Some spots remain on cooled.
Start desy again @ 165°C dose for 6m (T01 130°C)
→ Pattern fully covered by poly rings.
Warm back up to 300°C in 2.4 E-7 O2.
Anneal here, rings –> Spots Anned for 10 minutes.
Then ramp baratron 10.2 1 T 1970°C
500°C, Streaks reappear
grow 0.5 µc = 4.8 x 10^13. Cap layer looks
pretty good actually.

150 kΩ
2pt CRT
10 when removed.

8/26/19

1 K 350°C 2.6 x 10^13
Outgases 990 / Grow 970°C Baratron = 0.2 P = 6E-6 Torr
1m30s SrO then Coddep. RHEED looks really good. Saw some chevrons briefly, dipped Jr to 217° they went away. EIES = 0.06

lets grow 4 unit cells = 32SrO ~ 32 minutes and cool down. Film looked good by RHEED.
Dose for 12 seconds at 150°C (P = 2.7E-7 torr Baratron + 0 Togg < open)

Try levig shutter open. Get poly rings c 1m30sec dose for 2m45sec. (T = 1120° 130°C)
Annuel C300° Surface becomes rough. Will try to heat back up to 1000° in 1E-6 ozone.

→ This basically smoothed the surface again. Cool back down in O3 1E-6
**Wafer Title:** JC190825F

**Calibration**
- Reduced K to 365°C.
- S/E Ratio = 5.6E13 normal.
- Start EIES = 0.07.
- Correct. = 195 mA.

**Cleaning Procedure**
- Ozone Cleaned: 10 min.
- Wet Cleaned: [110] 110, [100] 245.

**Chamber Setup**

<table>
<thead>
<tr>
<th>Turbo</th>
<th>Ion</th>
<th>Cryo</th>
<th>Liq. N₂</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open</td>
<td>Open</td>
<td>Open</td>
<td>Open</td>
</tr>
<tr>
<td></td>
<td>Closed</td>
<td>Closed</td>
<td>Closed</td>
</tr>
</tbody>
</table>

**Base Pressure:** 4.7E-8 Torr
**Quartz Crystal Life:** 97%

<table>
<thead>
<tr>
<th>Setpoint (°C)</th>
<th>Flux (10¹³ atoms/(cm²-s))</th>
<th>Time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>450</td>
<td>355</td>
<td>60</td>
</tr>
</tbody>
</table>

**Notes:**
- Start 1155PM. 1.5mL SrO (1min) then add Ir.
- Baratron = 0.23 = 89% → 7.3E-6 w/o K.
- SIO buffer for 12 min (1.5mc) looks pretty good.
- P = 7.3 V 5.4 E-6 when K is open. Continue to plague.
- So increased to 0.235 to try and compensate.
- Reduced baratron to 0.24 = 93.8%. This seems to have stabilized things.
- ~30 min pressure starts to recover... odd... (6.58E-6)
- Pressure still going up. K flux?? did we run out?
- 56 min. Pressure almost back to "normal". I wonder if we oxidized the cell or ran out of K. Baratron = 0.235 = 89%
- Grow 68 SrO 1h 8min. Shut K. → NO CHANGES in Pressure. Film quality seems to have improved w/closed K.
- RHEED @ 450°C. Looks really nice. 45 ks @ 2 point pulled stock in desiccator.
410 min. Film is getting fuzzy and EIES \( \approx 0.063 \)
So Ir \( \\: \: \: 1 \: 202 \: m A \)
53 min. Chamber pressure suddenly takes a dive
\( \frac{1}{3} \) film goes rough very fast \( (4.2 \times 10^{-6}) \)
Closed \( k \) at 54 min 30 sec.
\( P1 \times 10^{-6} \).
Film recovered some but doesn't look great.
\( \rightarrow \) Looks reasonably smooth but Fukushima lines are weak.
Grow 1 uc of 214 cap.
\( \rightarrow \) Finish at 1h 3 min.
Tons of \( \frac{1}{2} \) order spots

\( ^{3}S_{1} \) at 52
2 pt @ RT when pulled.
Surface looked good.
Grower: Chris  Date: 2019/08/25

Orientation: STO/SKIO/S1O/STO(001)

Calibration
- Mixed Ir 3 nm reduced current
- Got back to 1.22 x 10^13
- N/EIES = 0.07
- and 194 mA

Sheet for intermediate K between O3 B samples

Date Loaded:

Cleaning Procedure:
- Ozone Cleaned 10 min.
- Wet Cleaned

[110] 113.1
[100] 248

Base Pressure: 3E-6 Torr
Quartz Crystal Life: 94.6 %

Chamber Setup
- Turbo: Open
- Ion: Open
- Cryo: Open
- Liq. N2: Open

<table>
<thead>
<tr>
<th>Tesla</th>
<th>Dy</th>
<th>M K</th>
<th>Fe</th>
<th>Lu</th>
<th>Yb</th>
<th>Ti</th>
<th>Sr</th>
<th>Sc</th>
<th>E-Beam</th>
</tr>
</thead>
<tbody>
<tr>
<td>450</td>
<td>365</td>
<td></td>
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<td></td>
<td>9.2</td>
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</tbody>
</table>

- There are extra spots in RHEED - different STO reconstruction
- Outgas 990 / Grow 970 TC
- Baratron 0.23 -> 7E-6 O2 w/o K is 90.7 %
- Start 9:45 PM w/ 1.5 SrO (1 min 30 sec)
- Some small metal spots in buffer layer - maybe just transmission
- Open K @ 12 min Film starts getting spotty w/in 30 sec to 1 min. Increase Ir a little.
- P -> 5.2E-6 w/ K open
- Film a bit spotty but passable I suppose
- P2 keeps falling so increase baratron to 0.24 / 94% to try and compensate (P -> 5.3E-6)
- 25 min - parts of film look good. Others clearly have metal.
Grow 68 SrO (1h 8min) then close K.
Final film is a tad spotty but fuzzy but no signs of Ir metal and no spots (looks smooth) little dots went away.
Grow 1 more uc of 214 as a cap (8sio=8min) Finish growth (1h 16min) Cap looks a little better than film.
Need to remelt Ir. Current is damn high.

