Sal's Thesis

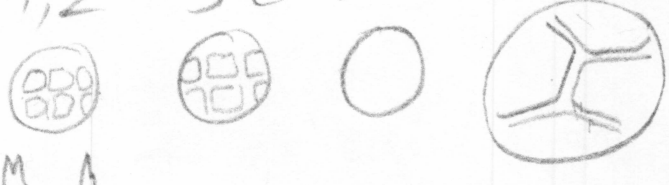
1. Introduction
2. ~~Decomp of ss~~ Thermodynamics ~~basis of AP~~
   Interpretation.
3. Sal's basis of AP (Ni Al to follow) + Appendix

Experimental

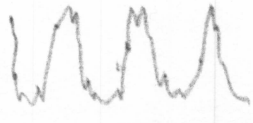
4. Ni Al — AP, TEM, Diff^{n} const, Spinodal + gb cellular etc. } 3 yrs

~~5. Ni Pt + Al 2 alloys~~

5. Ni Cr Al 16½ Good mismatch
   16½ as-q ← 1,2 5 ← 20 t 2 hours,
   30/40%



Rate of transf.



X-ray 0 || 0 high angle

6. Ni Al Ti 2 alloys 1350, 1250, 1050 } vacancies
   1350 q → 5 625°C

7. PE16 q ~~q+c~~ q+ct½ +2 +4

~~6th~~ July 1979.

Exp ternary 9/5 Al, Ti nickel-base alloy

As-quenched. Pulse ht investig^{n}.

Regions 16 & mm 8.55kV

+ 1.37 pulse

9.92 kV

S = 1.5 kV

	12		14		16		18		20	
8.1	0.97	1.12							1.62	1.87
8.2	0.98	1.14							1.64	1.89
8.3	1.00	1.15							1.66	1.91
8.4	1.01	1.16	1.18	1.36	1.34	1.56	1.51	1.74	1.68	1.94
8.5	1.02	1.18	1.19	1.37	1.36	1.58	1.53	1.77	1.70	1.96
8.6	1.03	1.19	1.20	1.39	1.38	1.60	1.55	1.79	1.72	1.98
8.7	1.04	1.20	1.22	1.41	1.39	1.61	1.57	1.81	1.74	2.01
8.8	1.06	1.22	1.23	1.42	1.41	1.64	1.58	1.83	1.76	2.03
8.9	1.07	1.23	1.25	1.44	1.42	1.65	1.60	1.85	1.78	2.05
9.0	1.08	1.25	1.26	1.45	1.44	1.67	1.62	1.87	1.80	2.08
9.1	1.09	1.26	1.27	1.47	1.46	1.70	1.64	1.89	1.82	2.10
9.2	1.10	1.27	1.29	1.49	1.47	1.71	1.66	1.91	1.84	2.12
9.3	1.12	1.29	1.30	1.50	1.49	1.73	1.67	1.93	1.86	2.15
9.4	1.13	1.30	1.32	1.52	1.50	1.74	1.69	1.95	1.88	2.17
9.5	1.14	1.32	1.33	1.53	1.52	1.76	1.71	1.97	1.90	2.19

Photos f 1.8 @ ¼ ½ 1 2 4 4 2 1 ½ ¼

8.42kV

4×10^{-5} We

bgpr 6×10^{-9}

image medium bright.

12th 00 00 DD4

hydrogen.

Time taken to get stable. Maybe repeat in case lost nickel in field.

Ended after 26 sectors
2010 ions.

@ 9.30 kV
+ 1.12 probe 1.29 setting.
total 10.52

14th to 02 00 DD4

Begin @ 9.00
1.26 kV 1.45 setting
T = 10.36 kV.

? some order.

Ended after 48 sectors = sectors data
2074 ions

@ 9.20 kV
+ 1.29 probe setting 1.49
total 10.49

18th to 08 00 DD4

Begin @ 8.90
1.42 setting 1.65
10.32

168 ended after 6F sectors = sectors 16
2062 revs

@ 9.80 kV
+ 1.64 pulse 1.67 setting
total 10.44

188 to OC OO DD4

Begin @ 8.~~~~70
1.~~~57 S=1.81
10.27

stopped @ 95 sectors = sectors 18
2205 revs

8.80 kV
+ 1.58 pulse setting 1.83
total 10.38

188 to 10 00 DD4

Begin @ 8.60 kV
1.68 S = 1.94

Ended @ 89 sectors = sectors 20
2016 revs

@ 8.45 kV
+ 1.69 pulse setting 1.95
total 10.14

2220.

8.0	1.76	2.03
8.1	1.78	2.06
8.2	1.80	2.08
8.3	1.83	2.11
8.4	1.85	2.13
8.5	1.87	2.16
8.6	1.89	2.18

Begin @ total 9.90kV
to 14 00 DD4

8.10kV
1.78 pulse S = 2.06
9.88

stopped EO sectors
2195 counts

8.10 kV
1.78 pulse S=2.06
9.88

Begin
1620 @ 9.70 kV
so @ 8.06kV
1.34 pulse sets 1.56
9.74

18 00 DD4

end @ 8.85kV
+ 1.415 pulse setting 1.645
total 10.265

105 sectors = sectors=data
2105 counts

12a

to IC 00

Begin @ 9.00
1.08
10.08 S=1.25

1460 KV A. High AL disappeared.

Fast and reg. rate noted for 20/22% pulse, not so for 16 etc. Flashing in both cases.

[redacted]

end after 12A sectors = sectors data
2047 revs

@ 9.50 kV
1.14 pulse setting 1.32
10.64

16a 20 00 DDy

start @ 8.90
1.42 setting 1.65
10.32 kV

End after 150 sectors = sectors 16
2086 revs

@ 9.05
1.45 S = 1.685
total 10.50

Lots of pictures into new film by 17 shots. (some blank). [redacted] 8.68 kV

Test for 20% pulse. July 1979

Finish 10.50 kV
begin 9.90 kV
8.30
1.66 S = 1.91
9.96

to DD6 00 00 checked floppy.
9.25, 8.98 kV photos
New film.

Begin 8.0 1.60 1.85

4,300 lots of additions.
4,800 Al + Ti
4,740 lots of Al.

25, 636 DOS 2.1
- 6 tracks + one ? re-enter.

send to 20 00

25, 660 missed 24 ots - forgot to turn off - stupid.
+ 2 other retries

drop @ 26, 632 - lost sector - no write

to 25 00

28,060 higher RL, faster rate

29,493 disc error

Reload to DD4 @ 2500 30,759
30 00 RL

31,790 stopped again.

To 32 00 32,021

to 33 00

Experiment ended after 1ins
sectors 33 00 DD4

@ 8.75kV
1.75 pulse S = 2.02 kV
10.50

20% pulse.

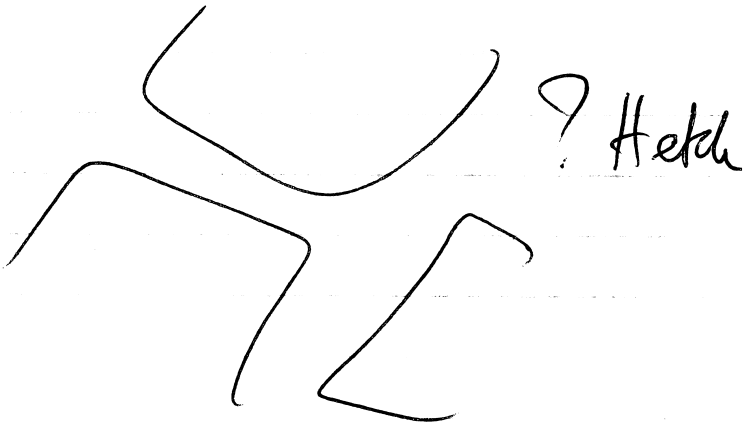
39,741 disc error. 8,000 ea~ 18hexs
2 = 30 hex
8 = C0 hex.

to DD6 @ 38 00

Spark @ 8.80
1.76 S = 2.03kV.
10.56

after 40,000 ins
85 sectors hex.

