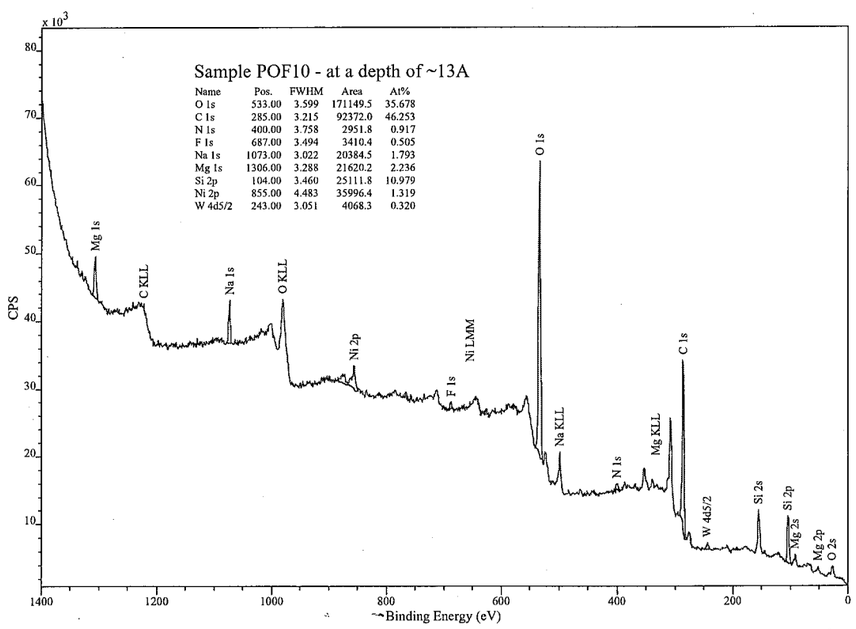

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From Page No. 2. Elemental Concentration data

POF04

Etch Time (sec)	SiO2 EQ (nm)	C 1s %	Cr 2p %	Mg 1s %	Mo 3d %	Na 1s %	Ni 2p %	O 1s %	Si 2p3 %	W 4d5 %
0.00	0.00	32.12	4.94	0.28	0.04	0.00	1.67	48.66	11.49	0.79
300.00	6.38	15.93	8.00	0.41	0.13	0.00	2.07	58.78	13.43	1.25
600.00	12.75	11.54	9.98	0.43	0.18	0.00	3.39	60.01	13.34	1.12
900.00	19.13	10.04	10.66	0.41	0.19	0.00	3.79	60.69	13.01	1.21
1200.00	25.50	6.82	10.83	0.39	0.24	0.00	4.13	63.02	13.31	1.26
1500.00	31.88	5.30	10.98	0.00	0.23	0.00	4.50	64.54	13.27	1.19
1800.00	38.25	4.28	10.68	0.00	0.19	0.17	4.73	64.78	14.09	1.08
2100.00	44.63	4.02	11.03	0.00	0.25	0.30	4.98	64.96	13.17	1.28
2400.00	51.00	3.27	10.38	0.00	0.22	0.72	5.35	65.58	13.43	1.06
2700.00	57.38	2.00	10.67	0.00	0.42	1.38	6.12	65.71	12.61	1.10
3000.00	63.75	3.00	10.13	0.00	0.55	1.81	7.40	64.21	11.88	1.03
3300.00	70.13	2.00	11.16	0.00	0.91	1.53	8.29	62.83	12.11	1.16
3600.00	76.50	1.85	11.82	0.00	1.32	1.87	10.50	59.98	11.34	1.31
3900.00	82.88	1.38	13.57	0.00	2.33	1.43	14.31	56.44	9.17	1.38
4200.00	89.25	1.18	14.86	0.00	3.48	1.08	20.07	49.34	8.21	1.78
4500.00	95.63	1.09	16.79	0.00	5.06	1.03	25.57	42.41	6.05	1.99
4800.00	102.00	1.47	17.92	0.00	7.02	0.51	32.24	34.77	3.55	2.52
5100.00	108.38	1.60	19.85	0.00	8.37	0.39	38.62	26.35	2.15	2.70
5400.00	114.75	0.00	21.11	0.00	10.36	0.00	41.61	22.13	1.42	3.38
5700.00	121.13	0.00	21.69	0.00	11.31	0.00	46.47	16.58	0.00	3.94
6000.00	127.50	0.00	22.18	0.00	11.82	0.00	48.91	12.81	0.00	4.28
6300.00	133.88	0.00	23.28	0.00	12.59	0.00	49.87	10.29	0.00	3.96
6600.00	140.25	0.00	24.02	0.00	13.23	0.00	49.32	9.41	0.00	4.02
6900.00	146.63	0.00	24.07	0.00	13.03	0.00	50.24	8.85	0.00	3.81
7200.00	153.00	0.00	23.52	0.00	13.03	0.00	52.56	6.96	0.00	3.93
7500.00	159.38	0.00	24.73	0.00	13.62	0.00	50.82	6.59	0.00	4.24
7800.00	165.75	0.00	24.97	0.00	13.36	0.00	51.87	6.05	0.00	3.75
8100.00	172.13	0.00	23.73	0.00	13.19	0.00	53.98	5.26	0.00	3.83
8400.00	178.50	0.00	24.47	0.00	13.30	0.00	52.62	5.63	0.00	3.96
8700.00	184.88	0.00	24.20	0.00	13.34	0.00	52.49	5.93	0.00	4.05
9000.00	191.25	0.00	24.48	0.00	13.65	0.00	51.76	5.76	0.00	4.35
9300.00	197.63	0.00	24.23	0.00	13.47	0.00	53.83	4.42	0.00	4.06
9600.00	204.00	0.00	25.38	0.00	13.16	0.00	51.79	5.44	0.00	4.23

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POF06

Etch Time (sec)	SiO2 EQ (nm)	C 1s %	Cr 2p %	Mg 1s %	Mo 3d %	Na 1s %	Ni 2p %	O 1s %	Si 2p3 %	W 4d5 %
0.00	0.00	24.58	0.00	3.26	0.00	0.71	2.69	52.25	16.24	0.28
300.00	6.38	14.21	0.00	5.03	0.00	0.82	4.83	57.36	17.27	0.48
600.00	12.75	11.18	0.00	5.37	0.00	1.06	6.60	58.70	16.55	0.55
900.00	19.13	8.29	0.00	5.15	0.00	1.22	8.49	61.19	15.11	0.55
1200.00	25.50	6.67	0.00	4.79	0.00	1.01	9.96	62.69	14.31	0.57
1500.00	31.88	5.80	0.00	4.21	0.00	1.14	11.08	63.18	14.10	0.49
1800.00	38.25	5.36	0.00	3.38	0.00	1.06	12.48	63.18	13.96	0.57
2100.00	44.63	3.90	0.00	3.36	0.00	1.14	13.75	64.13	13.19	0.52
2400.00	51.00	2.48	0.57	3.03	0.00	1.10	13.96	65.18	13.11	0.58
2700.00	57.38	2.03	1.15	2.84	0.00	1.19	13.69	65.55	13.04	0.52
3000.00	63.75	1.60	1.12	2.37	0.21	1.26	15.93	63.83	13.04	0.63
3300.00	70.13	1.41	1.79	2.46	0.37	1.56	16.96	62.85	12.03	0.56
3600.00	76.50	0.86	2.50	1.50	0.57	1.31	19.13	61.96	11.45	0.72
3900.00	82.88	0.88	3.09	1.70	0.67	1.61	20.11	60.40	10.88	0.65
4200.00	89.25	0.42	3.64	1.56	0.95	1.36	23.86	57.03	10.41	0.76
4500.00	95.63	0.00	5.07	1.61	1.20	0.75	25.96	54.63	10.13	0.66
4800.00	102.00	0.00	5.38	1.24	1.58	0.86	28.17	52.82	9.07	0.88
5100.00	108.38	0.00	7.25	0.74	2.16	0.70	30.52	49.62	7.96	1.05
5400.00	114.75	0.00	8.33	0.00	2.89	0.63	33.03	47.01	6.96	1.14
5700.00	121.13	0.00	9.30	0.00	3.83	0.43	35.67	42.96	6.46	1.35
6000.00	127.50	0.00	10.17	0.00	4.53	0.48	39.29	39.54	4.77	1.22
6300.00	133.88	0.00	11.60	0.00	5.23	0.51	39.60	36.59	4.87	1.61
6600.00	140.25	0.00	12.87	0.00	6.40	0.00	42.62	32.44	3.77	1.91
6900.00	146.63	0.00	14.75	0.00	7.48	0.00	43.70	28.05	3.85	2.18
7200.00	153.00	0.00	16.05	0.00	8.75	0.00	46.05	24.30	2.30	2.54
7500.00	159.38	0.00	17.03	0.00	9.84	0.00	48.22	20.14	2.10	2.67
7800.00	165.75	0.00	18.81	0.00	10.84	0.00	47.98	18.09	0.87	3.40
8100.00	172.13	0.00	20.52	0.00	11.86	0.00	50.36	13.94	0.00	3.32
8400.00	178.50	0.00	21.40	0.00	12.96	0.00	50.84	11.30	0.00	3.50
8700.00	184.88	0.00	22.88	0.00	13.10	0.00	50.74	9.58	0.00	3.70
9000.00	191.25	0.00	23.49	0.00	13.84	0.00	51.80	6.78	0.00	4.08
9300.00	197.63	0.00	24.31	0.00	13.97	0.00	50.65	7.00	0.00	4.07
9600.00	204.00	0.00	25.06	0.00	14.01	0.00	51.66	5.41	0.00	3.85
9900.00	210.38	0.00	24.20	0.00	13.93	0.00	52.69	5.42	0.00	3.76
10200.00	216.75	0.00	26.06	0.00	13.81	0.00	51.91	4.15	0.00	4.07
10500.00	223.13	0.00	25.54	0.00	14.33	0.00	52.40	3.53	0.00	4.20
10800.00	229.50	0.00	24.56	0.00	14.08	0.00	53.77	3.43	0.00	4.16
11100.00	235.88	0.00	25.06	0.00	14.15	0.00	53.07	3.62	0.00	4.10
11400.00	242.25	0.00	25.65	0.00	13.53	0.00	52.98	3.67	0.00	4.17

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From Page No. 2. Elemental concentration data (continued)