QCM Ir after growth:
get $1.78 - 1.84 \times 10^{13}$
Baratron Control

Calibration

\[ T = 0.05 \text{EIES } \frac{2.36 \text{ mA}}{\text{cm}^2} \text{ (Start same as end of last sample)} \]

K reduced by a factor of 0.61

Base Pressure: 3.6E-8 Torr
Quartz Crystal Life: 92%

<table>
<thead>
<tr>
<th>Sr</th>
<th>Dy</th>
<th>Al</th>
<th>Fe</th>
<th>Lu</th>
<th>K</th>
<th>Ti</th>
<th>Sr</th>
<th>Sc</th>
<th>E-Be</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>450</td>
<td>260</td>
<td>7.2</td>
<td>5.2</td>
<td></td>
<td>450</td>
<td>260</td>
<td>7.2</td>
<td></td>
</tr>
</tbody>
</table>

Setpoint (°C)

<p>| |</p>
<table>
<thead>
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<th></th>
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<tbody>
<tr>
<td></td>
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</table>

Flux (10^13 atoms/(cm²-s))

<table>
<thead>
<tr>
<th>Time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>60</td>
</tr>
</tbody>
</table>

Cleaning Procedure:
- Ozone Cleaned: 10 min
- Wet Cleaned

Cubic Units:
- (100) 108.25°
- (110) 153.25°

Chamber Setup

<table>
<thead>
<tr>
<th>Turbo</th>
<th>Ion</th>
<th>Cryo</th>
<th>Liq. N₂</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open</td>
<td>Open</td>
<td>Open</td>
<td>Open</td>
</tr>
</tbody>
</table>

Baratron → 0.23, 91% output \( \frac{1}{3} \) works. Output 900/Grown 970°C gives 7E-6 w/ K shutter closed.

1.5 ml SRO seed (1M30 sec) then open T.

START @ 6:25 PM

Grow 1.5 uc undoped SIO (12 SRO = 12 min) then open K.
Buffer layer looks a little fuzzy but not too bad. \( T = 2.36 \text{ mA} \) but don't want to push it too hard. EIES = 0.055
Open K @ 12 min film got a little fuzzy but not rough.

\( T = 2.40 \text{ mA} \) EIES = 0.055 film looks OK.

Pressure \( \downarrow 6.24 \text{E-6} \) w/ K shutter open.

\( T = 2.43 \text{ mA} \) EIES = 0.06 @ 31 min. Still looks good.

50 min → start to see some spots.

Seems coincident w/ increase in H₂O pressure to 2.2E-9...
Grower: Joanne; Date: 2019-08-25  high growth rate T,=370  Wafer Title: Bactron control test J0190825C

Calibration

Ir  220mA
He 13
0.04 A/satives

Cleaning Procedure:
- Ozone Cleaned ___________ min.
- Wet Cleaned ___________

[116] 2026
[1007]

Setpoint (°C)

450
370
11.7

Flux (10¹³ atoms/(cm²·s))

Time(s)

60?

Chamber Setup

<table>
<thead>
<tr>
<th>$^{85}$Sr</th>
<th>Dy</th>
<th>Al</th>
<th>Fe</th>
<th>Lu</th>
<th>Ti</th>
<th>Sr</th>
<th>Sc</th>
<th>E-Be</th>
</tr>
</thead>
<tbody>
<tr>
<td>450</td>
<td>370</td>
<td>11.7</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

Setpoint (°C): 450
Flux (10¹³ atoms/(cm²·s)): 11.7

Start: 3:45 PM 970°C $P_0$=5.4e-6  1:40 5r0
Increase Ir to 227 nA
Open K at 12 min
Increase baratron to 0.22 at 113 mm
Close all shutters at 33 min see if it improves
doesn't improve, try to save w/ undoped layer

Open K at 131 min/increase Ir to 240 mA
Close K at 1 hr 14 min RHEED rough smt

End 1 hr 31 min
type ozone nozzle baratron output setpoint

go up to max 600°C

20% N₂ 80% In
**Orientation:** STO (001)  # 104

<table>
<thead>
<tr>
<th>Calibration</th>
<th>Date Loaded:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jv 1.5e-12 227 mA</td>
<td></td>
</tr>
<tr>
<td>O2 0.05 %</td>
<td></td>
</tr>
<tr>
<td>Sr 5.3e12 amu</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cleaning Procedure:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ozone Cleaned ___ min.</td>
</tr>
<tr>
<td>Wet Cleaned ___</td>
</tr>
</tbody>
</table>

- [110]
- [100]

<table>
<thead>
<tr>
<th>Chamber Setup</th>
</tr>
</thead>
<tbody>
<tr>
<td>Turbo: Open</td>
</tr>
<tr>
<td>Ion: Open</td>
</tr>
<tr>
<td>Cryo: Open</td>
</tr>
<tr>
<td>Liq. N2: Open</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Base Pressure: Torr</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quartz Crystal Life: %</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Setpoint (°C)</th>
<th>Flux (10¹³ atoms/(cm²·s))</th>
<th>Time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>450</td>
<td>370</td>
<td>6838</td>
</tr>
<tr>
<td>2.14e8</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Output:

987°C grow 970°C, 3e-6 Start 11:59 AM SrO 90% 1:47
then open Jv. 24 min then open K pressure goes to 65e-6 w/90% valve open opening K decreases H₂O, & CO/N₂ ??
increase target O₃ pressure to 6.5
O₃ is continuously denary.
Sample getty rough pressre must drop to 4e-7 failed sample - fail*
Note:

- Sr fluctuating at low growth rate, unclear if any samples have Sr incorporated.
- Plan is to go back to high growth rate, grow w/ increasing K until sample RHEED changes dramatically.