Image 8.0



9.7 10X, OK.
4x155 Ve.
Medium
f 1.8.

DVCs used to date

DD3	00	00	6B
	05	00	256
	20	00	25E (08)
	25	00	2BC
* DD1	00	00	06
	01	00	2B
* DD5	00	00	03
	05	00	06
	06	00	08-06
	07	00	11-08
DD9	00	00	19,536 words
DD8	00	00	23,941 - 19,536 words
	05	00	24,158 - 23,941
	06	00	25,190

DD8 10 00 124 is 00

DD4
00	00	26
04	00	4B
08	00	6F
0C	00	95
10	00	B9
14	00	E0
18	00	105
1C	00	12A
20	00	150

DD6
00	00	25, 636
20	00	26, 632
25	00	29, 493

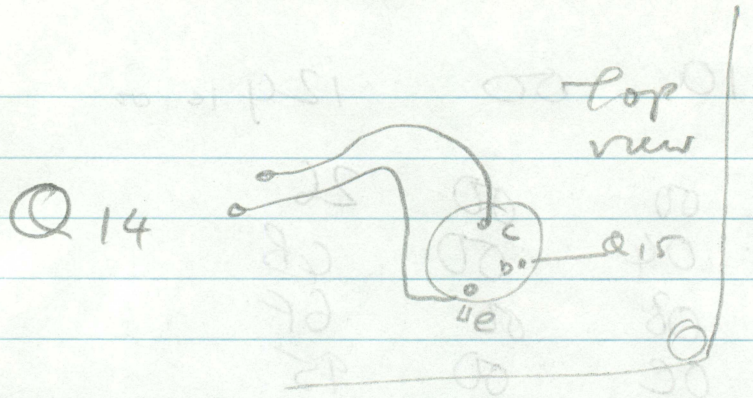
DD4
25	00	30, 759 - 29, 493
30	00	31, 790
32	00	32, 021
33	00	39, 741

DD6 38 00 05

today use DD1 @ 04 00

10th July 1979

Image 9.72 kV
bg pr 5×10^{-5}
4×10^{-5} Ne
image
dark (br
br) dark



4

CE tests

T. Pin 1 −0.6v + load of crud.
Pulled hard to remove + disc loaded

T. Pin 2 — same.

Peak on read TP1 or TP2 = 1.0v.

Error in edit. TP1 as before
wait on drop. TP2 as before

1) TP1/TP2 scoped and remove. CE continued as required to end of instruction.
2) OK this time although not regular read.
Repeats OK.

Previous alignment

72.0 74.2
75.0 77.7
@ 352°, 21.1

Use DD1 @ 04 00

Ni_3Al single crystal.

Frame 22 Ni_3Al.

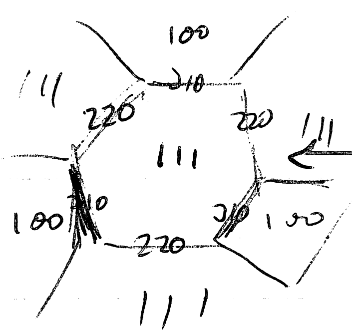


Image here.
Align 220 ①.
@ 6.10 kV

Tests to DD1 04 00. 10th Aug 1979

Attempt to look @ this again.
to DD1 04 00.

1/4 6.07
1/2 8×10^{-5} Torr
New film.

6.15 kV quite dim { 1
2
4

Begin @ total 6.38kV
5.50 0.88 1.03

Stopped after 904 cans alignment impossible. 13 sectors

to 06 00

H = 7.10
P$_S$ = 1.33
$\angle_S$ = 1.53

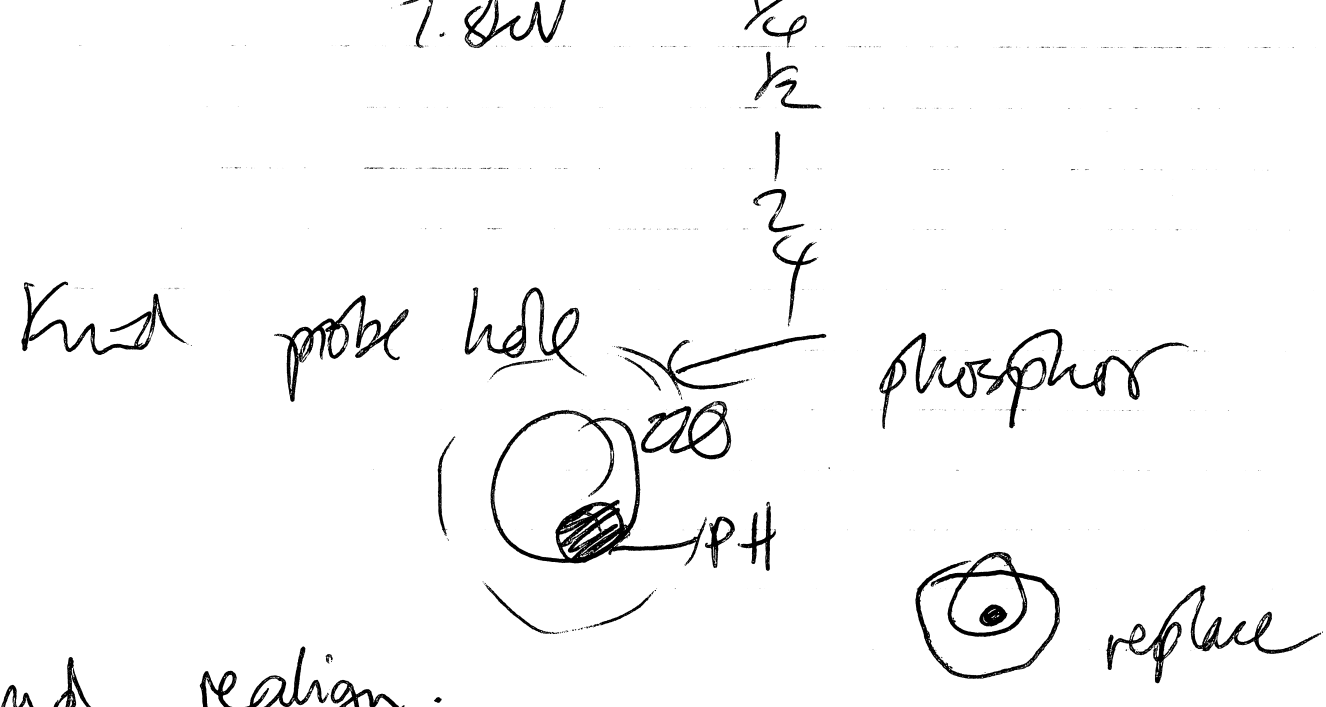
Check align
~~then~~ H = 6.9

Stopped @ 1201 28 - 13 sectors = 18 sectors

go to 08 00

rot. 359°

7.8kV



and realign.

to 08 00 stopped @ BA sectors.
H = 2.90
P = 1.58
S =
and 7,653 revs BA - 28 sector
8F

To 14 00 @ a.a.w 1/16, 1/8, 1/4, 1/2, 1, 2
beautiful.
Moved probe hole away from zone line.
ended after 25,221 revs
27D = sectors. 27D - BA total
= 1C3

Calibrate traverse now.
total no sectors 20 s = 1 tracks.
10 tracks = 16 x 20
= 200

Hence begin @ 24 00

Old alignment 0°, 05.2°

72.5 74.1
75.3 76.6

Change to spencer forward (+ max)
1/4, 1/2, 2 jams 2, 1.
Shutter jams.

PH OPK

stopped 280

@ 10.50kV

to 25 00 1049 counts
@ ~~10.00~~ 9.80 293 = 13 sectors

to 28 00 299
to 29, 00
¼ ½
new John ¼ ½ 1 } for moved probe hole.

stopped after 600 counts
2E1 = sectors

Alignment.
@ 10.50kV
Trans = 2E1 − 299 48

to 30 00 @ 0°, 10.2°

73.0 71.7
76.2 75.1

Move further back.

to DD1 @ 30 00

18th August 1979.