POF08

Etch Time(sec)	SiO2 EQ(nm)	C 1s %	Cr 2p %	Mg 1s %	Mo 3d %	Na 1s %	Ni 2p %	O 1s %	Si 2p3 %	W 4d5 %
0.00	0.00	13.10	0.95	1.79	0.00	3.19	10.12	59.12	11.32	0.41
300.00	6.38	4.96	0.92	2.69	0.00	3.55	14.28	62.77	10.33	0.49
600.00	12.75	5.05	0.84	2.97	0.00	3.29	16.98	60.87	9.45	0.55
900.00	19.13	3.98	0.84	2.78	0.00	3.55	17.02	61.84	9.43	0.57
1200.00	25.50	2.34	0.79	2.78	0.00	3.31	19.08	61.98	9.20	0.53
1500.00	31.88	2.19	0.82	2.59	0.00	3.06	19.85	61.87	9.04	0.57
1800.00	38.25	0.97	0.89	2.38	0.00	2.65	21.78	61.79	9.05	0.49
2100.00	44.63	0.94	0.96	2.31	0.00	2.58	23.28	60.91	8.44	0.59
2400.00	51.00	0.64	0.67	1.65	0.00	2.43	26.21	60.00	7.84	0.55
2700.00	57.38	0.38	0.91	1.50	0.00	2.56	25.43	60.52	8.04	0.65
3000.00	63.75	0.66	0.75	1.59	0.03	2.15	26.65	59.82	7.72	0.62
3300.00	70.13	0.00	1.15	1.30	0.18	2.55	28.35	58.44	7.36	0.67
3600.00	76.50	0.00	1.78	1.18	0.34	2.42	27.58	58.42	7.61	0.66
3900.00	82.88	0.00	1.95	1.19	0.53	2.42	30.68	55.33	7.11	0.79
4200.00	89.25	0.00	2.76	0.91	0.92	2.01	31.95	53.70	6.95	0.80
4500.00	95.63	0.00	3.15	0.55	1.08	2.21	34.06	52.23	5.89	0.82
4800.00	102.00	0.00	3.89	0.53	1.43	2.05	33.93	51.27	6.06	0.84
5100.00	108.38	0.00	4.45	0.22	1.73	2.52	33.90	50.02	6.35	0.81
5400.00	114.75	0.00	5.04	0.21	2.11	2.21	36.78	47.11	5.54	0.99
5700.00	121.13	0.00	6.64	0.00	2.80	1.85	37.55	45.44	4.67	1.06
6000.00	127.50	0.00	7.18	0.00	3.11	1.67	38.26	43.57	5.05	1.16
6300.00	133.88	0.00	8.54	0.00	3.66	1.56	41.77	39.37	3.66	1.45
6600.00	140.25	0.00	9.79	0.00	4.58	1.48	43.12	36.23	3.24	1.56
6900.00	146.63	0.00	11.40	0.00	5.67	1.14	44.89	32.71	2.39	1.81
7200.00	153.00	0.00	12.56	0.00	7.01	0.85	46.63	28.80	2.10	2.05
7500.00	159.38	0.00	14.30	0.00	8.24	0.53	48.55	24.92	1.05	2.41
7800.00	165.75	0.00	15.88	0.00	9.13	0.46	50.31	20.80	0.80	2.62
8100.00	172.13	0.00	18.36	0.00	9.84	0.13	51.58	17.37	0.00	2.72
8400.00	178.50	0.00	18.70	0.00	10.95	0.00	51.32	16.15	0.00	2.89
8700.00	184.88	0.00	19.60	0.00	11.79	0.00	52.38	13.25	0.00	2.98
9000.00	191.25	0.00	20.84	0.00	12.61	0.00	53.29	9.82	0.00	3.43
9300.00	197.63	0.00	22.39	0.00	12.81	0.00	51.86	9.60	0.00	3.35
9600.00	204.00	0.00	21.31	0.00	12.74	0.00	53.24	9.06	0.00	3.65
9900.00	210.38	0.00	21.95	0.00	12.55	0.00	54.15	7.54	0.00	3.81
10200.00	216.75	0.00	23.19	0.00	13.51	0.00	51.66	7.77	0.00	3.86
10500.00	223.13	0.00	23.22	0.00	13.21	0.00	52.05	7.71	0.00	3.81
10800.00	229.50	0.00	22.53	0.00	13.14	0.00	53.47	7.11	0.00	3.76
11100.00	235.88	0.00	22.77	0.00	13.12	0.00	53.32	7.06	0.00	3.73
11400.00	242.25	0.00	22.97	0.00	13.46	0.00	52.35	7.37	0.00	3.85
11700.00	248.63	0.00	22.81	0.00	13.86	0.00	52.60	6.67	0.00	4.06
12000.00	255.00	0.00	23.02	0.00	13.88	0.00	52.63	6.38	0.00	4.10
12300.00	261.38	0.00	23.64	0.00	13.76	0.00	53.09	5.37	0.00	4.13
12600.00	267.75	0.00	22.48	0.00	13.39	0.00	54.24	5.94	0.00	3.96
12900.00	274.13	0.00	23.46	0.00	13.38	0.00	52.77	6.46	0.00	3.94
13200.00	280.50	0.00	24.11	0.00	13.69	0.00	51.93	6.20	0.00	4.06
13500.00	286.88	0.00	22.83	0.00	13.94	0.00	53.30	6.05	0.00	3.88

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POF10

Etch Time (sec)	SiO2 EQ (nm)	C 1s %	Cr 2p %	Mg 1s %	Mo 3d %	Na 1s %	Ni 2p %	O 1s %	Si 2p3 %	W 4d5 %
0.00	0.00	51.80	0.32	1.29	0.00	1.50	1.48	33.50	9.83	0.26
300.00	6.38	32.40	1.07	4.05	0.00	1.90	2.29	45.10	12.70	0.61
600.00	12.75	28.40	0.99	5.47	0.00	1.98	2.92	46.40	13.10	0.70
900.00	19.13	25.40	1.19	6.30	0.00	2.28	3.52	47.40	13.20	0.66
1200.00	25.50	23.00	1.17	6.36	0.00	2.78	3.78	49.20	13.10	0.62
1500.00	31.88	21.00	1.29	6.30	0.00	3.08	4.89	49.80	13.00	0.66
1800.00	38.25	19.40	1.22	6.43	0.00	3.28	6.33	50.30	12.40	0.67
2100.00	44.63	19.20	1.60	5.79	0.00	3.20	6.41	51.30	12.00	0.56
2400.00	51.00	19.20	1.39	5.89	0.00	3.24	7.74	50.70	11.30	0.58
2700.00	57.38	17.30	1.33	5.55	0.00	3.50	7.98	52.90	10.90	0.63
3000.00	63.75	17.70	1.21	5.27	0.00	3.96	9.16	51.10	10.90	0.63
3300.00	70.13	16.40	0.97	5.08	0.00	3.90	10.50	52.40	10.20	0.55
3600.00	76.50	15.60	1.11	4.53	0.00	3.79	11.20	53.10	10.10	0.51
3900.00	82.88	14.70	1.04	4.04	0.00	4.15	11.80	54.40	9.51	0.48
4200.00	89.25	12.90	1.27	3.87	0.00	4.70	12.40	53.90	10.50	0.52
4500.00	95.63	11.50	1.05	4.36	0.00	4.81	13.00	55.20	9.54	0.49
4800.00	102.00	10.80	1.11	4.06	0.00	4.56	14.70	54.20	10.10	0.47
5100.00	108.38	8.89	1.18	3.83	0.00	4.93	15.50	55.30	9.86	0.51
5400.00	114.75	7.94	1.26	3.92	0.00	4.84	14.90	56.10	10.50	0.55
5700.00	121.13	6.45	1.47	3.90	0.00	5.65	15.90	56.40	9.52	0.73
6000.00	127.50	5.28	1.15	3.72	0.00	5.04	16.50	58.10	9.77	0.50
6300.00	133.88	4.99	1.46	3.34	0.11	5.01	18.10	56.60	9.90	0.45
6600.00	140.25	4.28	1.23	3.41	0.09	5.43	19.30	56.60	8.83	0.77
6900.00	146.63	3.26	1.32	2.84	0.15	5.13	21.50	55.90	9.25	0.59
7200.00	153.00	3.69	1.71	2.54	0.18	4.70	21.90	56.30	8.20	0.75
7500.00	159.38	1.67	2.26	2.76	0.29	4.57	24.40	55.00	8.61	0.53
7800.00	165.75	1.69	2.44	2.21	0.39	4.33	24.60	54.80	8.75	0.86
8100.00	172.13	2.02	2.56	1.98	0.43	3.93	27.00	53.00	8.26	0.76
8400.00	178.50	1.91	3.33	1.44	0.58	3.86	27.50	52.70	7.96	0.75
8700.00	184.88	2.15	3.55	1.58	0.72	3.91	29.90	50.30	7.27	0.60
9000.00	191.25	1.76	4.09	1.61	1.06	3.09	29.90	50.00	7.77	0.71
9300.00	197.63	0.77	4.80	1.23	1.27	2.51	32.10	49.80	6.78	0.81
9600.00	204.00	0.00	5.76	0.69	1.69	2.60	34.10	48.90	5.24	1.02
9900.00	210.38	0.00	6.16	0.39	2.33	2.20	36.10	46.40	5.26	1.17
10200.00	216.75	0.00	7.16	0.00	2.64	2.06	38.60	43.10	5.44	1.00
10500.00	223.13	0.00	8.12	0.00	3.56	2.22	40.90	40.10	3.82	1.27
10800.00	229.50	0.00	9.13	0.00	4.37	1.97	42.30	36.80	3.65	1.77
11100.00	235.88	0.00	10.50	0.00	5.18	1.20	41.60	36.40	3.26	1.82
11400.00	242.25	0.00	11.90	0.00	6.24	1.41	43.70	31.20	3.44	2.11
11700.00	248.63	0.00	11.70	0.00	7.18	1.22	45.60	27.60	4.47	2.24
12000.00	255.00	0.00	14.20	0.00	8.22	0.96	45.90	25.30	2.78	2.60
12300.00	261.38	0.00	15.80	0.00	9.57	0.65	48.00	22.10	1.45	2.44
12600.00	267.75	0.00	17.50	0.00	10.50	0.54	49.80	18.30	0.00	3.27
12900.00	274.13	0.00	19.20	0.00	11.00	0.00	50.60	15.90	0.00	3.33
13200.00	280.50	0.00	21.00	0.00	11.80	0.00	49.90	13.70	0.00	3.59
13500.00	286.88	0.00	20.60	0.00	11.70	0.00	52.60	11.20	0.00	3.87
13800.00	293.25	0.00	22.20	0.00	12.30	0.00	52.40	9.89	0.00	3.25
14100.00	299.63	0.00	23.00	0.00	13.10	0.00	52.00	7.79	0.00	4.19
14400.00	306.00	0.00	24.20	0.00	13.00	0.00	51.00	7.77	0.00	3.96
14700.00	312.38	0.00	23.30	0.00	13.40	0.00	52.60	6.82	0.00	3.88
15000.00	318.75	0.00	23.90	0.00	13.00	0.00	52.00	7.05	0.00	4.11
15300.00	325.13	0.00	23.80	0.00	13.50	0.00	52.90	5.78	0.00	4.00
15600.00	331.50	0.00	24.70	0.00	13.60	0.00	53.10	4.60	0.00	3.95
15900.00	337.88	0.00	24.40	0.00	13.40	0.00	53.40	4.74	0.00	4.02
16200.00	344.25	0.00	25.40	0.00	13.60	0.00	51.50	5.17	0.00	4.30
16500.00	350.63	0.00	25.30	0.00	13.70	0.00	51.20	5.36	0.00	4.48
16800.00	357.00	0.00	24.60	0.00	14.10	0.00	52.00	5.18	0.00	4.12
17100.00	363.38	0.00	24.50	0.00	13.90	0.00	52.70	4.51	0.00	4.39
17400.00	369.75	0.00	24.50	0.00	13.90	0.00	54.00	3.62	0.00	3.99