0. QCM Sr at high growth rate ✓
2. QCM K at 350°C ✓
3. Melt La & Al2
4. QCM La & A2

Temp K = 370°C, grow undoped while it stabilizes

10 min undoped, then open K, increase Jr by 2nA after 4 min
shut cell, 24 min, RHEED ok, kinks lines still there

Temp K = 380°C, grow undoped while K stabilizes/sample recovers

10 min undoped, then open K, appears that K flux pumps H2O from RHEA
decrease pressure again & cell value at 100% after open K → 3.2e-6
getty rough & high background

close Jr at 23 min (13 min 3.1e0)
EIES 0.06 AVS

Temp K = 390°C, grow undoped so sample recovers p: 3.5e-6 O3
Open K after 20 min undoped, increase Jr to 227 nA
inverter EIES 0.07 230 nA, pretty spotty w/ cross hatching
Close K after 16 min 3.1e0
Sample not recovering, probably time to kill it

QCM Jr after sample: 227 nA 1.5e13

QCM Jr after sample: 227 nA 1.5e13
Grower: Duenne/Chris  Date: 2019-08-24
Orientation: S100 cu/STO vary K / S10 buffer / STO (001)

Calibration
Re QCM Sr. Clearly Oscillisy w/ 40 min period.
1.35 - 2.11 E+12 E

Ir: 27mA
13e13
0.045 - 0.05 A/s

Base Pressure: _______ Torr
Quartz Crystal Life: _____ %

Setpoint (°C)
450

Flux (10^13 atoms/(cm^2*s))
N5.1e13 cm^2 ± 1e12
3.5e13

Time (s)
Chamber Setup
Turbo: Open Closed
Ion: Open Closed
Cryo: Open Closed
Liq. N2: Open Closed

Cleaning Procedure:
☐ Ozone Cleaned _________ min.
☐ Wet Cleaned __________

[110] 200 203.5
[100] 245

Outgas 980°C 45 min
Grow 970°C, 4.5e-6 O3

Start 7:08 AM SRO 90s then open Ir

Temp K = 350°C, 3.5e13 flux
Open K at [12 min, undoped] looks good
by RHEED increase Ir by 3mA
Close all shuttles at 22 min, take RHEED 0002S110

Temp K = 360°C; growing undoped 214 while K stabalizes. Start 7:35 AM
- 15 min undoped 214 then open K
- Close all shuttles 20 min (15 min SK10)

Decreased ozone to 4e-6 b/c valve was above 90%.
End C 1h31m12s (running out of ozone)

Started flush C 5:07pm

Stored in LL 3 transferred to suitcase

34KΩ

Weird blue line. Is metal?
**Calibration**

- Last sample S/Ir = 4.3/4 ~ 1.1
- So short for 4E12 Ir
- Ir = 4.3 (ox Ir)
- EIES = 0.025
- Current = 1.84 mA

**Cleaning Procedure:**
- Ozone Cleaned 10 min.
- Wet Cleaned [110] 108.5
- [100] 243.3

**Base Pressure:** 4E-8 Torr
**Quartz Crystal Life:** 97.5%

<table>
<thead>
<tr>
<th>Chamber Setup</th>
</tr>
</thead>
<tbody>
<tr>
<td>Turbo: Open □ Closed</td>
</tr>
<tr>
<td>Ion: Open □ Closed</td>
</tr>
<tr>
<td>Cryo: Open □ Closed</td>
</tr>
<tr>
<td>Liq. N₂: Open □ Closed</td>
</tr>
</tbody>
</table>

**Setpoint (°C)**

<table>
<thead>
<tr>
<th>Dy</th>
<th>Al</th>
<th>K</th>
<th>Lu</th>
<th>Yb</th>
<th>Ti</th>
<th>Sr</th>
<th>Sc</th>
<th>E-Be</th>
</tr>
</thead>
<tbody>
<tr>
<td>420</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>305</td>
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<td></td>
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<td></td>
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<td></td>
</tr>
</tbody>
</table>

**Flux (10¹³ atoms/(cm²·s))**

<table>
<thead>
<tr>
<th>Time (s)</th>
<th>152</th>
<th>420</th>
<th>4.3?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.5ml SrO = 1 min 48 sec</td>
<td>0.43?</td>
<td>0.35</td>
<td></td>
</tr>
</tbody>
</table>

**Outgas 990>Grow 970**

**Start:** 15:10 h

- On opening Ir pretty quickly saw chevrons, day Ir very slightly
- Got worse. Increase Ir to 185 mA, looks a little better but better
- Doesn't look great. Opening Ir didn't change much.

- 26 min Kitachu lines ok, but clearly Ir metal going to very slowly decrease it 3 sec if we can burn it off.

- (195 mA, EIES = 0.03)

- Going to grow 3% UC of doped 214 -> Close K at then put down 1 UC of 214 cap. End at

- Decrease Ir didn't help. Went back up (EIES = 0.035) and film looks ok enough I don't want to mess with it.

- Took a movie @ 1h 6 min before closely K shutter.

**End H₂O = 1.5E-8**

**N₂:** 1.53E-8
Date: 2019-06-24

Grower: Chas

Orientation: STO cap / SNO / STO buffer / STO(001)

Calibration: 3.6e12
10nA 4.0e12
0.025 A/s

[110] 292 K
[100] 292 K

Statepoint (°C)

Flux (10^12 atoms/(cm²·s))

Time (s)

Sr Dy Al Ba K Lu Yb Ti Sr Sc E-Be

42.0 315

4.3e12 6.3e12

-3.37 1.52 2.7

Turbo: Open Closed
Ion: Open Closed
Cryo: Open Closed
Liq. N₂: Open Closed

Cleaning Procedure:
☐ Ozone Cleaned ____________ min.
☐ Wet Cleaned ____________

Chamber Setup

Sr 980 °C ~ 15 min
Grow 970 °C
Start 11:18 AM 3:15 SrO Then codep undoped
Spotty, has kikuchi lines
Open K at 20 min increase Ir by 1 mA
Intentionally not applying Ir during growth
Sample possibly improving @ 52 min
Took OFF during hot before cap
Close K 1 hr 23 min 40 s
End 1 hr 43 min

Some spots might be edges??
<table>
<thead>
<tr>
<th>Sr</th>
<th>Dy</th>
<th>Al</th>
<th>Fe</th>
<th>K</th>
<th>Lu</th>
<th>Yb</th>
<th>Ti</th>
<th>Sr</th>
<th>Sc</th>
<th>E-Be.</th>
</tr>
</thead>
<tbody>
<tr>
<td>42.0</td>
<td>31.5</td>
<td>6.3e12</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Setpoint (°C) 42.0
Flux (10¹³ atoms/(cm²·s)) 4.3e12