As-9 1350 9/4 tonang.
(AEW is spec).

to DD1 @ 06 00

Stop before 25 00 and restart.

200 aligned k 1/2 1 24
bright (rather spotty) image
@ 9.8kV
3×10^{-9} bg + 4×10^{-5} Ne.

begin @ total of 9.30kV

H = 8.00
P = 1.28 U = 1.48 T = 9.28

problem with second ions.

Say 50 ions/sector there are 20 sectors per track = 32 s/track
hence 1600 ions = 1 track

and 8,000 ions = 05 tracks.

and 40,000 ions = 25 dec tracks = 19 hex tracks

expended @ H = 10.25kV
P = 1.64kV S = 1.90kV
T = 11.89

after ins 40,103
328 = sectors

Photos ¼ ½ 1 2 4 @ ~ 90.0kV.

Align 70.5 72.7

7.8 77.0

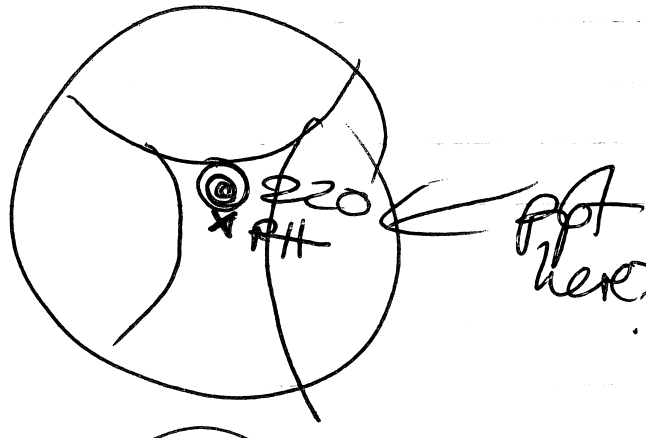
@ 355 7-8°

24th August 1979

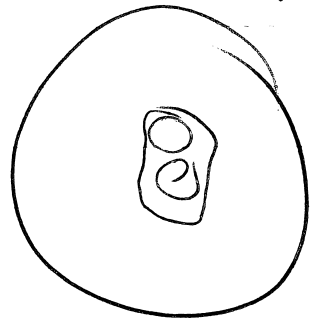
5hrs @ 625°C Ni-9Al-4½Ti approx
to DD3 @ 00 00.

7.10 medium bright

4×10^{-9}
+ 4×10^{-5} Ne.



¼
½
1
2
4

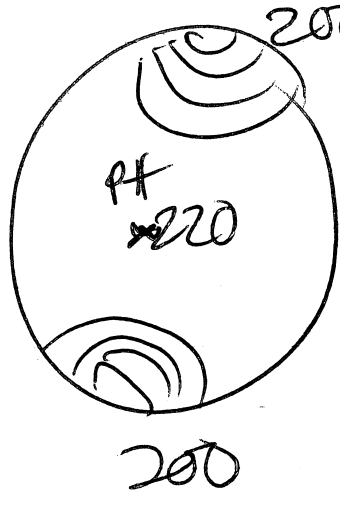


low field

Blew up.

1hrs @ 625°C as above DD3 00 00

¼
½
1
2
4



not v. bright
4×10^{-5} Ne
4×10^{-9} bgd

7.28 kV.

02 sectors stopped
04 " "
Stopped 1503 error in P = 1418.84

to 22-04 sectors
to 02 00 55 sectors 2876 ions.

to ob ov

940V
1.50 pulse
10.90 total $\mu = 1.74$

Blew up 3089 8D sectors.

AEW's tape no's

7K = 2.38 secs

Ni – Al	313	a, b	1000–1K	5	
	314		1K	5	
	315	[illegible]	?	5	
	316	a, b	?	5,5 ?	
	317		?	5?	
	318	a, b	?	5,5?	
spun	14.0 – 14.7 (M3) 468		12K	5	
	17.73 – 18.33 469		~~24K~~	~~10~~	~ M1
Ni – Al – Ti as q	8.23 – 8.38 M 453		1K	5	~~M2~~
	8.3 – 8.45 M3 454		1K3	5	
diff phase	9.66(a) 9.5 (b) 455	a, b	1K2, 1K2	5,5	~M
	10.7 – 11.5 456		~~11K~~	5	M1
	15.2 – 15.2 457		2K	~~5~~	M3
	15.3 – 15.3 ~~458~~		?	5?	M
	15.40 – 15.60 459		2K5	5	
	15.55 – 15.6 ~~460~~	a	~~2K~~	~~5~~	M3
	15.91 – ~~15.91~~ 461		4K7	5	M3
	15.3 – 15.95 462		19K	10	
	15.7 – 15.95 463	a, b	4K, 11K	~~5,5~~	M2
	Missing to M2 16.3 – 16.5 464	a, b	2K, ?	5,5	M
	16.6 – 16.9 ~~465~~		?	~~5?~~	✓
New batch as q	9.6 – 10.4 470		22K	10	M1
	11.75 – 12. 471		7K	5	✓
	11.63 – 12.15 M1 ~~472~~		30K	~~20~~	
	12.15 – 12.9 (M2) 473		?	?	
Shr	~~8~~ 10.2 – 10.7 (M1) 484		20K	10	
	10.7 – 11.2 ~~485~~		30K	20	~ M2
	486		50K	30	
	– 14.48 M2 ~~487~~				

11 kV ≡

FIRST TRANSFERS

-4 455 458 461 46
469 471 488

2nd

-3 457 463 = 462
464
470

3rd

-2 456 458 464 LONG = 463

4th

-1 453 454 468 47
473 484 487

5th

nothing 459 460 48

	time	
~~D8~~ 456	25	(-2)
462	(463) 35	(-3)
463	(464 long) 35	(-2)
470	40	(-3)
471	25	(-4)
472	50	(+1)
473	50	(+1)
485	50	(-4)
486	45	
487	50	(-1)
468	30	(-1)
469	40	(-4)

Changes. M2 time M11 (-N)
M3 background
G1 484 456

PLOTS IAPT484A
T

Alloy 2 9/4½

Data which I have

Quench from
1250°C Q^6 1^3 5^2
1350°C Q^{12} 1^4 5^{12}
1150°C Q^4 1 5
1050°C Q^4 1 5

Q_{1250} 8/2 12/4 12/6 8/4 (⅓→½)

Q_{1350} $\frac{6}{3}+\frac{10}{5}$ $\frac{12}{4}+\frac{4}{1}$ $\frac{7}{2}+\frac{10}{4}$ (⅓→½)

$\frac{5}{3}\rightarrow\frac{9}{4}$

(⅔−1)

5_{1350} $\frac{12}{8}+\frac{4}{4}$ $\frac{4}{4}+\frac{11}{10}$ $\frac{6}{4},\frac{8}{5},\frac{6}{4}$

$\frac{4}{4}$

Alloy 1 9/3

Much more obscure ppt.

$\frac{10}{8}+\frac{4}{2}$

To look @ $45^{-1}3$, $45^{-1}4$, $45^{-4}5$, $45^{-3}7$, $45^{-4}8$, $45^{\phi}9$
$46^{\phi}0$, $46^{-4}5$ A done

To do FT as l
file as l LST

531
578
691
587
653
707
454
679

I discover that Ti bins are wrong.

Edit Ti. Remove. ~~&~~ Good + Phx → ends.
Edit these A1 plots to have correct tape no.
Replot with key. 456 — 487.