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POF04

Etch Time (sec)	Depth (Å)	C 1s %	Cr metal %	Cr2O3 %	H2O %	Mg 1s %	Mo IV %	Mo O2 %	Mo V %	Mo VI %	Mo metal %	Na 1s %	Ni metal %	Ni2O3 %	NiO %	O2- %	OH- %	Si 2p3 %	W 4d5 %
0.00	0.00	32.46	0.76	4.00	0.63	0.29	0.00	0.00	0.01	0.01	0.00	0.00	0.16	0.50	0.50	0.32	7.54	11.61	0.80
300.00	63.75	16.08	1.63	6.28	0.00	0.41	0.06	0.02	0.05	0.04	0.05	0.00	0.45	0.58	0.43	20.64	38.47	13.55	1.26
600.00	127.50	11.49	2.09	7.50	0.00	0.43	0.02	0.06	0.09	0.10	0.04	0.00	1.10	0.66	0.82	27.87	33.33	13.29	1.12
900.00	191.25	9.94	2.36	7.71	0.00	0.40	0.06	0.07	0.06	0.05	0.07	0.00	1.43	0.71	0.90	30.38	31.76	12.89	1.20
1200.00	255.00	6.79	2.46	7.79	0.00	0.39	0.04	0.09	0.06	0.06	0.07	0.00	1.60	0.91	0.90	32.64	31.69	13.25	1.26
1500.00	318.75	5.20	2.49	7.99	0.00	0.00	0.04	0.08	0.10	0.07	0.07	0.00	1.72	0.92	1.01	34.61	31.51	13.02	1.17
1800.00	382.50	4.26	2.53	7.99	0.00	0.00	0.00	0.09	0.09	0.06	0.08	0.17	1.81	0.96	0.98	34.78	31.10	14.02	1.08
2100.00	446.25	4.00	2.48	7.88	0.00	0.00	0.04	0.05	0.10	0.10	0.07	0.30	1.98	1.02	0.95	36.28	30.39	13.09	1.27
2400.00	510.00	3.23	2.43	7.79	0.00	0.00	0.01	0.07	0.10	0.10	0.10	0.71	2.09	1.10	1.09	36.67	30.21	13.26	1.04
2700.00	573.75	1.99	2.49	8.01	0.00	0.00	0.00	0.08	0.11	0.15	0.15	1.37	2.50	1.09	1.04	37.85	29.55	12.55	1.09
3000.00	637.50	3.03	2.53	7.68	0.00	0.00	0.00	0.10	0.12	0.13	0.21	1.83	3.01	1.24	1.19	36.99	28.89	12.01	1.04
3300.00	701.25	2.01	3.04	7.89	0.00	0.00	0.00	0.19	0.13	0.14	0.47	1.54	4.07	1.32	1.36	37.03	27.49	12.15	1.17
3600.00	765.00	1.89	3.84	7.89	0.00	0.00	0.00	0.27	0.15	0.07	0.89	1.90	5.68	1.72	1.29	35.99	25.53	11.55	1.33
3900.00	828.75	1.43	5.23	8.43	0.00	0.00	0.00	0.48	0.13	0.13	1.65	1.48	8.22	1.92	1.76	36.12	22.14	9.48	1.42
4200.00	892.50	1.24	6.89	8.15	0.00	0.00	0.00	0.70	0.15	0.16	2.75	1.13	11.42	2.30	2.43	32.24	19.96	8.60	1.87
4500.00	956.25	1.16	9.58	8.15	0.00	0.00	0.00	1.07	0.05	0.12	4.15	1.10	15.03	2.43	3.32	28.30	16.94	6.47	2.12
4800.00	1020.00	1.63	12.64	7.56	0.00	0.00	0.00	1.30	0.12	0.13	5.78	0.56	18.88	2.70	4.45	24.21	13.35	3.92	2.78
5100.00	1083.75	1.81	15.58	7.19	0.00	0.00	0.00	1.65	0.11	0.07	7.46	0.44	22.43	3.08	4.88	20.10	9.72	2.43	3.05
5400.00	1147.50	0.00	17.97	6.82	0.00	0.00	0.00	2.09	0.01	0.00	8.77	0.00	24.70	2.29	8.27	16.97	6.83	1.56	3.72
5700.00	1211.25	0.00	20.14	5.62	0.01	0.00	0.00	1.88	0.08	0.08	10.22	0.00	27.78	4.01	7.04	12.64	6.10	0.00	4.40
6000.00	1275.00	0.00	21.62	4.36	0.00	0.00	0.00	2.05	0.09	0.30	11.33	0.00	29.34	3.81	6.42	12.15	3.57	0.00	4.95
6300.00	1338.75	0.00	22.67	5.18	0.00	0.00	0.00	2.40	0.09	0.19	11.73	0.00	30.03	3.44	7.04	9.56	3.01	0.00	4.65
6600.00	1402.50	0.00	23.10	5.06	0.00	0.00	0.00	2.36	0.16	0.22	11.77	0.00	28.91	3.38	9.56	8.17	2.71	0.00	4.60
6900.00	1466.25	0.00	23.60	3.94	0.00	0.00	0.00	2.38	0.07	0.09	12.06	0.00	29.12	2.48	11.15	9.36	1.28	0.00	4.48
7200.00	1530.00	0.00	24.21	4.63	0.00	0.00	0.00	2.54	0.17	0.16	12.44	0.00	30.16	2.87	9.35	6.94	1.79	0.00	4.72
7500.00	1593.75	0.00	24.63	4.38	0.00	0.00	0.00	2.50	0.04	0.04	12.54	0.00	31.80	2.55	8.35	8.27	0.00	0.00	4.92
7800.00	1657.50	0.00	25.21	5.21	0.00	0.00	0.00	2.51	0.03	0.02	12.44	0.00	30.59	3.01	9.45	7.12	0.00	0.00	4.41
8100.00	1721.25	0.00	24.74	4.55	0.00	0.00	0.00	2.51	0.03	0.01	12.50	0.00	32.12	4.52	7.84	5.92	0.62	0.00	4.64
8400.00	1785.00	0.00	25.16	4.44	0.00	0.00	0.00	2.57	0.13	0.10	12.54	0.00	31.67	3.99	7.60	6.72	0.37	0.00	4.70
8700.00	1848.75	0.00	25.14	5.27	0.00	0.00	0.00	2.44	0.03	0.02	12.45	0.00	29.86	2.36	10.63	6.80	0.19	0.00	4.80
9000.00	1912.50	0.00	25.23	4.04	0.00	0.00	0.00	2.66	0.00	0.02	12.74	0.00	31.16	4.12	9.04	5.78	0.00	0.00	5.20
9300.00	1976.25	0.00	25.51	4.64	0.00	0.00	0.00	2.56	0.04	0.00	12.72	0.00	31.71	3.72	9.74	4.44	0.00	0.00	4.92
9600.00	2040.00	0.00	25.85	5.13	0.00	0.00	0.00	2.43	0.04	0.08	12.47	0.00	30.50	2.84	10.55	5.08	0.00	0.00	5.04

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POF 06

Etch Time (sec)	Depth (Å)	C 1s %	Cr metal %	Cr2O3 %	H2O %	Mg 1s %	Mo IV %	Mo O2 %	Mo V %	Mo VI %	Mo metal %	Na 1s %	Ni metal %	Ni2O3 %	NiO %	O2- %	OH- %	Si 2p3 %	W 4d5 %
0.00	0.00	25.04	0.00	0.00	0.00	47.18	3.32	0.00	0.00	0.00	0.00	0.00	0.72	0.18	1.41	0.22	0.67	4.42	16.54	0.28
300.00	63.75	14.39	0.00	0.00	0.00	23.98	5.10	0.00	0.00	0.00	0.00	0.00	0.83	0.31	1.71	1.64	0.96	33.13	17.48	0.48
600.00	127.50	11.63	0.00	0.00	2.06	5.58	0.00	0.00	0.00	0.00	0.00	0.00	1.10	1.45	1.16	2.19	5.55	51.51	17.20	0.57
900.00	191.25	8.59	0.00	0.00	0.00	5.34	0.00	0.00	0.00	0.00	0.00	0.00	1.26	2.62	1.50	2.00	14.91	47.51	15.67	0.57
1200.00	255.00	7.02	0.00	0.00	0.00	5.04	0.00	0.00	0.00	0.00	0.00	0.00	1.06	3.06	1.71	2.32	19.64	44.50	15.04	0.60
1500.00	318.75	6.07	0.00	0.00	0.00	4.41	0.00	0.00	0.00	0.00	0.00	0.00	1.19	3.52	1.94	2.60	22.04	42.96	14.75	0.51
1800.00	382.50	5.61	0.00	0.00	0.00	3.54	0.00	0.00	0.00	0.00	0.00	0.00	1.11	4.30	2.22	2.25	24.36	41.42	14.60	0.59
2100.00	446.25	4.12	0.00	0.00	0.00	3.55	0.00	0.00	0.00	0.00	0.00	0.00	1.20	4.94	2.38	2.49	25.81	41.04	13.93	0.55
2400.00	510.00	2.59	0.24	0.47	0.00	3.18	0.00	0.00	0.00	0.00	0.00	0.00	1.16	5.72	3.15	2.32	26.51	40.33	13.73	0.60
2700.00	573.75	2.12	0.46	0.78	0.00	2.96	0.00	0.00	0.00	0.00	0.00	0.00	1.24	6.41	2.31	2.65	28.81	38.11	13.61	0.55
3000.00	637.50	1.70	0.56	0.82	0.00	2.52	0.00	0.00	0.03	0.00	0.00	0.00	1.34	7.20	2.63	2.98	28.55	36.97	13.87	0.67
3300.00	701.25	1.48	0.76	0.99	0.00	2.59	0.00	0.00	0.09	0.04	0.00	0.14	1.64	8.08	3.23	2.99	29.67	35.01	12.64	0.59
3600.00	765.00	0.91	1.22	1.47	0.00	1.59	0.00	0.12	0.06	0.05	0.00	0.21	1.38	9.22	3.68	2.56	30.61	33.96	12.09	0.77
3900.00	828.75	0.90	1.43	1.79	0.00	1.74	0.01	0.15	0.03	0.08	0.54	1.65	10.29	3.97	3.30	3.30	30.34	31.95	11.15	0.67
4200.00	892.50	0.46	1.85	2.19	0.00	1.70	0.01	0.21	0.09	0.07	0.69	1.48	11.99	3.97	2.85	2.85	30.58	29.72	11.31	0.83
4500.00	956.25	0.00	2.47	2.85	0.00	1.79	0.00	0.30	0.07	0.16	1.01	0.84	13.37	3.70	3.31	3.31	30.54	27.56	11.30	0.74
4800.00	1020.00	0.00	3.05	3.09	0.00	1.35	0.00	0.39	0.06	0.11	1.38	0.94	15.16	4.85	3.99	3.21	30.42	25.14	9.89	0.96
5100.00	1083.75	0.00	3.93	3.71	0.00	0.82	0.04	0.50	0.08	0.02	1.79	0.77	16.46	4.99	4.52	4.52	31.14	22.30	8.78	1.16
5400.00	1147.50	0.00	4.85	4.21	0.00	0.00	0.00	0.72	0.07	0.00	2.33	0.73	18.96	4.49	4.21	4.21	30.11	19.54	7.98	1.30
5700.00	1211.25	0.00	5.79	4.24	0.00	0.00	0.00	0.91	0.12	0.04	3.15	0.50	19.95	4.29	5.60	5.60	29.25	16.97	7.43	1.56
6000.00	1275.00	0.00	7.26	4.14	0.00	0.00	0.05	0.96	0.05	0.01	3.95	0.57	22.36	4.29	6.68	6.68	28.10	14.56	5.60	1.43
6300.00	1338.75	0.00	8.71	4.78	0.00	0.00	0.00	1.18	0.12	0.10	4.83	0.61	23.32	5.11	6.26	6.26	24.11	13.21	5.77	1.90
6600.00	1402.50	0.00	10.21	4.41	0.00	0.02	0.00	1.49	0.08	0.00	5.88	0.00	25.73	5.01	5.99	5.99	24.18	10.32	4.44	2.25
6900.00	1466.25	0.00	11.82	4.49	0.00	0.00	0.00	1.73	0.16	0.16	6.83	0.00	26.14	4.09	7.84	9.08	21.59	8.21	4.43	2.51
7200.00	1530.00	0.00	13.82	4.62	0.00	0.00	0.00	1.91	0.06	0.19	8.00	0.00	27.34	3.43	9.08	19.16	6.56	2.77	3.06
7500.00	1593.75	0.00	15.74	4.11	0.00	0.00	0.02	2.13	0.15	0.17	9.26	0.00	28.29	3.54	8.55	16.06	6.33	2.48	3.16
7800.00	1657.50	0.00	17.56	4.44	0.00	0.00	0.00	2.19	0.06	0.09	10.17	0.00	28.98	4.22	9.10	14.28	3.89	1.03	3.99
8100.00	1721.25	0.00	19.48	4.11	0.00	0.00	0.00	2.30	0.08	0.20	11.41	0.00	30.33	2.76	9.82	12.61	2.96	0.00	3.94
8400.00	1785.00	0.00	21.31	3.90	0.00	0.00	0.00	2.28	0.10	0.30	12.35	0.00	30.59	3.12	10.06	9.70	2.20	0.00	4.10
8700.00	1848.75	0.00	22.33	4.11	0.00	0.00	0.00	2.57	0.08	0.20	12.52	0.00	30.71	2.91	9.62	8.45	2.09	0.00	4.39
9000.00	1912.50	0.00	23.75	4.21	0.00	0.00	0.00	2.60	0.05	0.06	12.92	0.00	31.31	2.31	9.95	7.32	0.69	0.00	4.82
9300.00	1976.25	0.00	23.90	3.23	0.00	0.00	0.00	2.61	0.04	0.02	13.26	0.00	31.65	2.79	10.45	6.60	0.64	0.00	4.83
9600.00	2040.00	0.00	24.97	3.71	0.00	0.00	0.00	2.59	0.02	0.02	13.22	0.00	31.67	2.89	10.46	5.64	0.23	0.00	4.60
9900.00	2103.75	0.00	24.73	3.46	0.00	0.00	0.00	2.63	0.04	0.03	13.25	0.00	31.70	2.98	10.78	5.87	0.00	0.00	4.51
10200.00	2167.50	0.00	25.14	3.70	0.00	0.00	0.00	2.51	0.03	0.00	13.10	0.00	31.45	2.47	10.36	6.49	0.00	0.00	4.78
10500.00	2231.25	0.00	25.18	3.33	0.00	0.00	0.00	2.57	0.00	0.00	13.17	0.00	31.82	2.81	10.62	5.63	0.00	0.00	4.86
10800.00	2295.00	0.00	24.82	3.28	0.00	0.00	0.00	2.55	0.01	0.00	13.11	0.00	31.34	2.87	10.38	6.76	0.00	0.00	4.89
11100.00	2358.75	0.00	25.47	3.47	0.00	0.00	0.00	2.60	0.01	0.00	13.27	0.00	31.93	3.12	10.97	4.30	0.00	0.00	4.84
11400.00	2422.50	0.00	25.34	3.37	0.00	0.00	0.00	2.55	0.01	0.00	12.99	0.00	31.28	2.91	10.74	5.80	0.00	0.00	5.01

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3. Chemical state data (continued)