Base Pressure: Torr
Quartz Crystal Life: %

Cleaning Procedure:
- Ozone Cleaned ________ min.
- Wet Cleaned

Chamber Setup
- Turbo: Open
- Ion: Open
- Cryo: Open
- Liq. N₂: Open

Turbo: Open
Ion: Open
Cryo: Open
Liq. N₂: Open

Outgas 980 °C ~ 15 min
Grow 970 °C
Start 11:18 AM 3:15 SrO then codep undoped 2.14
Spotty, has kinked lines
Open K at 20 min increase Ir by 1 mA
Intentionally not adding Ir during growth
Sample possibly impure @ 52 min
Took RHEED while hot before cap
Close K 1 hr 23 min 40 s
End 1 hr 45 min
Some spots, might be edges??
Cal Low Growth Rate

**SrIrO$_3$ /STO(001)**

**Calibration**

<table>
<thead>
<tr>
<th>Jr atm</th>
<th>Sr Ir</th>
<th>EIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.8e12</td>
<td>185 mA</td>
<td>0.02-0.03% /s</td>
</tr>
</tbody>
</table>

**Cleaning Procedure**

- Ozone Cleaned: __________ min.
- Wet Cleaned: __________

**[110] 240°**

**[100] 335°**

**Chamber Setup**

<table>
<thead>
<tr>
<th>Turbo</th>
<th>Open</th>
<th>Closed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ion</td>
<td>Open</td>
<td>Closed</td>
</tr>
<tr>
<td>Cryo</td>
<td>Open</td>
<td>Closed</td>
</tr>
<tr>
<td>Liq. N$_2$</td>
<td>Open</td>
<td>Closed</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TsSr</th>
<th>Dy</th>
<th>Al</th>
<th>Fe</th>
<th>Lu</th>
<th>Yrk</th>
<th>Ti</th>
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<td></td>
<td>315</td>
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<td></td>
</tr>
</tbody>
</table>

**Setpoint (°C)**

1.3e12 - 2.2e12 atoms/3e12 sec 2.2e12 atoms

<table>
<thead>
<tr>
<th>Flux (10$^{13}$ atoms/(cm$^2$·s))</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.3e12 - 2.2e12 atoms/3e12 sec</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>212</td>
</tr>
</tbody>
</table>

**3:32**

Adgas: 750 °C grow 650 °C 4.5e-6 O$_3$

SrO 3:14 s then codep 1.705 layer the oxidized to 135°.

Growing Ir (0.03-0.035 A/s)

3.8e12-4.8e12 Sr flux

Closed K 48 min

and 58 min RHEED looks good

2.7 K, 2 pt
QCM Sr after sample:
took awhile to stabilize
3.9 e12 to 4.7 e12

K 315 7.6e12 to 5.8e12
Wafer Title: SL90823E
Grower: Chris  Date: 2019-08-23
Orientation: SrO cap / Sr IO / Sr IO buffer / STO(001)

**Calibration**
- Ir: 196.7 mA
- 14.6 e13
- EIES 0.05 A/S - 0.045

**Cleaning Procedure**
- Ozone Cleaned: 10 min.
- Wet Cleaned

**Chamber Setup**

<table>
<thead>
<tr>
<th>Base Pressure:</th>
<th>1 Torr</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quartz Crystal Life:</td>
<td>5%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Turbo:</th>
<th>Open</th>
<th>Closed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ion:</td>
<td>Open</td>
<td>Closed</td>
</tr>
<tr>
<td>Cryo:</td>
<td>Open</td>
<td>Closed</td>
</tr>
<tr>
<td>Liq. N2:</td>
<td>Open</td>
<td>Closed</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PmSr</th>
<th>Dy</th>
<th>Eu</th>
<th>Gd</th>
<th>Tb</th>
<th>Dy</th>
<th>Lu</th>
<th>Yb</th>
<th>Ti</th>
<th>Sr</th>
<th>Sc</th>
<th>E-Be</th>
</tr>
</thead>
<tbody>
<tr>
<td>445</td>
<td>340</td>
<td>2.56e13</td>
<td>2.56e13</td>
<td>2.56e13</td>
<td>2.56e13</td>
<td>2.56e13</td>
<td>2.56e13</td>
<td>2.56e13</td>
<td>2.56e13</td>
<td>2.56e13</td>
<td>2.56e13</td>
</tr>
</tbody>
</table>

**Setpoint (°C)**
- SrO 970 °C
- SrO 970 °C
- SrO 970 °C
- SrO 970 °C

**Flux (10^13 atoms/(cm^2*s))**
- 1.13

**Time (s)**
- 57

**Notes:**
- Raise K to 340 °C, use QCM to determine when it is stable.
- Stabilize at 2.46 e13 (probably different from last calibration is hig)
- Outgas 970-980 °C for n15min, RGA CO partial pressure stabilized.
- Grow 970 °C, 4.5 e-6 m³
- Start 1:45 AM SrO 970 °C then codep (0.05 A/S E128) 20mA
- Immediate chevrons, go to let it grow to see if it recovers, spotty at some rotations.
- Open K at 12:30 before opening K looks good at some rotations, broad & spotty at others.
- Increase Ir by 2mA at 17min → EIES < 0.0525 A/S
- ↑2mA 32min
- Close K at 1hr 10min
- 8 min undoped SrO
- End 1hr 18min
<table>
<thead>
<tr>
<th>Potassium Re-QCM</th>
<th>Temp</th>
<th>Flux ($\times 10^{13}$)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>345</td>
<td>3.31</td>
</tr>
<tr>
<td></td>
<td>340</td>
<td>2.56</td>
</tr>
<tr>
<td></td>
<td>335</td>
<td>1.89</td>
</tr>
<tr>
<td></td>
<td>330</td>
<td>1.47</td>
</tr>
<tr>
<td></td>
<td>325</td>
<td>1.16</td>
</tr>
<tr>
<td></td>
<td>320</td>
<td>0.82</td>
</tr>
</tbody>
</table>
Grower: Chris  Date: 2019-08-23
Orientation: SiO cap / SK10 / SiO buffer / STO(001)