Then submit Ti. &		11 IAPNMASS	13 legend	2 time	titime	
Tape ~~X~~	453	-1		15 25	10	P
~~X~~	454	-1		15 25	10	P
A1 ~~X~~	455	-4		15 25	10	P
A1 ~~X~~	456	-2		25	15	
A1 ~~X~~	457	-3		15 25	10	P
A1 ~~X~~	458	-4, -2		15 25	10	P
~~X~~	459	—		15 25	10	P
~~X~~	460	—		15 25	10	P
A1 ~~X~~	461	-4		15 25	10	
A1 ~~X~~	462	-3 as 463		35	20	
A1 ~~X~~	463	-2 as 466 LONG		35	20	
A1 ~~X~~	464	-3		15 25	10	
A1 ~~X~~	465	-4		15 25	10	P
~~X~~	468	-1		30	~~15~~ 20	
A1 ~~X~~	469	-4		40	~~20~~ 25	
A1 ~~X~~	470	-3		40	~~20~~ 25	
A1 ~~X~~	471	-4		25	15	
~~X~~	472	-1		50	~~25~~ 30	
~~X~~	473	-1		50	~~25~~ 30	
~~X~~	484	-1		50	~~25~~ 30	
A1 ~~X~~	485	-4		50	~~25~~ 30	
~~X~~	486	—		45	25	
~~X~~	487	-1		50	~~25~~ 30	

To PLOT ~~ALL~~ (IAPT XXXT) ∴ plots.
condensed next to PLOT1

∴ extra Al = (3.57 − 2.74) gms
= 0.83 gms.

and wt Cr = 9.82(5) gms

Sum = 39.35 + 9.82(5) + 0.83 = 50 gms (correct)

Mass bar = 29.60 (too small)
62.61 (43 mm)
185.43

length required = $\frac{39.35}{62.61} \times 43$ mm
= 27 mm. (say 30).

Actual wt = 42.97 or 44.62

Use 42.97
Hence Al = $\frac{42.97}{39.35} \times 0.83$
= 0.91 (say 0.93 for wastage)

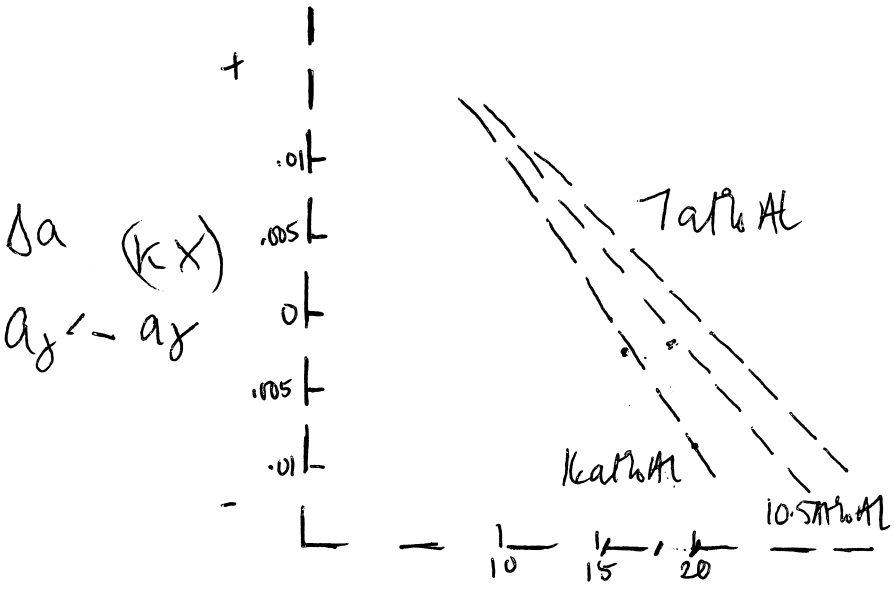
Cr = $\frac{42.97}{39.35} \times 9.82$
= 10.72

∴ 42.97 alloy + 0.91 − 0.93 Al + 10.72 − 10.73 Cr
(0.93) (10.73)

New alloy

Atomic weights Al : 26.982
Ni : 58.710
Cr : 51.996

Required alloy has



12½mm = 5 at%
1 at% = 2½mm all but
ref 10mm = .005 Δa

For zero mis-match alloys

at% Al	at% Cr	balance Ni
7.0	15.5	100 − 22.5 = 77.5
10.5	18.2	100 − 28.7 = 71.3
14.0	20.0	100 − 34.0 = 66.0

Making alloys 14at% Al – 20at% Cr – 66at% Ni.

$M_{Al} = 26.98$
$M_{Ni} = 58.71$
$M_{Cr} = 52.00$

$$\text{wt\% Al} = \frac{26.98 \times 14 \ (377.72)}{26.98 \times 14 + 20 \times 52.00 \times 66 \times 58.71} \times 100 = 7.14$$

$$\text{wt\% Cr} = \frac{20 \times 52.00 \ (1040)}{26.98 \times 14 + 20 \times 52.00 \times 66 \times 58.71} \times 100 = 19.65$$

$$\text{wt\% Ni} = \frac{58.71 \times 66 \ (3874.86)}{26.98 \times 14 + 52.00 \times 20 + 66 \times 58.71} \times 100 = 73.21$$

$D = 5292.58$

	Al	Cr	Ni
Thus in 100gms	7.14	19.65	73.21
50gms	3.57	9.82(5)	36.60(5)

Present Ni – 14at% Al alloy:

$$\text{wt\% Al} = \frac{26.98 \times 14 \ (377.72)}{26.98 \times 14 + 86 \times 58.71 \ (5426.78+)}$$
$$= 6.96 \text{ wt\%}$$

wt% Ni = (5069.06) / D = 93.04 wt%.
(= 46.52 in 50gms)

∴ for 36.61gms Ni require $\frac{36.61}{46.52} \times 50$gms
= 39.35 gms alloy.

This contains 2.74 gms Al (2.74 as above)

1250°C Ni – 20Cr – 16Al in @ 15.05 30.11.79.
1268°C 16.45 4.12.79.

1252°C " homog 2hrs 09.55 } 17.01.80
11.55 }

Heat tmt PE16(5) soln @ 1051° for 2 hours
in 19.43 } 18.01.80
out 19.43 }

Miss S. A. Hill

ANALYTICAL REPORT

To: Miss S.A. Hill

Description of Sample(s): Ni/Al/Ti Alloys

Date received: 13/11/79 Serial number: 1449 Date of report: 26/11/79

Sample mark		Specimen 1	Specimen 2
Aluminium	% by mass	4.4	4.2
"	% atomic	9.1	8.7
Titanium	% by mass	3.8	2.2
"	% atomic	4.4	2.5

JM

wt%	Cr	Ni	Fe	Mo	Al	Si	Ti	Mn	Co	Zr
③	18·6	34·2	41·3	3·79	1·16	0·01	<0·01	0·02	0·03	0·01
⑤	17·6	35·3	39·2	4·85	1·11	0·02	1·12	0·01	0·03	0·01

1) composition

2) previous hist } "Cast in vacuo homog 2) rolled 10 thou ~~3) soln heat 1050°C, ½hr~~ ~~4) 1hr at 900°C~~ $M_{23}C_6$ gb ~~5hrs 750°C γ'~~

3) suggested heat treatment Martin lead to me ⑤ γ' superlattice ③ ? no superlattice

Grn soln

? carbide content

n hours 750°C exp^i

as received!

Green camera = 1

other " = 2

other " = ½

green " = SQ.

Cu Kα 1·5417 1·5405

(1·5418) 1·5443

Kβ 1·3921

Green 5

Other 3

Green 6

Other Q9/4 1350.

Green Ni - Al - Cr

Other PE16

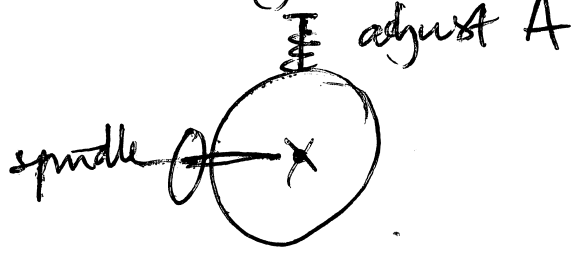
Instruction for X ray set.

1) Put spec in plasticine - pick up with thin rubber fingers FRAGILE.