POF 09

Etch Time (sec)	Depth (Å)	C 1s %	Cr metal %	Cr2O3 %	H2O %	Mg 1s %	Mo IV %	Mo O2 %	Mo V %	Mo VI %	Mo metal %	Na 1s %	Ni metal %	Ni2O3 %	NiO %	O2- %	OH- %	Si 2p3 %	W 4d5 %
0.00	0.00	14.11	0.21	0.57	43.24	1.93	0.00	0.00	0.00	0.00	0.00	0.00	3.44	0.49	3.95	0.69	0.00	18.73	12.20	0.44
300.00	63.75	5.35	0.21	0.74	0.00	2.90	0.00	0.00	0.00	0.00	0.00	0.00	3.83	2.19	4.07	4.18	5.15	59.70	11.14	0.53
600.00	127.50	5.42	0.26	0.79	0.00	3.19	0.00	0.00	0.00	0.00	0.00	0.00	3.54	4.48	3.66	3.48	21.62	42.83	10.14	0.59
900.00	191.25	4.21	0.22	0.66	0.00	2.94	0.00	0.00	0.00	0.00	0.00	0.00	3.76	5.30	4.03	3.32	27.52	37.44	9.98	0.60
1200.00	255.00	2.47	0.29	0.69	0.00	2.93	0.00	0.00	0.00	0.00	0.00	0.00	3.49	6.05	4.62	2.86	32.87	33.46	9.71	0.56
1500.00	318.75	2.34	0.35	0.71	0.00	2.77	0.00	0.00	0.00	0.00	0.00	0.00	3.27	6.10	4.85	3.27	34.82	31.25	9.66	0.61
1800.00	382.50	1.04	0.22	0.62	0.00	2.57	0.00	0.00	0.00	0.00	0.00	0.00	2.86	6.80	6.06	2.76	38.12	28.64	9.77	0.53
2100.00	446.25	1.01	0.36	0.71	0.00	2.48	0.00	0.00	0.00	0.00	0.00	0.00	2.77	6.94	6.56	3.37	39.32	26.81	9.05	0.63
2400.00	510.00	0.71	0.25	0.69	0.00	1.83	0.00	0.00	0.00	0.00	0.00	0.00	2.69	7.36	6.79	3.29	41.34	25.79	8.67	0.61
2700.00	573.75	0.42	0.37	0.64	0.00	1.63	0.00	0.00	0.00	0.00	0.00	0.00	2.78	7.74	7.60	2.68	43.27	23.44	8.72	0.71
3000.00	637.50	0.72	0.36	0.75	0.00	1.74	0.00	0.03	0.04	0.02	0.05	0.05	2.35	8.47	7.73	2.96	43.64	21.98	8.45	0.68
3300.00	701.25	0.00	0.44	0.86	0.00	1.43	0.00	0.06	0.04	0.05	0.05	0.14	2.81	9.18	8.01	2.99	44.77	20.37	8.10	0.74
3600.00	765.00	0.00	0.82	1.17	0.00	1.28	0.00	0.08	0.06	0.05	0.04	0.24	2.64	9.61	7.82	3.46	44.68	19.07	8.31	0.72
3900.00	828.75	0.00	1.00	1.08	0.00	1.29	0.00	0.11	0.04	0.04	0.37	2.63	10.68	7.82	3.28	44.17	18.93	7.71	0.86
4200.00	892.50	0.00	1.44	1.45	0.00	1.02	0.00	0.17	0.06	0.09	0.65	2.25	12.09	9.38	2.38	43.06	17.30	7.77	0.89
4500.00	956.25	0.00	1.81	1.38	0.00	0.64	0.00	0.22	0.08	0.07	0.90	2.56	13.14	7.96	2.71	43.97	16.78	6.83	0.95
4800.00	1020.00	0.00	2.45	1.93	0.00	0.59	0.00	0.26	0.07	0.06	1.10	2.30	13.48	8.15	3.91	42.88	15.06	6.79	0.94
5100.00	1083.75	0.00	2.72	2.10	0.00	0.24	0.00	0.32	0.03	0.09	1.42	2.81	14.15	7.85	3.85	41.34	14.83	7.07	0.90
5400.00	1147.50	0.00	3.37	2.40	0.00	0.24	0.00	0.49	0.02	0.06	1.79	2.51	15.85	7.83	3.81	40.59	13.60	6.30	1.13
5700.00	1211.25	0.00	4.22	2.79	0.00	0.00	0.00	0.59	0.09	0.08	2.20	2.06	16.48	8.02	5.10	40.47	11.51	5.20	1.18
6000.00	1275.00	0.00	5.14	2.83	0.00	0.00	0.00	0.66	0.12	0.12	2.69	1.88	18.32	7.73	4.50	37.69	11.31	5.70	1.31
6300.00	1338.75	0.00	6.17	3.34	0.00	0.00	0.00	0.76	0.07	0.15	3.41	1.86	20.49	6.91	4.05	36.92	9.79	4.36	1.73
6600.00	1402.50	0.00	7.48	3.13	0.00	0.00	0.00	0.78	0.14	0.21	4.44	1.76	21.74	6.84	4.95	34.38	8.45	3.85	1.85
6900.00	1466.25	0.00	9.06	4.06	0.12	0.00	0.00	1.28	0.07	0.00	4.98	1.36	24.63	5.80	4.37	31.81	7.44	2.86	2.16
7200.00	1530.00	0.00	10.50	3.90	0.14	0.00	0.00	1.42	0.09	0.09	5.89	0.95	25.76	6.56	5.51	29.18	5.64	2.36	2.31
7500.00	1593.75	0.00	12.34	3.73	0.49	0.00	0.00	1.81	0.03	0.14	7.18	0.61	27.58	6.15	5.61	25.35	5.02	1.20	2.76
7800.00	1657.50	0.00	14.51	3.74	0.09	0.00	0.00	1.44	0.01	0.20	8.75	0.54	29.79	4.28	6.42	23.39	2.75	0.96	3.13
8100.00	1721.25	0.00	16.31	3.98	0.00	0.00	0.00	2.23	0.08	0.15	9.39	0.16	31.19	3.99	6.96	20.16	2.13	0.00	3.27
8400.00	1785.00	0.00	17.90	3.45	0.17	0.00	0.00	2.51	0.17	0.09	10.24	0.00	31.81	4.19	7.27	17.74	0.95	0.00	3.51
8700.00	1848.75	0.00	18.91	3.63	0.13	0.00	0.00	2.61	0.19	0.21	11.12	0.00	32.75	3.06	7.39	15.18	1.16	0.00	3.65
9000.00	1912.50	0.00	20.06	3.79	0.00	0.00	0.03	2.41	0.09	0.30	11.58	0.00	32.59	3.73	7.35	14.03	0.00	0.00	4.05
9300.00	1976.25	0.00	21.09	3.45	0.00	0.00	0.00	2.44	0.00	0.13	11.86	0.00	32.89	3.95	7.61	12.66	0.00	0.00	3.91
9600.00	2040.00	0.00	22.26	4.04	0.00	0.00	0.00	2.47	0.00	0.11	12.71	0.00	33.56	2.59	7.66	10.07	0.00	0.00	4.54
9900.00	2103.75	0.00	22.15	3.09	0.00	0.00	0.00	2.53	0.06	0.22	12.74	0.00	34.07	3.49	7.67	9.28	0.00	0.00	4.71
10200.00	2167.50	0.00	22.17	3.53	0.00	0.00	0.00	2.59	0.00	0.13	12.39	0.00	33.49	4.01	7.54	9.64	0.00	0.00	4.50
10500.00	2231.25	0.00	22.23	3.31	0.00	0.00	0.00	2.57	0.11	0.19	12.72	0.00	33.71	3.37	7.59	9.65	0.00	0.00	4.53
10800.00	2295.00	0.00	22.80	3.33	0.00	0.00	0.00	2.60	0.09	0.13	12.76	0.00	33.59	3.72	7.68	8.73	0.00	0.00	4.58
11100.00	2358.75	0.00	22.88	3.82	0.00	0.00	0.00	2.59	0.06	0.11	12.75	0.00	33.51	3.47	7.61	8.75	0.00	0.00	4.45
11400.00	2422.50	0.00	22.91	3.39	0.00	0.00	0.00	2.58	0.03	0.07	12.76	0.00	33.63	3.71	7.56	8.84	0.00	0.00	4.52
11700.00	2486.25	0.00	22.38	3.23	0.00	0.00	0.00	2.61	0.04	0.08	12.81	0.00	33.99	4.13	7.85	8.13	0.00	0.00	4.75
12000.00	2550.00	0.00	23.24	3.19	0.00	0.00	0.00	2.65	0.01	0.00	12.83	0.00	34.11	3.84	7.70	7.63	0.00	0.00	4.79
12300.00	2613.75	0.00	23.13	3.72	0.06	0.00	0.00	2.57	0.00	0.05	12.67	0.00	33.39	3.54	7.64	8.36	0.00	0.00	4.86
12600.00	2677.50	0.00	23.50	4.16	0.00	0.00	0.00	2.54	0.03	0.07	12.56	0.00	33.01	3.67	7.41	8.42	0.00	0.00	4.63
12900.00	2741.25	0.00	23.34	3.53	0.00	0.00	0.00	2.46	0.00	0.12	12.55	0.00	33.47	3.87	7.60	8.51	0.00	0.00	4.66
13200.00	2805.00	0.00	23.62	3.79	0.00	0.00	0.00	2.58	0.07	0.12	12.62	0.00	33.26	3.95	7.64	7.69	0.00	0.00	4.66
13500.00	2868.75	0.00	23.93	4.31	0.00	0.00	0.00	2.54	0.04	0.10	12.52	0.00	32.85	3.77	7.40	8.04	0.00	0.00	4.49