Calibration

<table>
<thead>
<tr>
<th>Cool Ir 3/4 Qcm K at high temp</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shoot for Sr/Ir = 1.13/1.3 as in 23B</td>
</tr>
<tr>
<td>I = 1.3 E 5 E 5 E 8</td>
</tr>
<tr>
<td>0.05</td>
</tr>
<tr>
<td>I = 178 mA</td>
</tr>
</tbody>
</table>

Cleaning Procedure:
- Ozone Cleaned 10 min.
- Wet Cleaned

Chamber Setup

<table>
<thead>
<tr>
<th>Turbo</th>
<th>Open</th>
<th>Closed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ion</td>
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<td>Open</td>
<td>Closed</td>
</tr>
<tr>
<td>Liq. N2</td>
<td>Open</td>
<td>Closed</td>
</tr>
</tbody>
</table>

Setpoint (°C)

<table>
<thead>
<tr>
<th>Sr</th>
<th>446</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ir</td>
<td>335</td>
</tr>
<tr>
<td>K</td>
<td>335</td>
</tr>
</tbody>
</table>

Base Pressure: 3.7E-8 Torr
Quartz Crystal Life: 92.8%

Flux (10^15 atoms/(cm²s))

<table>
<thead>
<tr>
<th>1.13</th>
<th>1.95</th>
</tr>
</thead>
<tbody>
<tr>
<td>57</td>
<td></td>
</tr>
</tbody>
</table>

Shoot to grow a high flux sample at same conditions as previous: Outgas 990, grow 970, 4.5E-6 torr O₂.

STO substrate looks really, really nice.

1.5ml SrO → 1m26sec. Saw some chevrons when opening Iridium Shutter. 8 min → Sample seems to be going rough.

Start 10:49 PM

12 SrO (1.5 Sr/IrO₄) = 11min 24sec

Then opened K shutter. Film sorta is starting to recover. Increasing Ir seems to help. Some parts look better. Some parts spotty. Some parts chevrons.

Going to grow 68 SrO layers → 6hr 22min 24sec

Then a.8.6uc (8SrO) Cap. → 1hr 4min 36 sec

Finish 1hr 12min 12 sec

Still some chevrons at certain spots but some directions seen to have recovered reasonably well.
- 48 min. Kikuchi lines are not very strong.
- Start ramping to 325 at 1 hour 1h13m → RHEED images + inc ↑ Ir a little to 218
- Start ramping to 330 @ 1h15min
  RHEED still very streaky but Kikuchi lines are weak. Improves a little but still not super sharp.
- Ramp to 335C, 1h25min
  More RHEED images + at 1h30min - a bit fuzzier still so Ir ↑ 219mA / 0.065 EIES EIES.
- Ramp to 340C, 1h35min
  RHEED is getting pretty fuzzy, even though EIES = 0.065 - 0.07
- Ramp to 345C, 1h50min
  C341 I think th growth might be getting 3D.
  EIES dropped slightly so Ir ↑ 223 (EIES ↑ 0.07)
  C344 Some clear roughening. Kikuchi lines basically gone. took images e 3Z
  Film is getting rough. Go to next movie 2h
- Close K 3 grow cp of undoped material.
- Close Shutter 3 cool at 1h 10min
- Need to remelt Ir and want to QCM the potassium. at this temp.
  Kikuchi lines sort of reappeared but film still rough.
- Zpt after pull = 50 - 60
This puck is clean.

Outgases 990 / grow 970.
1.5 mL SnO then Codep 214 undoped (92 sec) and (114.8 sec).

Start 3:52 PM. Iridium: Start O.05 EIES.

Starts out a little fuzzy but no chevron. 211 mA. Ir ↑ 212 mA. Looks pretty darn good.

Got fuzzy again so Ir ↑ 215 mA. Going to be more conservative with Ir on this film. EIES 20.06.

Open K @ 300°C 4:04 PM. Will slowly ramp up.

Start ramping to 310°C = K at [15 min] (1°C/min).

Let settle for 10 min then increase again. No noticeable change in RHEED.

Start ramping to 315°C = T_k @ [35 min] and let settle for 5 min. RHEED looks a little fuzzy so Ir ↑ 217 mA. No noticeable change in EIES.

Start ramping to 320°C @ 45 min.
Surface colors

When removed

XRR looks bad (2 1st peaks)

XRD didn't look right → alignment must have gone wrong....

→ Store in He for later.
RGA: $8e^{-9} \text{ H}_2\text{O}$
$2e^{-8} \text{ N}_2/\text{CO}$
$1.6e^{-6} \text{ O}_2$

$H_2O^+ 5.0e^{-8}$
during growth

**Close K after 1hr 6min.**

Chevrons so decrease Ir to 207mA.

**Open K at 12min**

Orions at 11:55PM 9/2 5:40 then open Ir (20mA)

**Close K at 1hr 6min.**

Growth:

- Growth at 1020°C $4.5e^{-6}$ C
- Oxygen at 11:55PM 9/2 5:40 then open Ir (20mA)

**Conditions:**
- Base Pressure: $4.4e^{-6}$ Torr
- Quartz Crystal Life: 37.8%

Cleaning Procedure:
- 10°C Water Cleaned
- 10° Cleaning
- 24h C

**Table:**

<table>
<thead>
<tr>
<th>Time (s)</th>
<th>Flux (10^13 atoms/cm²/sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>57</td>
<td>1.1E5</td>
</tr>
<tr>
<td>445</td>
<td>300</td>
</tr>
<tr>
<td>0.265 968×10^-12 from sample 12A</td>
<td></td>
</tr>
</tbody>
</table>

**Notes:**
- Grow inc. 0.8mA
- End of 1 hr 30 min - 1 hr 13 min 45 sec growth time
- 200°C Z
Grower: 
Date: 2019-08-23
$T_k = 300 ^\circ C$
$T_{sub} = 970 ^\circ C$
Wafer Title: 