Centre motor arm

2) Centre by eye

3) centre on light bench



} iterative turn spindle spec highest ↑
turn A until centred, wind back.

4) Cut off film, punch holes. Load.

Back to LHS pip, pull RHS to right and fix lid.

5) Mount camera on slide with catch secure.
Mount motor secure.

6) set time. Activate timer. Activate source.

7) If reset time anticlockwise + reset both.

Development: 4 mins dev
dip in stop
7 mins fix + a bit
½ hr wash.
Dry.

Vernier take 1 line.

* Nickel	$(Ni)4F$	2.03_X	1.76_4	1.25_2	4—850
Nickel-aluminium	$(AlNi_3)4C$	2.07_X	1.80_7	1.27_6	9—97
Nickel-titanium	no ~~[redacted]~~ $(Ni_3Ti)4C$				
	but $(Ni_3Ti)16H$	1.95_X	2.13_5	2.07_5	5—723
Chromium	$(Cr)2B$	2.04_X	1.18_3	1.44_2	6—694
	$(Cr)8C$	2.05_X	1.87_5	2.30_6	19—323

$2\theta < 90°$ for 3 strongest lines in forward reflns
refer strongest line as 100 (unless over range)

no at/cell + Bravais

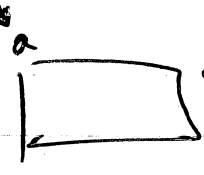
C primitive cubic
B bcc
F fcc
T prim tetragonal
U centred tetragonal
R rhombohedral
H hexag.
O prim. orthorhombic
P b. c ortho.
Q base c. ortho

S f.c. ortho
M prim monocl.
N centred ..
Z triclinic

ordered phase prime mark follows capital letter.

* high reliability
i indexed
o low

b Broad, fuzzy, diffuse
d Doublet
n not given all sources
nc not acc by cell
ni not index with cell
nβ " permitted by space sp
β I uncertain presence or overlap β lines
tr trace
+ After induces poss.

more than 1 card  2nd card.

ANALYTICAL REPORT

To: Miss S. A. Hill

Description of Sample(s): Ni/Al/Cr Alloy

Date received: 11/12/79 Serial number: 1462 Date of report: 18/12/79

	% by mass	% atomic
Aluminium	7.4	14.5
Chromium	16.4	16.7

J. M. Stanton

Miss S. A. Hill

23rd Jan. 1980

As-quenched Ni – 16½Cr – 14½Al.

Program from DD2 0600
DD5 } check ØØ ØØ set.
DD3 }

DD5 floppy test passed
DD3 " " bad disc

exp to DD5 ØØ ØØ

Background 3.4×10^{-9}
Ne 3.5×10^{-5}

Probably {111}

Marker

@ 5.8kV

New film

New film evap ns probe

f 18

BW 5.6kV

End 1437 ? gone pop : 1C sectors to dir ØØ
check alignment

Ne 4×10^{-5}

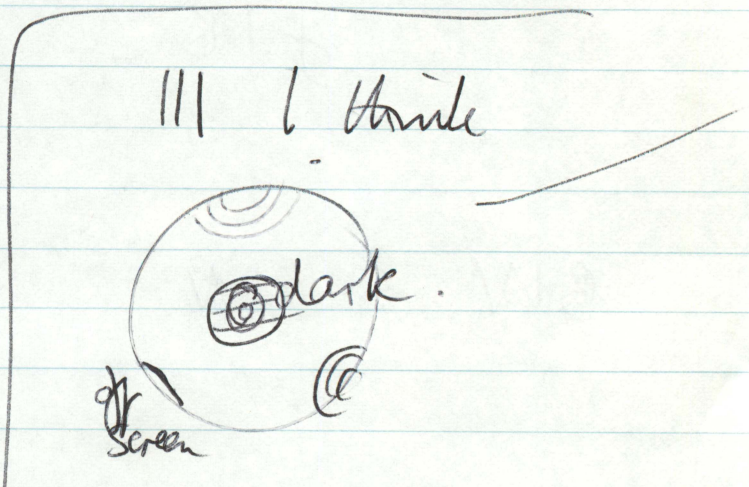
BW 8.42

1/8
1/4
1/2
1
2
4
64 00

Restart 370
454
564
658
798
942
990
1123
1366 ↓ +200
1690
1723
2006
2067~

End after 205 sectors to 08 00 2315ms
−16
21

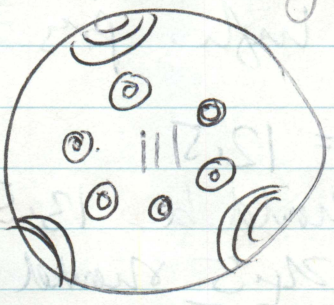
Background 3×10^{-9}
4×10^{-5} Ne



avg N1/a/M

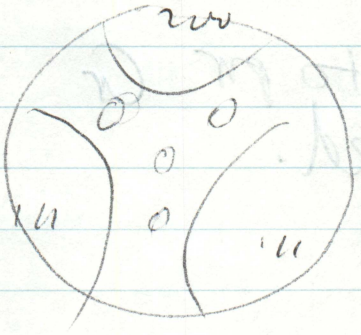
26th Jan 1980

Background $2-3 \times 10^{-9}$
Ne 4×10^{-5}
Image brighter than before but CP = ~5.8 kV



ppts also visible?

to DD5 ϕ8 ϕϕ



420 close to 110

1/8
1/4
1/2
1
2
4
4
2
1
1/2
1/4
1/2
1/4

below biv after ns pulse ~~ppts~~

biv

New Atm

biv after evap 5.70

230 2nd conts — } plane edge past?
290 2nd conts — }
high Al same pks
390 same 2on2 + Al
Al v. high. prs Cr or Ni?

Calc: if Al = 12.5
should be 13.5
then 24.5 should be 26.5 — this is Cr
27.5 29.7 Ni
28.3 30.6 Ni

∴ seems to to pr Cr
1 pr noted.

6730 Cr ↑
6980 "
2080 v. much so and little Al.
(7200 Al high again?!

34,560 high Al again. NA 2nd conts much.

Rate 3-6/s.

Gone home to bin in the sky.

@ 36,865 conts
247 sectors

Finished 8.00kV ϕ=1.28kV

Check in Ne.

Aligned 73.9 735
74.8 76.5
@ 6°, 1.4

Check DDI for exp.

exp to DD9 Shmos Ni/Cu/Al 29.01.80

Orient as before — probably 220

4×10^{-5} Ne 5.64 kV image medium
bg $3-4 \times 10^{-9}$

from frame 10 1/8 1/4 1/2 1 2 4
4 2 1 1/2 1/4 1/8 afterns pulse.

DD9 ØØ ØØ

Begin @
7100 v. high Cr + low Al

No cnts	Increment	Rate
7320	9.00	40 → 1.5
8045	9.10	
8297	recording 32.68 = 19. something on clock — timergoing	

Timer switched off + on again → ? cured trouble?

new set

209	9.20
475	9.30
1121 (9418)	9.40
1655	9.50
2054	9.60
2755	9.70
3238	9.80
3823	9.90
4720	10.00
5210	10.70

Reset at 1703
Done.

low reads correctly

30,776 gone home? ~~233~~ sectors

Attempts at astigmation forked but spec still there image @ 13 odd kV, evap @ 17.xx kV

⅛ ½ ½ 1 2 4 2 1 ½ ¼ ⅛ ~~⅛~~ ⅛ ⅛

New ptm beautiful pts.

marker 5 mins ⅟15 ⅛ ¼ ½ 1 2 12.67

Try ws pulse camera down

⅛ ¼ ½ 1 2 12.11

⅛ ¼ ½ 1 2 +4 on end. 13.78

Red – 5 mins

Other – 21 mins 60s.

Aligned 71.9 73.75
74.0 76.3

357°, 048°

Ni/Cr/Al 20 mins 31st Jan. 1980

exp to DD?