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Etch Time (sec)	Depth (Å)	C 1s %	Cr metal %	Cr2O3 %	H2O %	Mg 1s %	Mo IV %	Mo C2 %	Mo V %	Mo VI %	Mo metal %	Na 1s %	Ni metal %	Ni2O3 %	NiO %	O2- %	OH- %	Si 2p3 %	W 4d5 %
0.00	0.00	51.80	0.18	0.42	19.10	1.29	0.00	0.00	0.00	0.00	0.00	1.50	0.01	0.55	0.23	0.00	14.83	9.83	0.26
300.00	63.75	32.74	0.16	0.45	20.10	4.10	0.00	0.00	0.00	0.00	0.00	1.92	0.06	1.17	0.70	0.34	24.81	12.81	0.62
600.00	127.50	28.21	0.26	0.60	15.37	5.43	0.00	0.00	0.00	0.00	0.00	1.97	0.23	0.99	1.00	0.26	31.98	13.02	0.69
900.00	191.25	25.45	0.31	0.74	7.86	6.32	0.00	0.00	0.00	0.00	0.00	2.28	0.49	1.02	1.26	0.00	40.37	13.25	0.66
1200.00	255.00	23.06	0.42	0.77	0.52	6.37	0.00	0.00	0.00	0.00	0.00	2.78	0.70	0.99	1.73	2.09	46.84	13.12	0.62
1500.00	318.75	20.99	0.39	0.64	1.36	6.30	0.00	0.00	0.00	0.00	0.00	3.08	1.13	0.84	1.92	9.46	40.26	12.99	0.66
1800.00	382.50	19.53	0.43	0.80	1.23	6.47	0.00	0.00	0.00	0.00	0.00	3.30	1.52	0.72	2.11	12.75	38.03	12.44	0.68
2100.00	446.25	19.50	0.42	0.78	0.76	5.89	0.00	0.00	0.00	0.00	0.00	3.25	2.01	0.70	2.27	15.08	36.55	12.21	0.57
2400.00	510.00	19.64	0.53	0.81	1.56	6.03	0.00	0.00	0.00	0.00	0.00	3.32	2.54	0.77	2.21	17.48	33.03	11.51	0.60
2700.00	573.75	17.70	0.44	0.78	1.22	5.68	0.00	0.00	0.00	0.00	0.00	3.58	2.86	0.88	2.60	18.61	33.90	11.12	0.64
3000.00	637.50	17.92	0.62	0.81	1.10	5.33	0.00	0.00	0.00	0.00	0.00	4.00	3.32	1.11	2.51	19.38	32.23	11.05	0.64
3300.00	701.25	17.23	0.46	0.67	0.18	5.35	0.00	0.00	0.00	0.00	0.00	4.12	3.70	0.68	2.63	20.50	33.16	10.73	0.58
3600.00	765.00	16.05	0.62	0.83	0.06	4.67	0.00	0.00	0.00	0.00	0.00	3.91	4.31	1.79	2.40	22.00	32.39	10.45	0.52
3900.00	828.75	15.32	0.47	0.74	0.73	4.22	0.00	0.00	0.00	0.00	0.00	4.34	4.69	2.20	2.18	23.05	31.62	9.94	0.50
4200.00	892.50	13.44	0.39	0.75	0.20	4.04	0.00	0.00	0.00	0.00	0.00	4.91	4.69	1.77	2.40	24.47	31.43	10.97	0.54
4500.00	956.25	11.98	0.22	0.65	0.09	4.53	0.00	0.00	0.00	0.00	0.00	5.00	4.96	2.41	2.79	25.48	31.47	9.91	0.51
4800.00	1020.00	11.44	0.44	0.78	0.34	4.29	0.00	0.00	0.01	0.00	0.00	4.82	5.76	2.71	1.96	26.20	29.98	10.66	0.50
5100.00	1083.75	9.39	0.35	0.73	0.36	4.05	0.00	0.00	0.03	0.00	0.08	5.26	5.99	3.08	2.03	28.21	29.48	10.42	0.54
5400.00	1147.50	8.37	0.37	0.59	0.00	4.13	0.00	0.00	0.02	0.00	0.09	5.10	5.92	2.93	2.68	29.20	28.92	11.08	0.58
5700.00	1211.25	6.71	0.39	0.76	0.00	4.06	0.01	0.01	0.01	0.00	0.05	5.88	6.80	3.61	1.96	30.99	28.12	9.90	0.75
6000.00	1275.00	5.61	0.34	0.73	1.34	3.95	0.00	0.00	0.01	0.00	0.05	5.35	7.44	3.67	1.65	31.75	27.18	10.37	0.53
6300.00	1338.75	5.27	0.57	0.95	0.00	3.53	0.00	0.00	0.02	0.00	0.10	5.29	7.59	3.96	1.96	32.88	26.90	10.45	0.48
6600.00	1402.50	4.57	0.28	0.74	0.00	3.64	0.00	0.00	0.03	0.00	0.10	5.80	8.41	4.09	1.75	34.08	26.18	9.44	0.82
6900.00	1466.25	3.56	0.35	0.74	0.54	3.10	0.00	0.00	0.04	0.00	0.11	5.60	8.38	4.50	2.71	34.11	25.43	10.09	0.65
7200.00	1530.00	4.05	0.70	1.23	0.00	2.79	0.00	0.00	0.06	0.00	0.18	5.15	9.13	4.25	2.70	35.31	24.54	8.98	0.83
7500.00	1593.75	1.80	0.56	1.10	0.75	2.99	0.01	0.06	0.10	0.00	0.18	4.94	10.35	5.08	2.18	36.43	23.60	9.30	0.58
7800.00	1657.50	1.84	0.84	1.49	0.00	2.41	0.00	0.10	0.06	0.00	0.26	4.71	10.70	4.70	2.97	36.66	22.74	9.52	0.94
8100.00	1721.25	2.23	0.86	1.59	0.58	2.20	0.01	0.10	0.09	0.00	0.28	4.35	12.07	5.65	2.17	36.78	20.99	9.15	0.84
8400.00	1785.00	2.08	1.32	2.13	0.14	1.56	0.00	0.17	0.07	0.00	0.48	4.20	12.89	5.42	2.23	37.22	20.56	8.66	0.81
8700.00	1848.75	2.47	1.37	2.06	0.77	1.81	0.02	0.16	0.06	0.00	0.49	4.49	13.59	5.63	2.15	37.28	18.51	8.35	0.69
9000.00	1912.50	1.98	1.72	2.56	0.00	1.81	0.01	0.25	0.09	0.00	0.70	3.47	14.82	6.18	2.40	36.66	17.78	8.71	0.80
9300.00	1976.25	0.89	2.22	2.77	0.00	1.43	0.00	0.31	0.08	0.00	0.96	2.91	15.66	5.29	3.55	37.90	17.18	7.86	0.94
9600.00	2040.00	0.00	2.59	3.20	0.83	0.79	0.00	0.43	0.10	0.00	1.36	2.98	17.91	6.03	2.36	38.28	15.82	6.00	1.17
9900.00	2103.75	0.00	3.26	3.27	0.00	0.45	0.00	0.54	0.13	0.00	1.80	2.56	19.86	6.37	2.15	37.13	14.88	6.11	1.36
10200.00	2167.50	0.00	4.23	3.53	0.00	0.00	0.00	0.62	0.12	0.00	2.34	2.47	20.41	5.55	2.92	35.43	14.52	6.51	1.20
10500.00	2231.25	0.00	4.94	3.76	0.05	0.00	0.00	0.82	0.10	0.00	3.06	2.60	21.72	6.50	3.30	33.76	13.30	4.47	1.49
10800.00	2295.00	0.00	6.19	4.45	0.30	0.00	0.02	0.89	0.12	0.00	3.75	2.25	23.21	6.56	3.20	30.67	12.09	4.18	2.03
11100.00	2358.75	0.00	7.60	4.34	0.67	0.00	0.00	1.25	0.11	0.03	4.61	1.42	25.00	5.54	3.09	29.89	10.39	3.87	2.17
11400.00	2422.50	0.00	9.14	4.31	0.47	0.00	0.00	1.38	0.15	0.24	5.65	1.67	24.47	5.19	5.27	25.49	9.98	4.06	2.50
11700.00	2486.25	0.00	10.49	3.28	0.70	0.00	0.00	1.42	0.15	0.18	6.51	1.43	26.67	5.34	3.71	23.80	8.58	5.23	2.63
12000.00	2550.00	0.00	12.84	3.92	0.75	0.00	0.00	1.72	0.22	0.23	7.71	1.13	27.34	3.22	5.45	21.86	7.24	3.29	3.07
12300.00	2613.75	0.00	14.74	4.04	1.96	0.00	0.00	2.00	0.12	0.05	8.49	0.74	27.90	4.26	6.10	20.52	4.65	1.66	2.78
12600.00	2677.50	0.00	16.48	3.93	1.58	0.00	0.00	2.09	0.24	0.23	9.85	0.63	30.86	4.20	4.38	16.44	5.27	0.00	3.83
12900.00	2741.25	0.00	18.54	3.79	1.28	0.00	0.00	2.35	0.14	0.09	10.42	0.00	30.07	3.91	6.93	13.83	4.62	0.00	4.02
13200.00	2805.00	0.00	20.03	3.81	0.76	0.00	0.00	1.79	0.03	0.17	11.86	0.00	32.14	4.25	5.32	12.12	3.42	0.00	4.31
13500.00	2868.75	0.00	21.04	3.57	1.49	0.00	0.00	2.16	0.10	0.00	11.50	0.00	32.01	4.07	5.68	12.29	1.18	0.00	4.79
13800.00	2932.50	0.00	21.51	3.69	1.63	0.00	0.00	2.32	0.00	0.00	12.12	0.00	31.72	5.22	6.60	8.93	2.32	0.00	3.94
14100.00	2996.25	0.00	22.62	4.20	2.24	0.00	0.00	2.28	0.00	0.00	12.35	0.00	31.42	2.79	6.73	9.21	1.11	0.00	5.03
14400.00	3060.00	0.00	23.21	4.50	1.56	0.00	0.00	2.40	0.00	0.03	12.72	0.00	33.10	4.02	4.84	8.16	0.70	0.00	4.75
14700.00	3123.75	0.00	24.03	3.29	0.24	0.00	0.01	2.43	0.00	0.00	13.01	0.00	32.90	2.92	7.32	7.59	1.54	0.00	4.73
15000.00	3187.50	0.00	23.72	3.07	1.42	0.00	0.00	2.53	0.03	0.10	12.99	0.00	32.85	4.35	5.90	7.25	0.74	0.00	5.06
15300.00	3251.25	0.00	24.43	3.89	1.47	0.00	0.00	2.56	0.08	0.14	13.02	0.00	32.70	3.27	5.76	7.41	0.34	0.00	4.92
15600.00	3315.00	0.00	25.00	3.53	0.66	0.00	0.03	2.59	0.00	0.00	13.14	0.00	33.28	4.00	6.38	6.30	0.18	0.00	4.90
15900.00	3378.75	0.00	25.17	3.64	0.87	0.00	0.00	2.55	0.01	0.06	13.17	0.00	32.31	2.77	7.43	7.08	0.05	0.00	4.90
16200.00	3442.50	0.00	25.46	3.84	0.70	0.00	0.00	2.48	0.00	0.00	13.25	0.00	32.51	2.63	7.31	6.59	0.00	0.00	5.23
16500.00	3506.25	0.00	25.29	3.99	0.40	0.00	0.00	2.53	0.03	0.09	13.08	0.00	33.82	3.95	5.18	5.90	0.45	0.00	5.29
16800.00	3570.00	0.00	25.90	3.97	0.00	0.00	0.00	2.62	0.05	0.11	13.44	0.00	33.58	3.40	6.13	5.64	0.18	0.00	4.97
17100.00	3633.75	0.00	25.45	3.74	1.96	0.00	0.00	2.57	0.05	0.08	13.30	0.00	33.13	3.23	5.96	5.04	0.22	0.00	5.29
17400.00	3697.50	0.00	25.33	3.82	0.62	0.00	0.00	2.56	0.05	0.13	13.15	0.00	32.83	4.43	7.58	3.76	0.90	0.00	4.84

To Page No.

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Recorded by Yi Pan

Cover letter for shipping Alloy 22 specimen
TITLE POF07, 08A, and 12 for XPS analysis
Project No.
Book No.

From Page No.

CNWRA A center of excellence in earth sciences and engineering
6220 Culebra Road · San Antonio · Texas, U.S.A. 78228-5166

August 23, 2005

Mr. Carl Steinke
RBD Enterprises
2437 NE Twin Knolls Drive, Suite 2
Bend, OR 97701

Reference: Requisition # 05032364

Dear Carl:

Enclosed please find three Alloy 22 specimens (POF07, POF08A, and POF12) submitted for surface analyses with x-ray photoelectron spectroscopy. The objective of this investigation is to characterize the passive surface films for determination of the thickness, composition, and oxidation state of the films. For each specimen, a wide-energy survey will be conducted on the as-received surface to determine surface elemental composition. The survey will be followed by high resolution scans combined with in-depth ion sputtering to determine concentration depth profile. The high-resolution spectra will be curve fitted to determine the oxidation state of nickel, chromium, and molybdenum, as well as the chemical-bonding environment for oxygen. Note that the instrument needs to be calibrated for binding energy and sputtering rate. The calibration information will be provided to me along with the results from the passive film analysis.

Please call me if you have any questions. Thank you for your assistance.

Sincerely,

Yi Pan

Yi-Ming Pan
Center for Nuclear Waste Regulatory Analyses
Southwest Research Institute
Tel: 210-522-6640
Fax: 210-522-5184
e-mail: ypan@swri.org

Note: Electrochemical treatments of the Alloy specimens are documented in notebook # 637 for POF07 - pages 52-53, POF08A - pages 56-57, and POF12 - pages 64-65.

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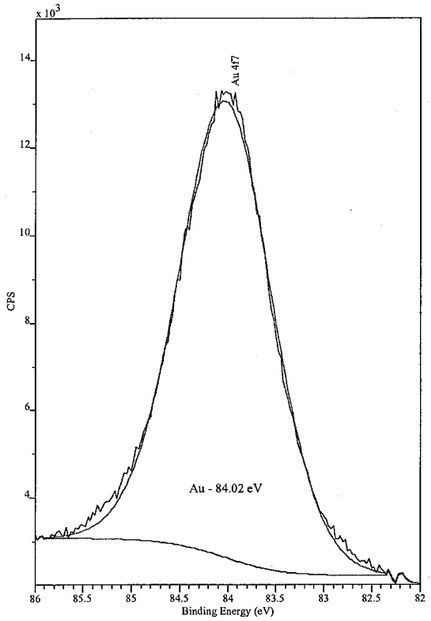
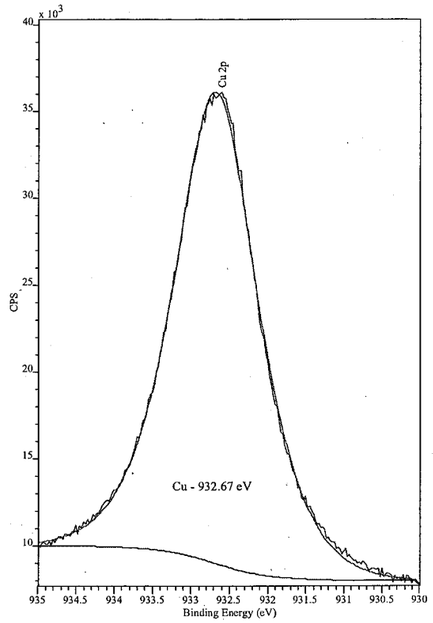
Project No.
Book No.
TITLE XPS Calibration

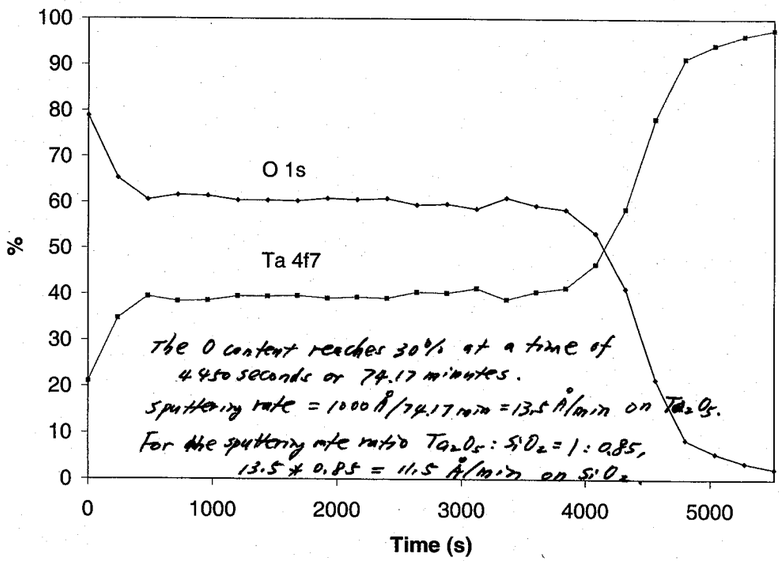
From Page No.