Calibration

I$_r$ = 206 mA
$1.4 \times 10^{13}$
$0.05 \text{~Etch}$

Cleaning Procedure:
- Ozone Cleaned ________ min.
- Wet Cleaned ________

Chamber Setup

Base Pressure: ________ Torr
Quartz Crystal Life: ________ %

<table>
<thead>
<tr>
<th></th>
<th>Turbo</th>
<th>Ion</th>
<th>Cryo</th>
<th>Liq. N$_2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sr</td>
<td>445</td>
<td>300</td>
<td>Open</td>
<td>Open</td>
</tr>
<tr>
<td>La</td>
<td></td>
<td></td>
<td>Open</td>
<td>Open</td>
</tr>
<tr>
<td>$\text{SrO}$</td>
<td>2.0E-6</td>
<td>0.26 - 0.38 vacumm</td>
<td>Open</td>
<td>Open</td>
</tr>
<tr>
<td>Fe</td>
<td></td>
<td></td>
<td>Open</td>
<td>Open</td>
</tr>
<tr>
<td>Lu</td>
<td></td>
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<td>Open</td>
<td>Open</td>
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<tr>
<td>Yb</td>
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<td>Open</td>
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<td>Ti</td>
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<td>Sr</td>
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<td>Sc</td>
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<tr>
<td>E-Be</td>
<td></td>
<td></td>
<td>Open</td>
<td>Open</td>
</tr>
</tbody>
</table>

Setpoint ($^\circ C$)

Flux ($10^{13}$ atoms/(cm$^2$·s))

Time (s)

Outgas 980 T°C, $4.5 \times 10^9$ O$_3$
Grow 970 T°C, Start 9:38 AM
90 S SrO then codep, good ricmela lines but broad
Open K at 11:40
Increase I$_r$

Increase to 216 mA at 24 min
Closed K at 1 hr 6 min 05
(normal ly 68 SrO)

7:36 min undoped 214
End 1 hr 13 min 42 S

70 K $\Omega$ 2 pt
Chargd at 3PM 8/22/19
Flushed bane at ~11PM 8/22/19 \( \Rightarrow \) 32 hrs

Started chargng 4AM (was ready sometime between 3AM & 4AM
by Inn on clock)

7AM

1PM lunch
Grower: Chris  Date: 2019-08-22  Temp K = 325 °C

Wafer Title: JC190822E

Orientation: /Sr2+KxIrO4/1.5ucSr2IrO4 /STO (001)

Calibration:
Cool/Warm Ir for 10 min.
K Qcm. Kf to 325 °C:

Ir = 1.23 E+13
Sr/Ir ~ 0.93 to Start

EIES ~ 0.045
Correct = 195

Cleaning Procedure:
- Ozone Cleaned 10 min.
- Wet Cleaned

#140

STO (001)

Base Pressure: 4.5x10^-8 Torr
Quartz Crystal Life: %

<table>
<thead>
<tr>
<th>Chamber Setup</th>
</tr>
</thead>
<tbody>
<tr>
<td>Turbo: □ Open □ Closed</td>
</tr>
<tr>
<td>Ion: □ Open □ Closed</td>
</tr>
<tr>
<td>Cryo: □ Open □ Closed</td>
</tr>
<tr>
<td>Liq. N2: □ Open □ Closed</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sr</th>
<th>La</th>
<th>K</th>
<th>Fe</th>
<th>Lu</th>
<th>Yb</th>
<th>Ti</th>
<th>Sr</th>
<th>Sc</th>
<th>E-Be</th>
</tr>
</thead>
<tbody>
<tr>
<td>445</td>
<td>825</td>
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</tr>
</tbody>
</table>

Setpoint (°C)

Flux (10^15 atoms/(cm²·s))

Time (s) Based on previous use

57.1

Outgases 1 grow 970°C
Same start as previous: 1.5ml SrO + 1.5uc Sr2IrO4
Start: 9:52 PM

RHEED looks pretty good some spots but I think they are from below the pins

Close K at 1.06 1hr 6min

Grow luc of undoped 214 cap:

1hr 14min 8s end

Cooling in O3, RHEED images 300°C look good!

2 pt 75 K 52 night after
XRR $\rightarrow$ 24.2 nm. in 71.43 min

$\approx$ 0.951 min/sro $\approx$ 57.09 sec

75.06 sro layers

After XRAY $\rightarrow$ $\approx$ 207 kV

(Why lower?)
No recalibration of Sr or Ir from last growth.

Start current = 209 mA
EIES = 0.065

Calibration

Cleaning Procedure:
- Ozone Cleaned 10 min.
- Wet Cleaned [110] 106.45°
- [100] 151.5°

Chamber Setup
- Turbo: Open
- Ion: Open
- Cryo: Open
- Liq. N₂: Open

Setpoint (°C)
Sr 445
La 315
K Fe Lu Yb Ti Sr Sc E-Be:

Flux (10¹⁵ atoms/(cm²·s))
1.13 0.51

Time (s)
56.25

Outgases 970°C
Same as previous: 1.5 ml Sr₀ + 1.5 uc Sr₂Ir₀₄
Start: 5:41 PM

→ Some chevrons on open Ir. Going to say they are alright.

→ Source is becoming a bit unstable. EIES 70.075 all of a sudden. Chevrons seem to have subsided (16 22s) and film looks really good.

44 min in (1826h) RHEED a little streaky so current up to 211 mA / EIES 70.075 (had slowly dropped down)

Going to put an undoped layer on very top (12uc)
Close K shutter at 1h3m 40sec
and grow 1uc = 8 Sr₀ = 7min 46sec

Total growth time = 1h11min 26sec

Final RHEED Images @ 800°C → look great

Ramp down Ebeam & Re-run potassium

2pot = 36 keV
CIRT after vent
55 - 65 kΩ/RT after unload.
Grown 970°C, 1.5 mL of SrO [1.27 mC]

Then a STO-214 buffer layer.

Start 1531 h — see some chorions on open but strictly otherwise look good.

Reducing Ir Veg slightly gets rid of the but RHEED gets fuzzy.

11 min 39 sec (12 SrO → 1.5 mL of 214) open K shutter

Leaving Ir & E EIES = 0.06 seems ok.

Slowly inc. Ir flux during growth to keep sharp (EIES ↑ 0.07

Grow 64 SrO layers (8 mL 214) →

Final EIES = 0.07
Current = 202 mA

Final RHEED @ 600°C
XRR - 21.7 nm = 8.22 units cells e 3 SrO per cell

= 65.744 SrO layers

in 63 m 38 sec => 1.03 SrO per min

95 kΩ 2 point

58.25 s/me
Grow 1.5 lyres SrO (1m 30s) (grow e 970 C)
then start Sr₂IrO₄ w/o K.