Background $3\text{-}4 \times 10^{-9}$ Orientn (110)
6×10^{-5} Ne

6.2 kV BIV ⅛ ¼ ½ 1 2
ns pulse 6.13 BIV 2 1 ½ ¼

to DD1 @ ϕϕ ϕϕ 61 sectors false start

No	H
672	6.65
759	6.70
922	6.75
1091	6.80
1325	6.85
1534	6.90
~1950	6.95
2122	7.00

Increments increases 2nd conv
Obs. as before with 110

1200 lots of 2nd conv

328 @ @ 10^9 again
Stop timer @ 17,785
so reset @ 2,215

Stopped @ 2530 (2215) 315

17,785
2,530
20,315

(This is really 20,315) giving 19.9 J/ns FT
turned off again (338 @ @ 10^9)
This reset @ 9685 done
∴ reads correctly

		M	%	2+
Isotopes	Al	27	100	13.5
	Cr	50	4.31	
		52	83.76	26.0
		53	9.55	
		54	2.38	
	Ni	58	67.76	29.0
		60	26.16	
		61	1.25	
		62	3.66	
		64	1.16	

Peaks @ Al 12.8
Cr 24.7 Ratio 0.95 Original
Ni 27.5

∴ bins for ternary plot

Al 12.0 – 16.0
Cr 23.5 – 26.2
Ni (26.6 – 31.0) + (53.2 – 62.0)

Tuner has overflow problems.
Also does not write 0,1 or 5, 4 or 8,9

0001
0010
0011
0100
0101
0110
0111
1000 1001

1
2
3
4
5
6
7
8
9

J = ?
L = ?

If $H = 10.20$
$P = 1.63 \quad T = 11.83$

$M/n = C.T.\mu^2$

[illegible]

μ in μs
where T in kN
C in $c<|$ $= 0.076$

Then $\mu = \left(\frac{27.6}{.0767 \times 11.83}\right)^{1/2}$

$5.52\,\mu s \equiv 27.64$ etc.

See 27.6 103
27.5 $\frac{1.65}{11.95}$
27.4
27.7
27.8

New $H =$ [illegible] $5.49 \longrightarrow$
5.48
5.47
5.50
5.5|

3.76
5.4⌐ and 5.47
5.52|7

Somewhat irrelevant

Observe 5.4⊏ 5.4⌐
5.1⊏ 5.5⊏
5.1⌐
5.6⊏

Fault ∴ in 2nd digit up as APW said

Have decided that 27.5 ≡ 29.0

∴ $29.0 = C \cdot T \cdot \mu^2$ $\quad T = 5.65 + 0.90$

$27.5 = .0767 \cdot T \cdot \mu^2$ $\quad = 6.55\,kV$

∴ $\mu = 7.40$

$\mu_{27.6} = 7.41$ etc.

∴ seems to be recording OK.

40,595 something went wrong when on the blank

41,500 just but lots of 2nd cons.

exp ended after 50,006 cons

301 sectors ($-\phi 1 = 30\phi$)

@ 10.90kV

1.7kpulse ($S = 2.0$ kV)

10.36 ½ ¼ ½ 1 2 end of fun

Argued @

72.9	76.7
76.0	78.8
@ 353.5°	5.3°

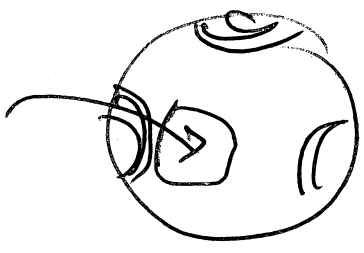
Exp to DD3 @ ϕ_4 ϕ_2 (error ϕ_2) 5th Feb. 1980

PE16(5) 2 hours γ1 after cathode

Background 3×10^{-9} : 4×10^{-5} Ne

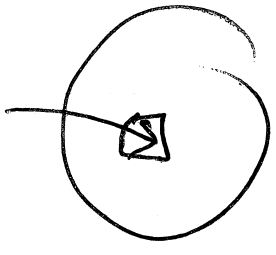
2·63 BIV ? γ1

½
|
2



2·3× below BIV

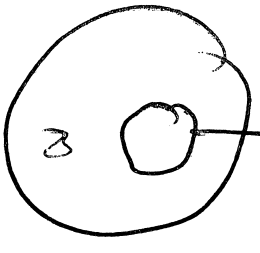
½
|
2



γ1 ? also ordered

2·68 below BIV

½
|
2



ordered

~~of~~ size ~ 6at planes–8at planes ?!!!!!

2·70 repeat ½
|
2 now? 20 planes

2·85 BIV show pos ½
|
2

2·83 below BIV v. nice crystal str (+ other poles)

½
|
2

2.9 ½ smaller now.
well resolved

2.91 ½

1

2.95/8 2

2

½ BIV

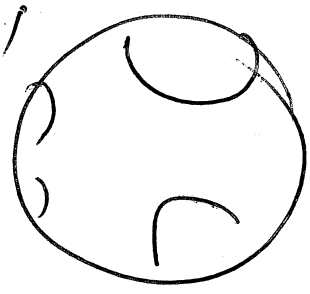
2.85 ½

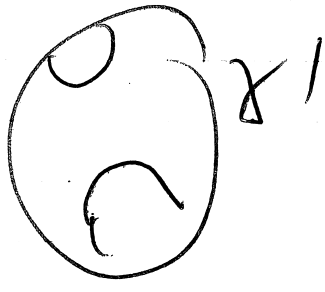
1

3.2 ½ Almost 100% sure.

1

end of film

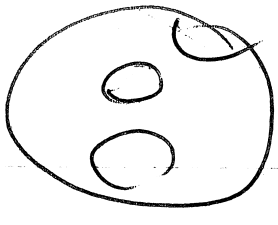




New film 3.6 ½

1

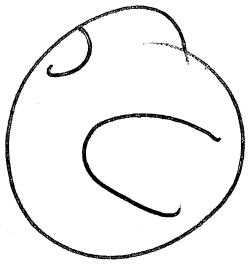
2



3.74 ½

1

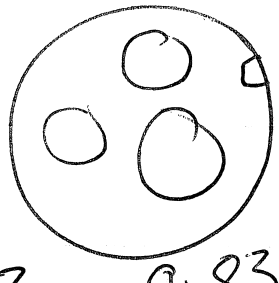
2



3.82 ½

1

2



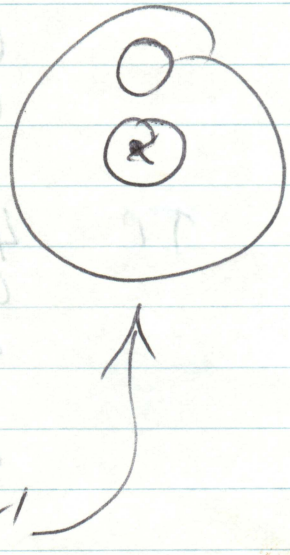
40 0.72 0.83

4.1 0.74 0.85

4.2	0.76	0.81
4.3	0.77	0.89
4.4	0.79	0.91(5)
4.5	0.81	0.94
4.6	0.83	0.95(5)
4.7	0.85	0.98
4.8	0.86	1.00
4.9	0.88	1.02
5.0	0.90	1.04
5.1	0.92	1.06
5.2	0.94	1.08

18% pulse

4.62 below BIV



to ϕ4 00 DD3
(+30m count)
Pulse = 18%.

Hopefully started on γ'

NB pulse inadvertently set wrong 5.1 + 9.2 instead of .92 - needs editing

< 6X+5031 — SORRY!