1. Binding energy





2. Sputtering rate



The O content reaches 30% at a time of 4450 seconds or 74.17 minutes.
Sputtering rate = 1000 Å/74.17 min = 13.5 Å/min on Ta_2O_5.
For the sputtering rate ratio $Ta_2O_5 : SiO_2 = 1 : 0.85$,
13.5 * 0.85 = 11.5 Å/min on SiO_2.

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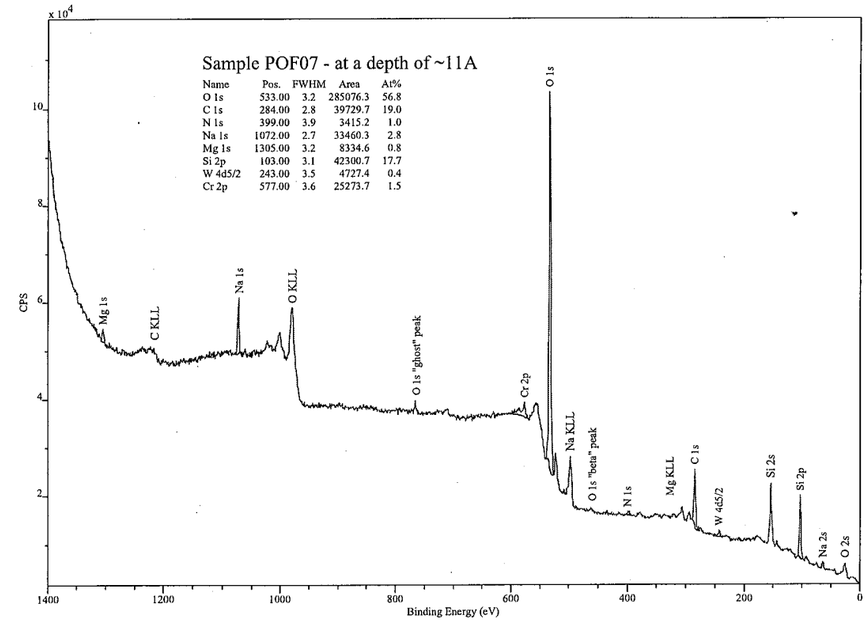
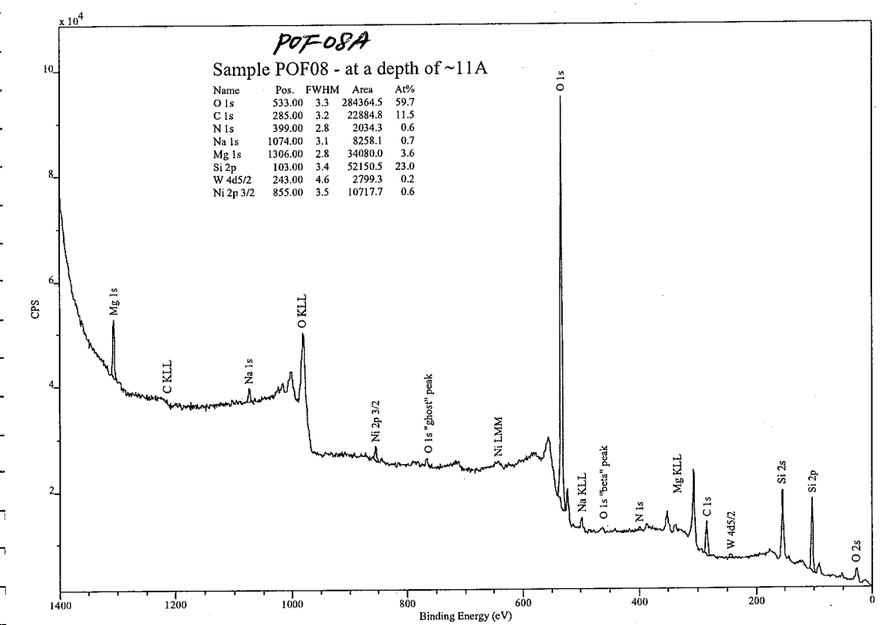
Recorded by

XPS Analysis Results of Alloy 22 Specimens
TITLE POF 07, 08A, and 12
Project No.
Book No.

From Page No.

1. Wide-energy survey of the initial surfaces





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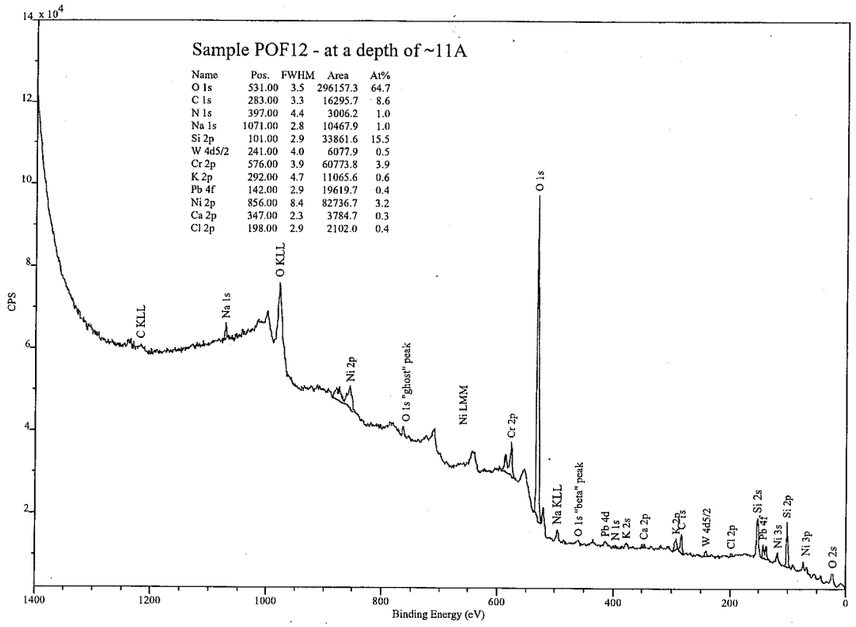
Project No.
Book No.
TITLE

From Page No.



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Project No.
Book No.
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From Page No. | 2. Elemental concentration data

POF 07

Etch Time (sec)	Depth (A)	C 1s %	Cr 2p %	Mg 1s %	Mo 3d %	Na 1s %	Ni 2p %	O 1s %	Si 2p3 %	W 4d5 %
0.00	0.00	56.50	0.98	0.22	0.00	2.06	0.87	29.68	9.70	0.00
90.00	17.25	20.39	2.04	0.34	0.22	3.14	0.57	56.04	16.80	0.46
180.00	34.50	13.13	4.06	0.38	0.44	4.21	0.65	58.73	17.90	0.50
270.00	51.75	10.01	7.15	0.47	0.62	5.24	1.56	59.03	15.30	0.63
360.00	69.00	8.64	11.44	0.18	1.01	4.74	3.69	56.09	13.44	0.78
450.00	86.25	7.98	14.93	0.00	1.95	4.20	8.15	51.07	10.84	0.87
540.00	103.50	7.82	16.39	0.00	3.27	3.35	17.78	42.92	7.30	1.16
630.00	120.75	7.40	17.35	0.00	5.25	3.37	27.36	33.41	4.33	1.54
720.00	138.00	6.07	17.31	0.00	6.79	2.72	36.14	25.97	3.12	1.88
810.00	155.25	6.14	18.22	0.00	8.29	1.99	41.61	20.55	0.85	2.36
900.00	172.50	6.75	18.27	0.00	9.27	2.23	44.79	15.39	0.34	2.97
990.00	189.75	4.57	19.55	0.00	10.27	1.93	47.46	13.34	0.00	2.88
1080.00	207.00	5.08	20.34	0.00	10.63	2.05	47.32	11.36	0.00	3.23
1170.00	224.25	3.16	20.04	0.00	11.30	2.33	48.93	10.58	0.00	3.66
1260.00	241.50	2.88	20.85	0.00	11.76	1.85	49.03	9.86	0.00	3.78
1350.00	258.75	3.63	20.37	0.00	12.30	1.28	50.83	7.98	0.00	3.61
1440.00	276.00	3.13	19.84	0.00	12.02	1.56	51.69	8.07	0.00	3.68

POF 08A

Etch Time (sec)	Depth (A)	C 1s %	Cr 2p %	Mg 1s %	Mo 3d %	Na 1s %	Ni 2p %	O 1s %	Si 2p3 %	W 4d5 %
0.00	0.00	10.05	0.65	3.96	0.00	0.59	0.59	60.49	23.44	0.24
300.00	57.50	10.88	1.00	4.39	0.00	0.52	1.46	58.74	22.46	0.57
600.00	115.00	10.01	2.19	5.15	0.00	0.15	2.09	58.97	20.63	0.81
900.00	172.50	7.24	4.85	5.05	0.24	0.08	2.29	61.50	17.91	0.84
1200.00	230.00	2.90	9.28	3.80	0.40	0.20	2.93	63.29	16.35	0.86
1500.00	287.50	1.63	12.62	2.90	0.74	0.71	3.58	63.13	13.65	1.03
1800.00	345.00	0.41	14.35	1.79	0.82	1.91	4.11	63.06	12.40	1.15
2100.00	402.50	0.00	15.45	1.19	0.86	2.64	4.69	62.94	11.06	1.17
2400.00	460.00	0.00	15.25	0.64	0.98	3.69	4.84	62.82	10.78	1.00
2700.00	517.50	0.00	15.71	0.50	0.98	3.98	5.28	61.64	10.75	1.16
3000.00	575.00	0.00	15.54	0.25	1.06	4.57	6.45	61.23	9.93	0.96
3300.00	632.50	0.00	17.11	0.18	1.27	3.97	8.73	58.79	8.89	1.07
3600.00	690.00	0.00	18.33	0.13	2.07	3.84	12.55	54.07	7.89	1.12
3900.00	747.50	0.00	19.70	0.00	3.22	2.98	20.07	46.20	6.44	1.40
4200.00	805.00	0.00	21.20	0.00	5.21	2.06	28.16	37.60	3.90	1.87
4500.00	862.50	0.00	22.18	0.00	8.09	1.45	38.06	26.29	1.44	2.50
4800.00	920.00	0.00	23.65	0.00	9.98	1.42	43.13	17.55	1.21	3.07
5100.00	977.50	0.00	24.56	0.00	11.68	0.66	47.53	11.93	0.00	3.64
5400.00	1035.00	0.00	24.66	0.00	12.56	0.00	49.80	8.99	0.00	3.99
5700.00	1092.50	0.00	25.33	0.00	13.21	0.00	50.96	6.41	0.00	4.09
6000.00	1150.00	0.00	25.18	0.00	13.15	0.00	52.37	5.26	0.00	4.04
6300.00	1207.50	0.00	25.46	0.00	13.64	0.00	52.44	4.01	0.00	4.44
6600.00	1265.00	0.00	25.35	0.00	13.43	0.00	53.41	3.27	0.00	4.54
6900.00	1322.50	0.00	26.32	0.00	13.55	0.00	52.08	3.96	0.00	4.10
7200.00	1380.00	0.00	25.49	0.00	13.49	0.00	52.88	3.98	0.00	4.16
7500.00	1437.50	0.00	25.90	0.00	13.71	0.00	52.58	3.68	0.00	4.13
7800.00	1495.00	0.00	26.04	0.00	14.00	0.00	52.31	3.09	0.00	4.55
8100.00	1552.50	0.00	26.42	0.00	13.94	0.00	52.04	2.74	0.00	4.86
8400.00	1610.00	0.00	26.56	0.00	13.86	0.00	52.17	3.46	0.00	3.95
8700.00	1667.50	0.00	26.00	0.00	13.80	0.00	52.79	3.19	0.00	4.22
9000.00	1725.00	0.00	25.51	0.00	13.72	0.00	53.54	3.15	0.00	4.09
9300.00	1782.50	0.00	25.87	0.00	14.07	0.00	52.84	3.10	0.00	4.12