Start 1143 h
Ir = 162 mA → immediate chevrons/. Dropping to 175 mA didn’t help. (0.38 EIES)
Increase Ir seems to clean it up.
0.062 EIES / 196 mA

[22 min] in open K shutter (1205 PM)
22 functional units wedged.

After opening K film looks a bit fuzzy
develops w/ open K shutter.

Film doesn’t look great → bit better than A at least.
(not rough) Final Ir: 201 mA / 0.065 EIES

63 m 38 sec total time! Final RHEED C 380 C
— looks decent.
grow for \[50 \pm 45 s\] - same as last

Electron is 0.042 or so by EIES

Film never fully flattened out + there are still chevrons @ end. Will try to grow buffer W/O K next time first.

Took RHEED end @ 10 Meyer C 350C

\[\rightarrow \text{2p+ is above scale on DMM} \ldots \]

XRR trash \(\rightarrow 17 \text{ nm}??\)

Basiclly notty in XRA/
-70 base → flush.

Grower: [Signature]  Date: 8/21/19  Temp: 290°C  Wafer Title: [Signature]

Orientation: $Sr_2-xKxIrO_4/STO$  $x=7$

Calibration

<table>
<thead>
<tr>
<th>$Irr$</th>
<th>1.3e13 185 mA</th>
</tr>
</thead>
<tbody>
<tr>
<td>$Irr$</td>
<td>1.3e13 (320 mA)</td>
</tr>
<tr>
<td>$Irr$</td>
<td>0.05–0.06 A/s</td>
</tr>
<tr>
<td>$Irr$</td>
<td>6.05 A/s</td>
</tr>
</tbody>
</table>

K 280 7.6e11 + 1.6e12
K 290 1.8e12 − 3.2e12

Base Pressure: 4E-8 Torr
Quartz Crystal Life: 93%

Chamber Setup

<table>
<thead>
<tr>
<th>Turbo:</th>
<th>□ Open  □ Closed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ion:</td>
<td>□ Open  □ Closed</td>
</tr>
<tr>
<td>Cryo:</td>
<td>□ Open  □ Closed</td>
</tr>
<tr>
<td>Liq. N$_2$:</td>
<td>□ Open  □ Closed</td>
</tr>
</tbody>
</table>

Setpoint (°C)

<table>
<thead>
<tr>
<th>Sr</th>
<th>La</th>
<th>K</th>
<th>Fe</th>
<th>Lu</th>
<th>Yb</th>
<th>Ti</th>
<th>Sr</th>
<th>Sc</th>
<th>E-Be</th>
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<tbody>
<tr>
<td>445</td>
<td>290</td>
<td>0.14 ± 0.0</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.1e13</td>
<td>2.2</td>
<td>0.32</td>
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</tbody>
</table>

Flux (10$^{13}$ atoms/(cm$^2$·s))

RGA: $H_2O$ 1.4E-8, $O_2$ 1.85E-6, $N_2$ 1.8E-8  $4.5E-6$ Ozone

Sr $→$ 0.16 A/s $→$ 59.65 ml min STO
growth rates $→$ 970 Tc/511 pyro (Window coated)

Start 9:38 AM. 1 ml SrO to start
then open K & Ir

Immediate strong chevron pattern. Drop Ir for 185 ± 183 mA

get fuzzy fast so inc. Ir back
By 100 s Ir looks very 30.

Film is still growing rough. Will grow out to see. Ir 718 mA
increase Ir defn made it worse. Tons of chevrons
(look RHEED images)

102 s Ir. Still a lot of Ir melt but film seems to be getting flatter.

Drop Ir Veg slightly (0.45E10 to 1.82 mA)
Grower: Jivarthi / Mut Date: 2/11/19 Temp = 280 °C

Sr₂₋ₓKₓIrO₄ / sto X = ?

Calibration: 1.4e13 (198 mA) used for sample C 0.06 A/SEES

[110] 291
[100] 335

STO(001) #126

Chamber Setup

<table>
<thead>
<tr>
<th>Base Pressure</th>
<th>_______ Torr</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quartz Crystal Life</td>
<td>______%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Turbo</th>
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<tr>
<td>Liq. N₂</td>
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Setpoint (°C)

<table>
<thead>
<tr>
<th>Sr</th>
<th>La</th>
<th>Al</th>
<th>Ba</th>
<th>K</th>
<th>Lu</th>
<th>Yb</th>
<th>Ti</th>
<th>Sr</th>
<th>Sc</th>
<th>E-Be</th>
</tr>
</thead>
<tbody>
<tr>
<td>445</td>
<td></td>
<td></td>
<td></td>
<td>280</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

Flux (10⁻¹³ atoms/(cm²·s))

5.2e12 1.1e13 28.2e12

Time (s)

- QCM right before growth
- QCM after is 800 mA, 1.38e13 for Ir
- XRR 18 nm, did K stick??

Sr flux + K flux = (1.4 + 0.157) e₁³ = 1.257 e₁³

→ Ir am 1.1e13

Contents: 970 TC / 51bpyro grow 4.5e⁻⁶ O₃

Start 5:34 AM SrO 1:55 then codep Sr/K/Ir

Because RHEED looks good
grow for same time as last sample use diff of recipe to
figure out flux of K.