5.2	.94	1.08	1.153846
5.3	.96	1.11	
5.4	.98	1.13	
5.5	.99	1.14	
5.6	1.01	1.16	
5.7	1.03	1.19	
5.8	1.05	1.21	
5.9	1.07	1.23	
6.0	1.08	1.25	

Isotopes		M	%	2+	Corr.
	Al	27	100	135	12.7
	Cr	50	4.31	25.0	23.5
		52	83.76	26.0	24.5
		53	9.55	26.5	24.9
		54	2.38	27.0	25.4
	Ni	58	67.76	29.0	27.3
		60	26.16	30.0	28.2
		61	1.25	30.5	28.7
		62	3.66	31.0	29.2
		64	1.16	32.0	30.1
					Corr 2+
	Ti	46	7.95	46 23.0	43.3 21.
		47	7.75	47 23.5	44.2 22.
		48	73.45	48 24.0	45.2 22.
		49	5.51	49 24.5	46.1 23.
		50	5.34	50 25.0	47.0 23.

(Co 59 100)

Fe	54	5.84	27.0	25.4
	56	91.68	28.0	26.3
	57	2.17	28.5	26.8
	58	0.31	29.0	27.3
Si	28	92.27	1.60	13.2
	29	4.68	1.65	13.6
	30	3.05	1.50	14.1

			2+	3+	4+	Corrected 2+	3+	4+
Mo	92	15.86	46.0	30.7	23.0	43.3	28.9	21.6
	94	9.12	47.0	31.3	23.5	~~44.2~~ 44	29.4	22.1
	95	15.70	47.5	31.7	23.8	44.7	29.8	22.4
	96	16.50	48.0	32.0	24.0	~~45.2~~ 45	30.1	22.6
	97	9.45	48.5	32.3	24.2	45.6	30.4	22.8
	98	23.75	49.0	32.7	24.5	46.1	30.8	23.0
	100	9.62	50.0	33.3	25.0	47.0	31.3	23.5

28,246 overflows January.
Switch off + on again

Reset counter at 1,754
321

321 again reset @ 1,433

? Disc error @ 130 =
several ticks 28,597

820 ? disc error @ ~~29,387~~ (603)
1040 30,430

Summary

Al	12.7
Cr	24.5
Ni	27.3
Fe	26.3
Si	13.2
Ti	45.2, 22.6
Mo	43.3–46.1, 28.9–30.8, 21.6–230

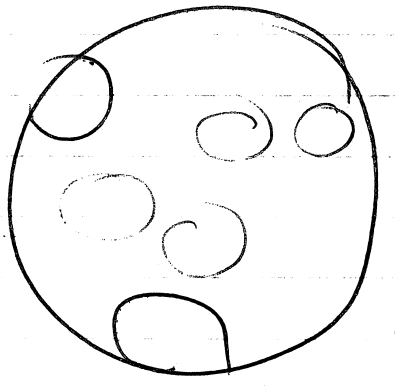
Al	Si	Mo	Cr	Fe	Ni	Mo
12.7	13.2	21.6–23.0	24.5	26.3	27.3	43.3–46.1
		22.6 Ti				45.2 Ti

30,980 Stopped timer again
30,220+950

Expended after 40,086+950
41,006 = 60's

and 284 sectors.

4.8 ¼ ½ 1 2



Other pts same as ORW

6.12 2 1 ½ ¼

4.8 ¼ ½ 1 2

? 220

Aligned @ 72.4 75.0
75.2 78.5

356°, 28.5°

284
04

Heat treatments

Ni/Cr/Al

620°C ± 10 deg C

as-g
2mins? + 1min
5mins
20mins

O.A Leake recommends more hrs - not right for sidebands

PF16(5) 1050°C (2 hours)
980°C (1 hour)
750°C 2, 4, 8 hours.

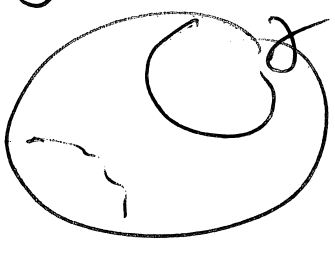
PE16(5) Aged 8 hours 7th Feb 1980

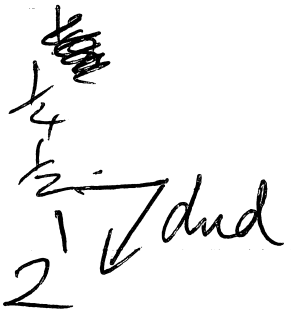
Background $4-5 \times 10^{-9}$, 4×10^{-5} Ne

Used DD5 — Ni/Cr/Al 9
DD9 — 5 mins Ni/Cr/Al
DD1 — Ni/Cr/Al 20 mins
DD3 — PE16(5) 2 hours

Use DD4 today @ ØØ ØØ

3.50 BIV

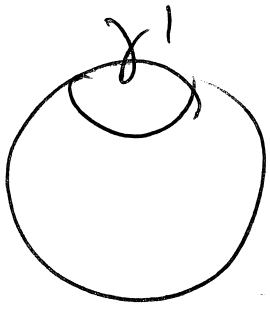




½
New fitm
2
2
1
½

@ 3.74 BIV

3.67



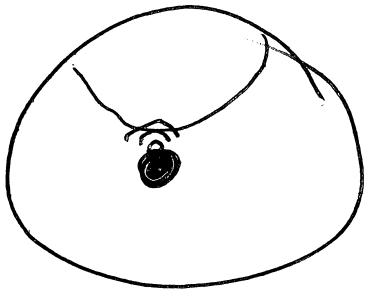
picture developed well

3.84 ½
1
2

4.00 ½
1
2

γ1 much larger now

Alignment



* Much more structure to image

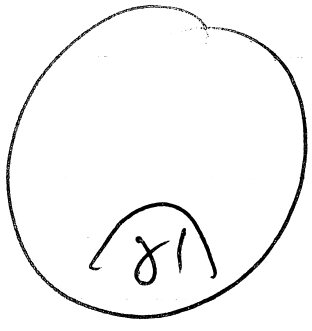
4.80	0.86	1.00	5.80
4.90	0.88	1.02	5.92

186 pulse

5.00	0.90	1.04	6.04
5.10	0.92	1.06	
5.20	0.94	1.08	
5.30	0.95	1.10	

5.6 kV

1/8
1/4
1/2
1
2
4



Stopped @ 207 Ø6 sectors of rubbish

Stopped @ 5.30kV

~~Plugged~~

Started restart
~~[illegible]~~
PB168

to DD4 ØØ ØØ

5.68 kV

½
½
1
2
4

some ppts.

Background $2-3 \times 10^{-9}$
Ne 4×10^{-5} image medium

Start @ 5.10 kV

5.10	0.92	1.06
5.20	0.96	1.08
5.30	0.95	1.10
5.40	0.97	1.12
5.50	0.99	1.14
5.60	1.01	1.16
5.70	1.03	1.18
5.80	1.04	1.20
5.90	1.06	1.22
6.00	1.08	1.25
6.10	1.10	1.27
6.20	1.12	1.29
6.30	1.13	1.31
6.40	1.15	1.33
6.50	1.17	1.35
6.60	1.19	1.37
6.70	1.21	1.39
6.80	1.22	1.41
6.90	1.24	1.43
7.00	1.26	1.45
7.10	1.28	1.47

Stopped @ 15,697 after 120 sectors

Aligned. 722 751
75.6 79.0
@ 359°; 3.7

ARW's examn of PE16(5) carbide + 4hrs @ 1

AL:

to do X-rays PE16 carbide + 4 hours and (1)
+ 2 hours?

Ni/Cr/Al as-q 6 overnight
1+½ min } do today (1) 6 overnight
5 min
20 min 6 overnight
2 hours 6+3 midday tomorrow

Seal off Ni/Cr/Al 2 hours @ 620°C
Ni/Al/Ti 1 day @ 1050°C
" 1 hour @ 625°C

Green PE16/4
Blank Ni/Cr/Al 5 mins
Red " +2 mins

Green quenched NiCrAl GR
Blank 20 mins NiCrAl

Exp to DD8 dd dd 11th February 1980

Ni/Ni/Cr 142 mms @ 620°C ± 10 deg C.