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POF 12

Etch Time (sec)	Depth (A)	C 1s %	Cr 2p %	Mg 1s %	Mo 3d %	Na 1s %	Ni 2p %	O 1s %	Si 2p3 %	W 4d5 %
0.00	0.00	43.36	1.37	0.00	0.00	0.00	2.03	43.47	9.77	0.00
90.00	17.25	7.06	4.25	0.00	0.00	0.00	3.71	68.50	16.03	0.46
180.00	34.50	3.87	5.30	0.00	0.00	0.00	3.54	70.62	15.92	0.75
270.00	51.75	2.60	6.17	0.00	0.16	0.00	3.96	71.68	14.60	0.83
360.00	69.00	2.19	7.44	0.00	0.27	0.00	4.46	70.59	14.12	0.94
450.00	86.25	1.94	8.65	0.00	0.30	0.00	5.95	69.74	12.43	0.99
540.00	103.50	1.91	10.02	0.00	0.61	0.00	7.45	67.98	10.94	1.10
630.00	120.75	1.74	11.37	0.00	0.87	0.00	9.94	65.79	9.24	1.05
720.00	138.00	1.14	12.06	0.00	1.22	0.00	11.90	63.89	8.53	1.25
810.00	155.25	1.71	12.94	0.00	1.57	0.00	13.83	60.75	7.98	1.21
900.00	172.50	1.49	13.00	0.00	2.05	0.00	16.66	57.94	7.46	1.40
990.00	189.75	1.81	13.85	0.00	2.58	0.00	19.59	53.73	7.03	1.41
1080.00	207.00	1.11	14.28	0.00	3.05	0.00	22.44	51.68	5.76	1.69
1170.00	224.25	0.82	14.70	0.00	3.59	0.00	23.90	49.53	5.76	1.71
1260.00	241.50	1.02	15.46	0.00	4.01	0.00	25.65	45.78	6.25	1.83
1350.00	258.75	0.00	16.46	0.00	4.83	0.00	28.15	43.11	5.37	2.07
1440.00	276.00	0.00	15.77	0.00	5.44	0.00	29.67	42.30	4.61	2.21
1530.00	293.25	0.00	16.60	0.00	5.78	0.00	30.85	40.11	4.51	2.14
1620.00	310.50	0.00	16.98	0.00	6.23	0.00	33.26	37.53	3.52	2.47
1710.00	327.75	0.00	17.00	0.00	6.40	0.00	35.04	35.87	3.27	2.43
1800.00	345.00	0.00	16.75	0.00	6.79	0.00	35.86	34.92	3.16	2.52
1890.00	362.25	0.00	17.12	0.00	7.12	0.00	35.30	34.29	3.60	2.58
1980.00	379.50	0.00	18.25	0.00	7.52	0.00	35.70	33.54	2.25	2.74
2070.00	396.75	0.00	18.46	0.00	7.97	0.00	38.09	30.82	1.91	2.75
2160.00	414.00	0.00	17.96	0.00	8.21	0.00	38.70	29.89	2.40	2.85
2250.00	431.25	0.00	18.29	0.00	8.46	0.00	39.42	28.98	1.94	2.91
2340.00	448.50	0.00	18.09	0.00	8.63	0.00	40.58	28.45	1.24	3.02
2430.00	465.75	0.00	18.29	0.00	8.97	0.00	41.31	27.21	1.03	3.19
2520.00	483.00	0.00	19.52	0.00	9.05	0.00	42.26	26.10	0.00	3.06
2610.00	500.25	0.00	19.48	0.00	9.89	0.00	42.51	25.00	0.00	3.12
2700.00	517.50	0.00	20.30	0.00	9.45	0.00	43.37	23.57	0.00	3.30
2790.00	534.75	0.00	19.64	0.00	9.83	0.00	44.36	23.12	0.00	3.06
2880.00	552.00	0.00	20.68	0.00	9.85	0.00	44.27	22.13	0.00	3.07
2970.00	569.25	0.00	20.14	0.00	10.28	0.00	44.83	21.50	0.00	3.24
3060.00	586.50	0.00	20.42	0.00	10.15	0.00	44.32	22.07	0.00	3.04
3150.00	603.75	0.00	19.69	0.00	10.23	0.00	45.33	21.28	0.00	3.47
3240.00	621.00	0.00	22.13	0.00	10.63	0.00	43.64	19.96	0.00	3.64
3330.00	638.25	0.00	20.76	0.00	10.99	0.00	46.03	18.59	0.00	3.62
3420.00	655.50	0.00	20.57	0.00	10.86	0.00	46.40	18.49	0.00	3.68
3510.00	672.75	0.00	21.02	0.00	10.87	0.00	46.87	17.50	0.00	3.74
3600.00	690.00	0.00	21.49	0.00	11.09	0.00	47.03	16.78	0.00	3.61
3690.00	707.25	0.00	20.91	0.00	11.11	0.00	47.70	16.58	0.00	3.70
3780.00	724.50	0.00	20.63	0.00	10.93	0.00	48.26	16.72	0.00	3.45
3870.00	741.75	0.00	21.22	0.00	11.19	0.00	49.29	14.82	0.00	3.48
3960.00	759.00	0.00	21.76	0.00	11.38	0.00	49.54	13.92	0.00	3.40
4050.00	776.25	0.00	22.24	0.00	11.57	0.00	48.09	14.33	0.00	3.78
4140.00	793.50	0.00	21.49	0.00	11.30	0.00	48.92	14.72	0.00	3.56
4230.00	810.75	0.00	22.06	0.00	11.55	0.00	49.41	13.36	0.00	3.62
4320.00	828.00	0.00	22.19	0.00	11.31	0.00	50.33	12.25	0.00	3.92
4410.00	845.25	0.00	21.85	0.00	11.33	0.00	50.10	13.12	0.00	3.61
4500.00	862.50	0.00	21.10	0.00	11.50	0.00	50.10	13.32	0.00	3.98

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Witnessed & Understood by me, | Date | Invented by | Date 9/16/05

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Project No.

TITLE Book No.

From Page No. 3. Chemical state Data

POF 07

Etch Time (sec)	Depth (A)	C 1s %	Cr metal %	Cr2O3 %	H2O %	Mg 1s %	Mo IV %	Mo O2 %	Mo V %	Mo VI %	Mo metal %	Na 1s %	Ni metal %	Ni2O3 %	NiO %	O2- %	OH- %	Si 2p3 %	W 4d5 %
0.00	0.00	57.13	0.22	0.67	3.34	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.58	0.02	0.48	0.06	0.00	17.52	0.24
90.00	17.25	21.05	0.50	1.39	1.54	0.35	0.03	0.04	0.05	0.04	0.00	0.00	0.53	0.06	1.18	0.02	0.00	20.44	0.58
180.00	34.50	13.62	1.04	2.78	1.30	0.40	0.04	0.13	0.10	0.04	0.00	0.00	0.15	0.08	0.69	1.05	2.89	55.51	0.82
270.00	51.75	10.50	2.33	5.00	0.79	0.50	0.06	0.19	0.10	0.04	0.00	0.18	0.20	0.90	0.33	0.98	33.50	29.89	16.63
360.00	69.00	9.11	4.29	7.07	0.00	0.19	0.05	0.25	0.10	0.07	0.00	0.31	0.73	1.27	0.43	1.09	39.79	23.38	14.01
450.00	86.25	8.67	6.72	9.04	0.00	0.00	0.00	0.50	0.05	0.07	0.00	0.37	1.95	1.65	0.41	1.13	44.93	18.38	12.67
540.00	103.50	8.65	8.89	9.31	0.00	0.00	0.00	0.70	0.06	0.14	0.47	2.70	1.95	0.60	1.21	47.14	16.05	11.29	1.18
630.00	120.75	8.35	11.14	7.53	0.00	0.00	0.21	0.87	0.00	0.15	0.44	3.80	2.09	0.57	1.27	47.68	14.79	11.11	1.20
720.00	138.00	7.09	13.00	7.04	0.00	0.00	0.00	1.23	0.10	0.14	0.35	4.08	2.60	0.72	1.11	50.51	11.28	11.03	1.03
810.00	155.25	7.16	15.09	6.95	0.00	0.00	0.13	1.34	0.16	0.12	0.43	4.75	3.96	6.72	1.32	52.37	9.00	10.31	1.19
900.00	172.50	7.86	16.29	5.55	0.00	0.00	0.23	1.12	0.06	0.06	0.04	4.00	4.07	1.10	1.55	50.68	9.40	9.12	1.10
990.00	189.75	5.29	17.57	5.64	0.00	0.00	0.00	1.83	0.07	0.02	0.05	3.21	2.29	16.74	2.60	48.89	7.20	8.14	1.16
1080.00	207.00	6.00	18.38	5.01	0.00	0.00	0.00	1.70	0.06	0.00	0.00	2.52	1.65	23.01	3.12	44.48	4.97	6.94	1.51
1170.00	224.25	3.77	19.58	4.21	0.00	0.00	0.01	1.59	0.02	0.00	0.00	0.47	1.66	27.13	2.43	36.16	4.53	4.34	2.07
1260.00	241.50	3.36	20.16	4.95	0.00	0.00	0.00	1.96	0.00	0.13	0.44	3.80	2.09	29.53	3.48	27.11	2.95	1.63	2.84
1350.00	258.75	4.24	20.62	3.85	0.00	0.00	0.00	2.08	0.00	0.00	0.14	0.35	4.08	2.60	0.72	2.85	8.13	1.41	3.59
1440.00	276.00	3.75	20.71	3.86	0.00	0.00	0.00	2.07	0.00	0.00	0.12	0.43	4.75	2.95	0.74	1.44	7.82	0.00	4.23

POF 08A

Etch Time (sec)	Depth (A)	C 1s %	Cr metal %	Cr2O3 %	H2O %	Mg 1s %	Mo IV %	Mo O2 %	Mo V %	Mo VI %	Mo metal %	Na 1s %	Ni metal %	Ni2O3 %	NiO %	O2- %	OH- %	Si 2p3 %	W 4d5 %
0.00	0.00	10.04	0.19	0.33	43.15	3.96	0.00	0.00	0.00	0.00	0.00	0.00	0.58	0.02	0.48	0.06	0.00	17.52	0.24
300.00	57.50	11.16	0.31	0.83	37.36	4.50	0.00	0.00	0.00	0.00	0.00	0.00	0.53	0.06	1.18	0.02	0.00	20.44	0.58
600.00	115.00	10.20	0.57	1.80	0.00	5.25	0.00	0.06	0.06	0.00	0.00	0.00	0.15	0.08	0.69	1.05	2.89	55.51	0.82
900.00	172.50	7.38	1.42	3.74	0.00	5.15	0.00	0.06	0.06	0.00	0.00	0.18	0.20	0.90	0.33	0.98	33.50	29.89	16.63
1200.00	230.00	2.95	3.09	6.32	0.00	3.86	0.01	0.15	0.07	0.11	0.00	0.31	0.73	1.27	0.43	1.09	39.79	23.38	14.01
1500.00	287.50	1.68	4.49	8.37	0.00	2.98	0.04	0.20	0.11	0.14	0.07	0.37	1.95	1.65	0.41	1.13	44.93	18.38	12.67
1800.00	345.00	0.42	5.18	9.45	0.00	1.83	0.00	0.25	0.14	0.02	0.15	0.47	2.70	1.95	0.60	1.21	47.14	16.05	11.29
2100.00	402.50	0.00	5.28	10.39	0.00	1.22	0.02	0.24	0.11	0.12	0.14	0.44	3.80	2.09	0.57	1.27	47.68	14.79	11.11
2400.00	460.00	0.00	5.21	10.82	0.00	0.65	0.07	0.20	0.12	0.18	0.14	0.35	4.08	2.60	0.72	1.11	50.51	11.28	11.03
2700.00	517.50	0.00	4.88	11.15	0.00	0.51	0.06	0.22	0.18	0.19	0.12	0.43	4.75	2.95	0.74	1.32	52.37	9.00	10.31
3000.00	575.00	0.00	4.82	11.42	0.00	0.26	0.02	0.30	0.19	0.18	0.12	0.60	4.07	4.00	1.10	1.55	50.68	9.40	9.12
3300.00	632.50	0.00	5.31	12.15	0.00	0.18	0.09	0.36	0.18	0.18	0.06	2.52	3.21	10.76	1.35	1.66	48.89	7.20	8.14
3600.00	690.00	0.00	6.29	12.18	0.00	0.14	0.00	0.51	0.25	0.12	0.05	4.51	2.29	16.74	2.60	2.43	44.48	4.97	6.94
3900.00	747.50	0.00	8.39	12.48	0.00	0.00	0.01	0.74	0.14	0.00	0.00	7.08	1.65	23.01	3.12	3.67	27.11	2.95	1.63
4200.00	805.00	0.00	11.12	11.64	0.00	0.00	0.00	0.98	0.02	0.00	0.00	9.18	1.66	27.13	2.43	4.66	19.64	0.95	1.41
4500.00	862.50	0.00	15.66	9.93	0.00	0.00	0.00	1.32	0.02	0.00	0.00	11.00	0.76	29.53	3.48	7.12	12.94	0.00	0.00
4800.00	920.00	0.00	19.43	8.13	0.00	0.00	0.00	1.80	0.00	0.00	0.00	12.18	0.00	31.17	2.85	7.82	9.27	0.13	0.00
5100.00	977.50	0.00	22.19	6.78	0.00	0.00	0.03	1.93	0.00	0.00	0.00	12.79	0.00	32.13	3.48	8.82	6.17	0.00	0.00
5400.00	1035.00	0.00	23.99	5.84	0.00	0.00	0.00	2.01	0.00	0.00	0.00	13.47	0.00	32.76	3.51	7.69	5.78	0.00	0.00
5700.00	1092.50	0.00	24.80	5.04	0.00	0.00	0.00	1.95	0.00	0.00	0.01	13.35	0.00	33.30	3.09	7.60	5.01	0.00	0.00
6000.00	1150.00	0.00	25.23	4.60	0.00	0.00	0.00	1.94	0.00	0.00	0.02	13.34	0.00	33.13	2.99	7.43	4.97	0.00	0.00
6300.00	1207.50	0.00	25.97	4.09	0.00	0.00	0.00	2.22	0.00	0.00	0.00	13.42	0.00	32.92	3.45	7.93	4.72	0.00	0.00
6600.00	1265.00	0.00	26.23	4.08	0.00	0.00	0.00	2.29	0.00	0.00	0.00	13.41	0.00	32.08	4.13	8.53	4.26	0.00	0.00
6900.00	1322.50	0.00	26.47	4.12	0.00	0.00	0.00	2.07	0.00	0.00	0.00	13.49	0.00	33.19	3.54	8.82	3.55	0.00	0.00
7200.00	1380.00	0.00	26.15	4.35	0.00	0.00	0.00	2.06	0.00	0.00	0.00	13.63	0.00	32.87	3.34	8.58	3.83	0.00	0.00
7500.00	1437.50	0.00	26.48	3.85	0.00	0.00	0.00	2.14	0.00	0.00	0.00	13.55	0.00	33.70	3.52	7.48	3.04	0.00	0.00
7800.00	1495.00	0.00	26.43	3.88	0.00	0.00	0.00	2.06	0.00	0.00	0.00	13.52	0.00	33.15	2.93	8.50	3.15	0.00	0.00
8100.00	1552.50	0.00	26.61	4.15	0.00	0.00	0.00	2.16	0.00	0.00	0.01	13.42	0.00	32.90	3.21	8.65	3.74	0.00	0.00
8400.00	1610.00	0.00	27.19	4.60	0.00	0.00	0.00	2.17	0.00	0.00	0.02	13.63	0.00	32.87	3.43	8.78	3.28	0.00	0.00
8700.00	1667.50	0.00	26.74	4.21	0.00	0.00	0.00	2.12	0.00	0.00	0.00	13.81	0.00	32.76	3.41	9.05	3.23	0.00	0.00
9000.00	1725.00	0.00	26.67	4.18	0.00	0.00	0.00	2.18	0.03	0.00									
9300.00	1782.50	0.00	26.63	4.17	0.00	0.00	0.00	2.05	0.00	0.00									