Increase to 200 mA at 35 min

50:45 end

70-80 K ≤" larger than
underdoped sample C

pp H₂O = 3.8e⁻⁸
pp O₂ = 1.56e⁻⁶
**Calibration**
- Ir: 9.3e12
- ETES: 0.04-0.6%
- 190 mA, 1.1e13

**Cleaning Procedure**
- Ozone Cleaned: 10 min.
- Wet Cleaned: 30 s

**Chamber Setup**
- Turbo: Open
- Ion: Open
- Cryo: Open
- Liq. N₂: Open

**Setpoint (°C)**
- 445

**Flux (10¹³ atoms/(cm²*s))**
- 1.1e13

**Time (s)**

---

**Outgas 970 °C, grow 970**

4.5 × 10⁻⁶ O₃ (10⁻⁶ atm) Ebeam to 195 mA before start

Start 3:09 AM, 90 s SrO then codep

9 mm thickness to 197 mA (0.05-0.07 A/s ETES)

Some spots/chems, but strong kilodolphins (substrate had same spots also, though)

End 50:35

ORC after: 1.57 e13

XRD: Low angle XRD 19 mm

---

Partials pressures:
- H₂O = 1e⁻⁷
- CO₂ = 1.9 e⁻¹¹
- N₂O = 2 e⁻⁸
- O₂ = 1.5 e⁻⁶

Lacks like pure phase 214

2pt B 50-60 keV
<table>
<thead>
<tr>
<th>Grower:</th>
<th>Date: 8/21/19</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orientation:</td>
<td>SrIrO$_3$(001)/STO(001)</td>
</tr>
<tr>
<td>Calibration</td>
<td></td>
</tr>
<tr>
<td>Ir:</td>
<td>1.2e+13</td>
</tr>
<tr>
<td>188 mA</td>
<td>1e13</td>
</tr>
</tbody>
</table>

Calibration Chamber Setup

<table>
<thead>
<tr>
<th>Base Pressure:</th>
<th>Torr</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quartz Crystal Life:</td>
<td>%</td>
</tr>
</tbody>
</table>

Cleaning Procedure:
- Ozone Cleaned: 10 min.
- Wet Cleaned: 30 s
- Oscillations: 335°
- Etch 7
- [110] 29°
- [100] 335°

<table>
<thead>
<tr>
<th>Turbo:</th>
<th>Open</th>
<th>Closed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ion:</td>
<td>Open</td>
<td>Closed</td>
</tr>
<tr>
<td>Cryo:</td>
<td>Open</td>
<td>Closed</td>
</tr>
<tr>
<td>Liq. N$_2$:</td>
<td>Open</td>
<td>Closed</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sr</th>
<th>La</th>
<th>Al</th>
<th>Fe</th>
<th>Lu</th>
<th>Yb</th>
<th>Ti</th>
<th>Jr</th>
<th>Sc</th>
<th>E-Be:</th>
</tr>
</thead>
<tbody>
<tr>
<td>445</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Setpoint (°C): 750 TC, grow 850 TC (approx. needs 400)

Start 1:05 AM 82 °C SrIrO$_3$ then cool up, increase beam to 203 mA

RHEED looks great!

RHEED minima from oscillations: 196, 263, 322, 380

67, 59, 58 ~ 61 s/layer

When

Partial pressures:

$P_{H_2O} = 2.2 \times 10^{-8}$

$CO_2 = 2.34 \times 10^{-10}$

$N_2CO = 3.25 \times 10^{-9}$

$O_2 = 1.66 \times 10^{-6}$

XRD: 17 nm → 42 layers → 55 layers / 55 layers
<table>
<thead>
<tr>
<th>K temp</th>
<th>flux (e beam 0#)</th>
<th>Note: K flux as measured by QCM is very sensitive to e beam emission current</th>
</tr>
</thead>
<tbody>
<tr>
<td>300 °C</td>
<td>7 - 8.5 e12</td>
<td>Started to go crazy.</td>
</tr>
<tr>
<td>290 °C</td>
<td>8.3 E+12</td>
<td>started to go</td>
</tr>
<tr>
<td>285 °C</td>
<td>1 - 4 e12</td>
<td>oscillations...</td>
</tr>
<tr>
<td>275 °C</td>
<td>0.9 - 2.4 E+12</td>
<td></td>
</tr>
</tbody>
</table>

50 uc → 53min ÷ 20.1 nm
RHEED taken at 340°C.

XRD - 3θ nm? (using epitaxial program)

- 87 layers → 36.5 s/layer

→ 1.821 e13 → \[ \frac{\text{QCM}}{\text{Actual}} = \frac{9.9e12}{1.82e13} = 0.54 \]

→ set Sr to 445°C

reasonable for Sr...
**Grower:** Chio/Sciex  
**Date:** 8/21/2019  
**Orientation:** Sr:IrO$_3$ (001) / STO (001)  
**Wafer Title:** STO (001)

### Calibration

<table>
<thead>
<tr>
<th>Calibration</th>
<th>Sr</th>
<th>1E+12</th>
<th>9.9E+12</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ir</td>
<td>8.2E+12</td>
<td>7.9E+12</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>QCM 1</th>
<th>4.8E+12</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>166 mA</td>
</tr>
</tbody>
</table>

**EIES (Pt) = 0.05 A/s**

### Cleaning Procedure

- Ozone Cleaned: 6 min.
- Wet Cleaned: 108.7 s

### Chamber Setup

<table>
<thead>
<tr>
<th>Component</th>
<th>Turbo</th>
<th>Ion</th>
<th>Cryo</th>
<th>Liq. N$_2$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Open</td>
<td>Open</td>
<td>Open</td>
<td>Closed</td>
</tr>
</tbody>
</table>

**Base Pressure:** 4.47E-8 Torr

**Quartz Crystal Life:** 93%

### Setpoint (°C)

<table>
<thead>
<tr>
<th>Element</th>
<th>Sr</th>
<th>La</th>
<th>K</th>
<th>Fe</th>
<th>Lu</th>
<th>Yb</th>
<th>Ti</th>
<th>Sr</th>
<th>Sc</th>
<th>E-Be</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flux ($10^{13}$ atoms/(cm$^2$·s))</td>
<td>4E6</td>
<td>280</td>
<td>9.9E12</td>
<td>0.16 ± 0.08</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Notes

- **H$_2$O:** 8.5E-9 ml/1
- **9:03 PM:** Sr: 8.5E-6 ml/1 93% on valve
  - Punch is outgassed H$_2$O like crazy. ⇒ 750°C
  - Manulacator not yet outgassed.
  - Drop to 650°C for growth.
- **STO Mowdy time:** 63.63 sec.
- **9:12 PM Start:** 0.5 layers Sr
  - A bit fuzzy ⇒ Inc. Ir to 176 mA
  - Still fuzzy, growth looks a little 3D. Inc. Ir to 186 mA
  - A little better. Inc. to 188 (9:32 PM)
  - Grow longer. Film poorer.
- **20 uc → 31 min 40 sec → P$_{HeO}$ V 
  (I + I)**
- **D0.8 A/s by EIES (Pt)**