Background 4×10^{-9}.
Ne 4×10^{-5}

¼
½
1
2
4

@ 4.5kV
B1V

~~4.0~~	0.72	0.83
3.8	0.69	0.79
3.9	0.70	0.81
4.0	0.72	0.83
4.1	0.74	0.85
4.2	0.76	0.87
4.3	0.77	0.89
4.4	0.79	0.91(5)
4.5	0.81	0.94
4.6	0.83	0.95(5)
4.7	0.85	0.98
4.8	0.86	1.00
4.9	0.88	1.02
5.0	0.90	1.04

Disc error @ 20,027 revs

assume < 20 tracks lost 16 revs

to [redacted]C 00

7.2	1.30	1.69(5)

7.30	1.31	152
7.40	1.33	1.54
7.50	1.35	1.56
7.60	1.37	1.58
7.70	1.39	1.60
7.80	1.40	1.62
7.90	1.42	1.64
8.00	1.44	1.66

Stopped 8.10 1.46 1.68
after 25' from stop

52,172 ions

8.33 ½ 1 2 ¼ end of film
end of AP.

Notes of polishing conditions

Ni/Cr/Al 4% perchloric butoxy
(−20) − (−5)°C
115V

Ni/Al/Ti 2% perchloric / 5% perchloric
−10°C
95V − 115V.

PE16 Martin

Ni Al as above

Heat treatments

1050°C Ni Al Ti −1070°C

1) Run all masses
plots
2) Run all ARW tapes to IBM
3) Run lists of masses to calibrate properly
4) Develop 8 films
5) Collect + catalogue X-ray films
6) Do chapter headings
7) Ex. TEM.

Thesis

Introduction

Phase Transformations

Rev. of AP technique

Mech. study of a Ni/Al alloy

Similar studies in Ni/Cr/Al alloy

Ni/Ti/Al and Si/Fe behaviour

Examn of PE16 model materials → real behaviour

Summary Conclusions

Appendices
Fourier Transform and AP

Bin sizes required for analysis

If Ni/Cr/Al

Al 120 — 140
Cr 230 — 262
Ni 266 — 310, 532 — 620

If PEI6 (check on a mass ds)

Al^{2+} 120 - 140
Ti^{2+} 210 — 235 , 430 — 470
call 225-227 450 - 454 — est to get rid of Mo

call Mo next
Mo^{2+} 430 — 470 $^{3+}$ 289 - 315 $^{4+}$ 216 — 235
call {430-449, 455-470} 289 - 315 {210-224, 228-235}

tail of Ni

Ni^{2+} 273 - 301 , 546 - 602
call 278 — 288 546 — 610

Cr^{2+} 236 — 254

Fe^{2+} 255 — 272

Ti	Mo	Ni
450-454	430-449 455-470	546-610

Summary

Al	Ti + Mo		Cr	Fe	Ni	Ti
120-140	225-227	210-224 228-235	236-254	255-272	273-288	289-315

Best to run spectrum program.

Mods to existing programs

1) Make plot Cr and Al on same graph
Easy — call PEN 2
etc.

2) Do for Al and Ti in readiness

3) Increase tests ready for PE16.
After no. of axes available
Check bins and plot 3/ set of axes

4) Make running change of histogram size
to account for change in no/plane

5) Repeat this in Fourier program

6) Reformer

7) 1/plane by hand

8) Attempt correln on ¼ – 1/10 wavelength grouping

9) Attempt 2nd stripped transform — remove all
high terms and look again a short λ

Label peaks on spectrum
Title PE16 model alloy.

On Cr-Al work out length
title Ni - 16.5Cr - 4.5at% Al 5mins 620°C.
and axes Mean ~ 9.0/9.5 say 75 ions/plane 75/55,000 730 525 250

plane = 730 2.2 14600 7460 16006.6 A° 16mm

PE16 spec trace done
PE16 trace correctly + dist

Cards with data

Cut IAP's.
Get own spectrum, own comp plot

MALTi manual.

[redacted]

455
456
461
462
463
470
471
472
473
484
485
486
487

453
454
457
458
459
460
464
465

AFW dance M 13.0 - 16.0
Ti 15.1 - 16.9
22.5 - 25.0
Mi 28.5 - 33.0
57.0 - 66.0

From Sal's tape ? check.

455	(-4)	[redacted]5s	453	(-1)	15s
456	(-2)	20s	454	(-1)	15s
461	(-4)	20s	457	(-3)	[redacted]5s
462	(-3)	" as "463" 25s	458	(-4)	[redacted]15s
463	(-2)	as 464 LONG" 25s	459	—	[redacted]15s
470	(-3)	25s	460	—	[redacted]15s
471	(-4)	20s	464	(-3)	[redacted]15s
472	(-1)	[redacted]5s	465	(-4)	[redacted]15s
473	(-1)	30s			
484	(-1)	[redacted]5s			
485	(-4)	30s	55 takes	20.14s.	
486	—	30s	40k	15.71	
487	(-1)	30s			

Suggest do these by Sal. method? over 100 wms mid. others.
Also re-run MIDAS for C and others.

wt%	Cr	Ni	Fe	Mo	Al	Si	Ti	Mn	Co	Zr
③	18·6	34·2	41·3	3·79	1·16	0·01	<0·01	0·02	0·03	0·01
⑤	17·6	35·3	39·2	4·85	1·11	0·02	1·12	0·01	0·03	0·01

1) composition

2) previous hist } "Cast in vacuo homog 2) rolled 10 thou ~~3) soln heat 1050°C, ½hr~~ ~~4) 1hr at 900°C~~ $M_{23}C_6$ gb ~~5hrs 750°C~~ δ'

3) suggested heat treatment Martin heat to me ⑤ δ' superlattice ③ ? no superlattice

Grn soln

? carbide content

n hours 750°C exp^{i}

as received!

Green camera = 1

other " = 2

other " = ½

green " = SQ.

Cu K_α 1·5417 1·5405

(1·5418) 1·5443

K_β 1·3921

Green 5

Other 3

Green 6

Other Q9/4 1350.

Green Ni - Al - Cr

Other PE16

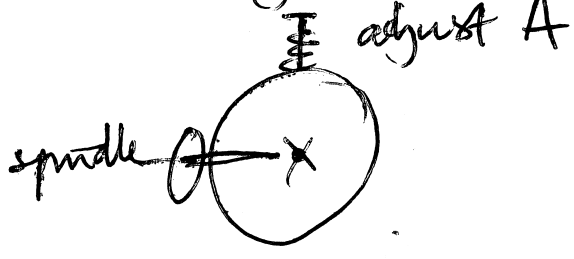
Instruction for X ray set.

1) Put spec in plasticine - pick up with thin wooden rods FRAGILE.

Centre motor arm

2) Centre by eye

3) centre on light bench



} reiterative turn spindle spec highest ↑
turn A until centred, wind back.

4) Cut off film, punch holes. Load.

Back to LHS pip, pull RHS to right and fix lid.

5) Mount camera on slide with catch secure.
Mount motor secure.

6) set time. Activate timer. Activate source.

7) If reset time anti clockwise + reset both.

Switch High 300b

Matrix 1–14 / A–M

300	1200	current loop set
A5	A5	
C4	C4	
E3	D2	
F2	F1	
H1	D3	

present.

Additions on CS 211'

Loop pin 8–13 ~~[illegible]~~ 75154 receiver

or

current loop 20mA. V24

Low Shift 110b

76.1

Hornbogen Roth Ni-18.2Cr-5.7Al wt%.

$$at\% = \frac{\text{[redacted]}\,Ni}{\text{[redacted]}\,Ni + \text{[redacted]}\,Cr + \text{[redacted]}\,Al} = \frac{wt\%\,Ni / M_{wi}}{\frac{wt\%\,Ni}{M_{Ni}} + \frac{wt\%\,Cr}{M_{Cr}} + \frac{wt\%\,Al}{M_{Al}}}$$

$$wt\% = \frac{\text{[redacted]}\,M_i}{x_{Ni} + x_{Cr} + x_{Al}}$$

$wt\%\,Ni/M_i$	= 1.296	= [redacted]69.79
Cr	= 0.35	= 18.84
Al	= 0.211	= 11.36