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POF 12

Etch Time (Sec)	Depth (A)	C 1s %	Cr metal %	Cr2O3 %	H2O %	Mg 1s %	Mo IV %	Mo O2 %	Mo V %	Mo VI %	Mo metal %	Na 1s %	Ni metal %	Ni2O3 %	NiO %	O2- %	OH- %	Si 2p3 %	W 4d5 %
0.00	0.00	44.62	0.20	1.16	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.89	0.04	8.15	34.67	10.05	0.00
90.00	17.25	7.19	0.79	3.46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.78	1.32	0.28	35.73	33.66	16.33	0.47
180.00	34.50	3.86	1.07	4.36	0.00	0.00	0.01	0.05	0.09	0.03	0.00	0.00	0.58	1.28	0.37	40.01	31.70	15.85	0.75
270.00	51.75	2.61	1.39	5.14	0.00	0.00	0.04	0.03	0.08	0.07	0.01	0.00	1.11	1.23	0.49	45.16	27.19	14.63	0.83
360.00	69.00	2.15	1.53	5.75	0.01	0.00	0.08	0.06	0.10	0.09	0.06	0.00	1.85	1.32	0.50	48.73	22.94	13.91	0.93
450.00	86.25	1.95	2.05	6.81	0.00	0.00	0.06	0.12	0.12	0.08	0.13	0.00	2.69	1.44	0.88	50.83	19.35	12.51	0.99
540.00	103.50	1.93	2.55	7.72	0.00	0.00	0.04	0.17	0.14	0.15	0.26	0.00	3.67	1.62	0.81	53.02	15.73	11.07	1.11
630.00	120.75	1.81	3.06	8.45	0.00	0.00	0.01	0.23	0.20	0.13	0.46	0.00	5.12	1.70	1.06	54.89	12.19	9.60	1.09
720.00	138.00	1.17	3.64	8.64	0.04	0.00	0.06	0.30	0.20	0.11	0.70	0.00	6.17	1.68	1.80	54.57	10.90	8.73	1.28
810.00	155.25	1.79	4.48	9.09	0.00	0.00	0.07	0.36	0.19	0.08	1.07	0.00	8.02	1.98	1.67	52.53	9.09	8.32	1.26
900.00	172.50	1.54	4.98	9.07	0.00	0.00	0.00	0.45	0.10	0.09	1.53	0.00	9.13	2.06	2.55	51.00	8.39	7.68	1.44
990.00	189.75	1.89	5.63	9.14	0.00	0.00	0.00	0.53	0.12	0.06	1.98	0.00	11.59	2.20	1.63	49.96	6.44	7.34	1.47
1080.00	207.00	1.18	6.19	8.91	0.00	0.00	0.00	0.58	0.09	0.07	2.58	0.00	13.05	2.87	2.42	48.52	5.56	6.16	1.81
1170.00	224.25	0.87	7.09	8.86	0.00	0.00	0.00	0.69	0.14	0.15	3.09	0.00	14.42	2.99	2.63	45.63	5.51	6.12	1.81
1260.00	241.50	1.08	7.69	8.65	0.00	0.00	0.00	0.73	0.08	0.06	3.47	0.00	14.72	2.37	3.72	43.40	5.45	6.65	1.94
1350.00	258.75	0.00	8.56	8.19	0.00	0.00	0.00	0.85	0.06	0.14	4.10	0.00	16.11	2.40	3.78	41.81	6.09	5.71	2.20
1440.00	276.00	0.00	9.33	8.07	0.00	0.00	0.00	0.76	0.24	0.00	4.63	0.00	16.90	2.46	4.45	41.23	4.67	4.90	2.35
1530.00	293.25	0.00	10.04	8.07	0.00	0.00	0.00	1.08	0.08	0.13	5.13	0.00	17.99	2.83	4.56	38.35	4.56	4.87	2.32
1620.00	310.50	0.00	10.58	6.15	0.00	0.00	0.00	1.08	0.06	0.06	5.57	0.00	20.07	3.55	3.89	37.09	5.23	3.91	2.74
1710.00	327.75	0.00	11.70	7.00	0.00	0.00	0.00	1.24	0.05	0.11	5.94	0.00	20.63	1.54	5.08	35.81	4.42	3.72	2.76
1800.00	345.00	0.00	11.82	6.85	0.00	0.00	0.00	1.14	0.04	0.08	6.30	0.00	21.44	2.76	4.16	35.58	3.43	3.56	2.83
1890.00	362.25	0.00	12.26	6.61	0.00	0.00	0.00	1.21	0.00	0.13	6.70	0.00	21.88	3.18	4.43	33.08	3.69	3.96	2.84
1980.00	379.50	0.00	13.30	7.42	0.00	0.00	0.00	1.36	0.00	0.00	6.81	0.00	21.67	2.85	5.46	32.70	2.84	2.52	3.07
2070.00	396.75	0.00	13.53	6.47	0.00	0.00	0.00	1.54	0.06	0.03	7.23	0.00	23.30	3.25	5.31	32.06	1.95	2.16	3.11
2160.00	414.00	0.00	14.02	6.79	0.00	0.00	0.00	1.25	0.02	0.05	7.46	0.00	24.50	3.35	4.89	29.68	2.02	2.73	3.24
2250.00	431.25	0.00	14.28	6.49	0.00	0.00	0.00	1.44	0.04	0.05	7.46	0.00	24.08	3.79	5.13	29.37	2.50	2.14	3.23
2340.00	448.50	0.00	14.89	6.18	0.00	0.00	0.00	1.56	0.00	0.03	7.72	0.00	24.05	3.54	6.16	28.22	2.84	1.40	3.41
2430.00	465.75	0.00	15.59	6.35	0.00	0.00	0.00	1.44	0.04	0.08	8.38	0.00	23.89	2.50	6.70	27.50	2.75	1.16	3.61
2520.00	483.00	0.00	16.11	6.69	0.00	0.00	0.00	1.54	0.01	0.08	8.50	0.00	25.42	3.76	5.59	27.12	1.64	0.00	3.53
2610.00	500.25	0.00	16.37	6.13	0.00	0.00	0.00	1.39	0.29	0.11	9.09	0.00	26.83	3.45	5.45	26.65	0.75	0.00	3.50
2700.00	517.50	0.00	17.23	5.46	0.00	0.00	0.01	1.43	0.09	0.02	9.37	0.00	27.20	3.04	5.75	25.46	1.02	0.00	3.93
2790.00	534.75	0.00	17.46	4.96	0.00	0.00	0.00	1.63	0.00	0.09	9.33	0.00	26.28	2.93	7.79	24.94	1.02	0.00	3.56
2880.00	552.00	0.00	17.60	6.16	0.00	0.00	0.14	1.44	0.00	0.06	9.88	0.00	27.76	3.25	5.58	23.57	0.96	0.00	3.61
2970.00	569.25	0.00	17.54	6.19	0.00	0.00	0.09	1.16	0.00	0.09	9.77	0.00	28.36	3.94	6.24	22.16	0.77	0.00	3.68
3060.00	586.50	0.00	18.30	6.03	0.00	0.00	0.00	1.89	0.04	0.07	9.57	0.00	26.93	3.07	7.30	22.77	0.49	0.00	3.54
3150.00	603.75	0.00	18.04	5.44	0.00	0.00	0.00	1.77	0.00	0.14	9.83	0.00	27.85	2.75	6.55	22.59	1.00	0.00	4.05
3240.00	621.00	0.00	18.04	5.87	0.00	0.00	0.00	1.68	0.00	0.03	9.76	0.00	28.10	3.27	7.19	21.15	0.76	0.00	4.16
3330.00	638.25	0.00	18.89	5.88	0.00	0.00	0.00	1.82	0.00	0.19	10.16	0.00	28.51	2.97	6.40	20.90	0.08	0.00	4.20
3420.00	655.50	0.00	19.11	5.79	0.00	0.00	0.00	1.91	0.00	0.07	9.93	0.00	27.92	3.66	7.13	19.56	0.70	0.00	4.21
3510.00	672.75	0.00	18.90	6.07	0.00	0.00	0.00	1.71	0.00	0.00	9.98	0.00	28.37	3.44	7.30	19.40	0.53	0.00	4.28
3600.00	690.00	0.00	19.47	4.80	0.00	0.00	0.00	1.83	0.09	0.00	10.33	0.00	28.97	4.05	6.73	18.26	1.31	0.00	4.16
3690.00	707.25	0.00	19.81	4.60	0.00	0.00	0.00	1.71	0.00	0.15	10.99	0.00	29.40	3.29	7.41	18.23	0.00	0.00	4.39
3780.00	724.50	0.00	19.15	5.27	0.00	0.00	0.00	1.60	0.00	0.15	10.65	0.00	28.80	3.48	7.62	19.31	0.00	0.00	3.96
3870.00	741.75	0.00	19.89	5.73	0.00	0.00	0.00	1.69	0.00	0.11	10.97	0.00	29.91	4.10	5.93	17.60	0.00	0.00	4.07
3960.00	759.00	0.00	20.37	5.38	0.00	0.00	0.00	1.68	0.00	0.07	11.04	0.00	29.36	3.10	7.02	16.66	1.29	0.00	4.00
4050.00	776.25	0.00	20.45	4.60	0.00	0.00	0.01	1.82	0.00	0.13	11.15	0.00	29.95	2.84	7.74	15.50	1.34	0.00	4.47
4140.00	793.50	0.00	19.99	5.13	0.00	0.00	0.00	1.80	0.05	0.00	10.78	0.00	29.79	3.54	7.23	17.46	0.00	0.00	4.21
4230.00	810.75	0.00	19.99	5.58	0.00	0.00	0.00	1.79	0.03	0.15	11.05	0.00	30.07	3.25	7.95	15.26	0.76	0.00	4.13
4320.00	828.00	0.00	20.62	5.07	0.00	0.00	0.00	1.95	0.00	0.00	11.20	0.00	31.16	3.01	7.09	14.75	0.41	0.00	4.74
4410.00	845.25	0.00	20.28	4.68	0.00	0.00	0.01	1.87	0.00	0.10	11.06	0.00	30.59	3.55	8.07	14.24	1.28	0.00	4.26
4500.00	862.50	0.00	20.35	4.00	0.00	0.00	0.00	1.79	0.05	0.15	11.21	0.00	30.43	3.42	8.28	15.64	0.00	0.00	4.68

Copies sent to QA Records

Witnessed & Understood by me,

Date

Invented by

Recorded by

Date 9/16/05

To Page No.____